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Assignment 2

Problem Statement:

Perform the following operations using R/Python on the given dataset:

- a) Compute and display summary statistics for each feature (e.g., minimum value, maximum value, mean, range, standard deviation, variance, and percentiles).
- b) Data Visualization - Create a histogram for each feature to illustrate the feature distributions.
- c) Perform data cleaning, data integration, data transformation, and data model building (e.g., classification).

Objectives:

- 1) To perform exploratory data analysis (EDA) by computing statistical summaries.
- 2) To visualize the dataset to understand feature distributions.
- 3) To clean, integrate, and transform data for better analysis.
- 4) To build a classification model based on the dataset.

Resources used:

- 1) Software used: Visual Studio Code
- 2) Libraries used: Pandas, Matplotlib, sklearn

Theory:

Summary Statistics:

Summary statistics provide essential insights into the dataset. The key statistical measures include:

- **Minimum & Maximum Values:** Identify the smallest and largest data points in each feature.
- **Mean:** Represents the average value of a feature.
- **Range:** Difference between the maximum and minimum values.
- **Standard Deviation:** Measures the amount of variation in a feature.
- **Variance:** The square of standard deviation, showing dispersion in the data.
- **Percentiles:** Provide insights into the data distribution at specific percentage points.

Data Visualization:

Histograms are used to represent the frequency distribution of numerical data. They help in identifying skewness, outliers, and patterns in data distribution.

Data Processing Techniques:

1. **Data Cleaning:** Handling missing values, removing duplicates, and correcting errors.
2. **Data Integration:** Combining multiple sources of data into a unified dataset.
3. **Data Transformation:** Scaling, normalization, and encoding categorical variables.
4. **Data Model Building (Classification):** Applying supervised learning models such as Decision Trees, Random Forest, or Logistic Regression to classify data.

Methodology:

1. Computing Summary Statistics
 - Load the dataset using Pandas (Python) or dplyr (R).
 - Use functions like describe(), min(), max(), mean(), std(), and percentile() to compute statistics.
2. Data Visualization
 - Generate histograms for each numerical feature using Matplotlib/Seaborn (Python) or ggplot2 (R).
 - Interpret the distribution of each feature.

3. Data Processing

- Cleaning: Handle missing values with imputation techniques or remove null values.
- Integration: Merge multiple datasets if applicable.
- Transformation: Normalize numerical values and encode categorical data.

4. Data Model Building (Classification)

- Choose a classification algorithm such as Decision Tree, Random Forest, or Logistic Regression.
- Split the dataset into training and testing sets (e.g., 80% training, 20% testing).
- Train the model and evaluate its accuracy using a confusion matrix and performance metrics (Accuracy, Precision, Recall, F1-score).

Conclusion:

- Summary statistics provide an overview of the dataset's distribution and variation.
- Histograms help in understanding feature distribution and identifying potential anomalies.
- Data preprocessing ensures that the dataset is clean and ready for analysis.
- Classification models can be built using the processed data to derive insights and make predictions.