**Weather Forecasting using Machine Learning**

1. **Problem Definition**

Weather forecasting is a crucial investigation for planning daily activities, agriculture, transportation, and disaster management. The ability of predicting the possibility of rain the next day and amount of rainfall can significantly impact decision-making processes. This project was developed with the aim of designing a predictive model using machine learning algorithms to forecast the probability if it will rain tomorrow and if yes than the amount of rainfall.

1. **Data Analysis**

The dataset used for this project contains approximately 10 years of daily weather observations from different locations in Australia. It includes various features such as temperature, rainfall, wind speed, humidity, and atmospheric pressure. Before diving into building predictive models, it's essential to perform exploratory data analysis (EDA) to gain insights into the data.

1. **EDA Concluding Remarks**

During EDA, we observed that the dataset contains missing values, categorical variables, and features with different scales. We examined the distribution of numerical features, correlations between variables, and the frequency of rainfall occurrences. Additionally, we visualized the data using histograms, scatter plots, and correlation matrices to understand relationships between variables.

1. **Pre-processing Pipeline**

To prepare the data for modeling, we implemented a pre-processing pipeline. This involved handling missing values by either imputing or dropping them, encoding categorical variables using one-hot encoding, and scaling numerical features to ensure uniformity in scale. We also split the data into training and testing sets to evaluate model performance.

1. **Building Machine Learning Models**

For Problem 1 (predicting whether it will rain tomorrow), we trained a Random Forest Classifier using the pre-processed data. The model achieved a satisfactory accuracy score on the test set, indicating its ability to predict rain occurrences with reasonable accuracy.

For Problem 2 (predicting the amount of rainfall), we utilized a Random Forest Regressor to predict rainfall values. Despite challenges such as non-linear relationships and variability in rainfall patterns, the model performed reasonably well in predicting rainfall amounts.

1. **Concluding Remarks**

In conclusion, this project demonstrated the application of machine learning algorithms in weather forecasting. By leveraging historical weather data, we were able to build predictive models that forecasted whether it will rain tomorrow and estimated the amount of rainfall. These models can be further refined and integrated into weather prediction systems to improve accuracy and reliability. However, it's essential to continuously update and validate these models with new data to ensure their effectiveness in real-world scenarios.