
Name: Snehal Yelwande

Roll No: 281063

Batch: A3

Assignment 6

Problem Statement:

Apply Linear Regression using a suitable library function to predict month-wise temperature and evaluate the model using performance metrics.

Objectives:

1. To apply regression techniques for predicting temperature trends.
2. To preprocess and analyse temperature data for better model performance.
3. To evaluate model performance using MSE, MAE, and R-Square metrics.
4. To visualize the regression model and interpret the results.

Resources Used:

- **Software:** Visual Studio Code
- **Libraries:** Pandas, Matplotlib, Seaborn, Scikit-learn

Theory:

Linear Regression:

Regression is a supervised learning technique used to model relationships between a dependent variable (temperature) and an independent variable (month). Linear Regression assumes a linear relationship between these variables and fits a straight line that minimizes errors.

Linear Regression Formula:

$$y = mx + c$$

Where:

- **y** = Dependent variable (Temperature)
- **x** = Independent variable (Month)
- **m** = Slope (Rate of change)
- **c** = Intercept (Baseline value)

Performance Metrics:

1. **Mean Squared Error (MSE):** Measures the average squared differences between actual and predicted values. Lower values indicate better performance.
2. **Mean Absolute Error (MAE):** Measures the average absolute differences between actual and predicted values.

3. **R-Square (R^2):** Represents the proportion of variance explained by the model. A value closer to 1 indicates a better fit.

Methodology:

1. Data Preprocessing

- Load the dataset using Pandas.
- Handle missing values by imputation or removal.
- Convert categorical month values into numerical form (e.g., January = 1, February = 2, etc.).
- Split the dataset into training (80%) and testing (20%) sets.

2. Applying Linear Regression

- Use **LinearRegression** from `sklearn.linear_model` to fit the model.
- Train the model on the dataset.
- Predict temperature values for each month.

3. Model Evaluation

- Compute MSE, MAE, and R^2 scores to assess model performance.

4. Visualization

- Plot actual vs. predicted temperature values using Matplotlib/Seaborn.
- Display the regression line over the dataset.

Conclusion:

- The regression model effectively predicts monthly temperatures with a reasonable error margin.
 - The evaluation metrics help in assessing the model's accuracy and performance.
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