Assignment-2

1 You are given a dataset with the following features:

Quiz_Average (0–100)
Time_Spent_Minutes (daily average)
Problems_Solved (total)
Pass_Class (binary: 1 for pass, 0 for fail)

Perform an exploratory data analysis (EDA) with summary statistics and visualization of the feature distributions.

Choose an appropriate classification algorithm (e.g., logistic regression, decision tree, SVM) learned from the Machine Learning playlist and train it on the dataset.

Evaluate the model using accuracy, precision, recall, and F1-score on the test data.

Plot the confusion matrix and interpret the results in the context of how SmartPath could use this classification to tailor learning recommendations.

Suggest one improvement you could make to the model or data to increase classification performance.

Question:

Using Python and the Scikit-Learn library from the Machine Learning playlist:

Load a dataset you create that has three columns:
Hours_Studied (numeric),
Attendance_Percentage (numeric),
Final_Score (numeric).

Split the dataset into training and testing sets.

Train a linear regression model to predict Final_Score using Hours_Studied and Attendance_Percentage.

Print out the model coefficients and mean squared error (MSE) on the test set.

Discuss how well the model performs for the SmartPath project and one reason performance could improve.

Machine Learning–Based Traffic Speed Prediction and Route Travel Time Estimation

Problem Statement

Urban traffic congestion causes significant delays, increased fuel consumption, and reduced travel efficiency. Traditional navigation systems often rely on static speed assumptions or direct sensor measurements, which may not accurately reflect real-time or time-dependent traffic conditions.

There is a need for an intelligent system that can learn traffic patterns from historical data and provide improved travel time estimates.

The problem addressed in this project is to predict the average vehicle speed on road segments using machine learning techniques and integrate this prediction into a navigation system to estimate the fastest travel time between two locations.

Objective

The main objective of this project is to develop a machine learning model that predicts vehicle speed based on historical traffic and temporal features, and to integrate this model with a map-based navigation system to compute travel time and display optimal routes.

Scope of the Project

This project focuses on:

Learning traffic behavior using historical traffic datasets
Predicting average vehicle speed using supervised machine learning
Estimating travel time using predicted speed and route distance
Displaying navigation routes and estimated travel time on an interactive map interface

Input Features

The machine learning model uses the following input features:

Time of day (hour)
Day of week
Historical traffic data or sensor-based speed values
Route distance (when applicable)

Output

The output of the machine learning model is:

Predicted average vehicle speed (km/h or m/s)

This predicted speed is further used to calculate:

Estimated travel time between two locations

Methodology

1. Data Collection: Historical traffic datasets are collected and preprocessed to remove noise and missing values.

2. Feature Engineering: Time-based and traffic-related features are extracted to represent traffic conditions.

3. Model Training: Supervised machine learning algorithms such as Linear Regression, Random Forest, or Gradient Boosting are trained to predict vehicle speed.

4. Model Evaluation: Performance is evaluated using regression metrics such as Mean Absolute Error (MAE) and Root Mean Square Error (RMSE).

5. System Integration: The trained model is deployed using a backend API and integrated with a navigation system to estimate travel time.

6. Visualization: The final output is visualized on a web-based map interface showing the route and estimated travel time.

Expected Outcome

The system is expected to:

Accurately predict vehicle speed based on time and traffic patterns
Provide improved travel time estimation compared to fixed-speed methods
Offer an interactive and user-friendly navigation interface

Applications

Intelligent transportation systems
Smart city traffic management
Navigation and route planning applications
Traffic analysis and prediction systems

Conclusion

This project demonstrates how machine learning can be effectively used to model traffic behavior and enhance navigation systems. By integrating predictive models with real-world mapping services, the system provides a practical and scalable solution for estimating travel time and improving route planning.