

# ARTTIFAI TECH

## Data Science

### Project Idea: Weather Data Analyzer

#### Aim:

The objective of this project is to develop a **Weather Data Analyzer** that processes historical weather data, identifies patterns, and provides **graphical insights** through visualizations. This project will help users understand temperature variations, humidity levels, and rainfall patterns while also incorporating **predictive modelling** to forecast future temperature trends using **Machine Learning (Linear Regression)**.

#### Key Focus Areas:

- **Data Collection & Cleaning:** Gathering structured weather datasets, handling missing values, and normalizing data for accurate analysis.
- **Exploratory Data Analysis (EDA):** Extracting patterns, statistical relationships, and correlations within the dataset.
- **Graphical Representation:** Using **Matplotlib & Seaborn** to create **line charts, bar graphs, scatter plots, and trend predictions**.
- **Predictive Analysis:** Implementing **Linear Regression** to forecast future weather trends based on historical data.
- **User Interaction:** Displaying results in an easy-to-understand format for meteorologists, researchers, or weather enthusiasts.

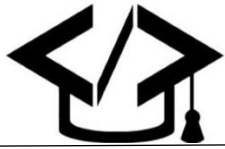
#### Objectives:

##### Data Processing & Preprocessing Objectives:

- **Import & Clean Data:** Load real-world weather datasets (CSV format) containing fields such as **date, temperature, humidity, and rainfall**.
- **Handle Missing Values:** Use techniques like **mean/mode imputation** to replace missing or incorrect values.
- **Normalize Data:** Scale values to improve the accuracy of machine learning predictions.
- **Convert Date Fields:** Extract relevant features like **year, month, season, and trends** for time-series analysis.

##### Exploratory Data Analysis (EDA) Objectives:

- **Identify Climate Trends:** Analyze how temperature, humidity, and rainfall vary over the years.
- **Statistical Analysis:** Generate descriptive statistics such as **mean, median, standard deviation** for different weather attributes.
- **Correlation Analysis:** Find relationships between temperature, rainfall, and humidity using **heatmaps & scatter plots**.



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## Visualization Objectives:

- **Line Chart:** Show temperature fluctuations over time (yearly or monthly trends).
- **Bar Graph:** Represent total rainfall in different years for comparison.
- **Scatter Plot:** Illustrate relationships between **temperature and humidity**.
- **Trend Line & Forecasting:** Use **Linear Regression** to predict temperature trends for future years.

## Predictive Modelling Objectives:

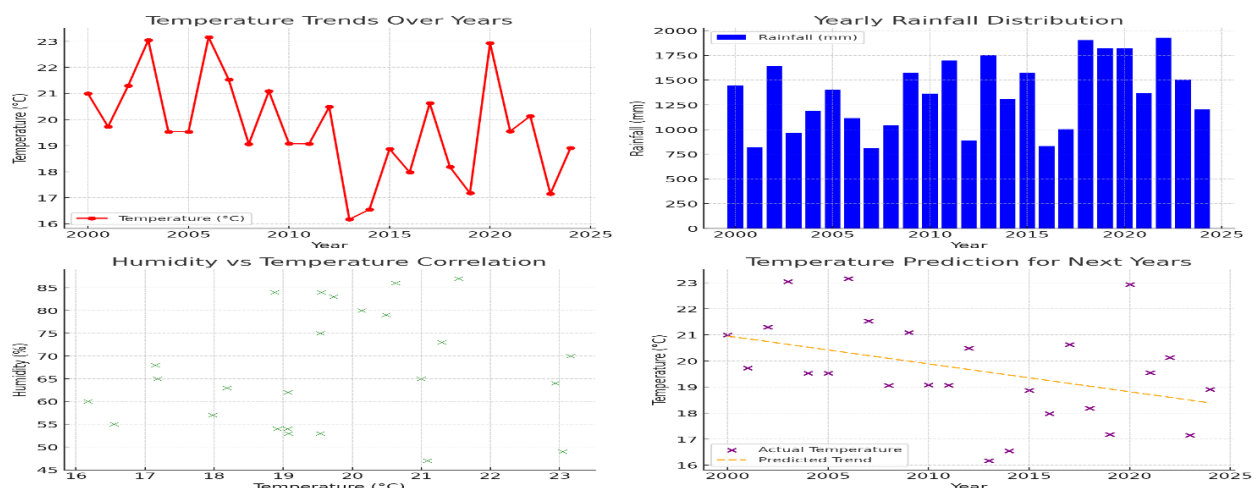
- **Train a Regression Model:** Use **Linear Regression** to forecast future temperature trends.
- **Evaluate Model Accuracy:** Compute error metrics such as **Mean Squared Error (MSE)** and **Root Mean Squared Error (RMSE)**.
- **Make Predictions:** Display future temperature trends based on historical data inputs.

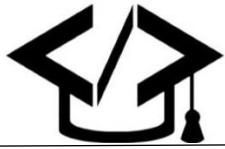
## Expected Output:

Upon running the Python script in an IDE (VS Code, PyCharm, Jupyter Notebook), the program will generate:

- **Line Chart:** A **temperature trend graph** over the years, showing how climate has changed over time.
- **Bar Graph:** Yearly **rainfall comparison** to analyze precipitation patterns.
- **Scatter Plot:** A graphical relationship between **humidity and temperature**.
- **Temperature Prediction Graph:** A **Linear Regression model** forecasting future temperature changes, visualized in an orange **trend line**.
- **Statistical Summary:** The console will display key climate insights.

## Sample Output:





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**NOTE:**

- The completed project must be uploaded to the student's own GitHub repository.
- The GitHub repository must be public for evaluation purposes.
- The repository link should be submitted via the Google Form:

<https://forms.gle/tNFMkX5wt343vpCo7>