PROJECT PROPOSAL

Project Title: Predictive Vehicle Maintenance

Student Name: Sahil Khan

Student ID: 202482066

1. Introduction

The field of predictive maintenance is expanding quickly and has the potential to save costs, increase operational effectiveness, and improve safety in a variety of industries. The objective of this project is to create a machine learning model that can forecast when maintenance is required for a vehicle based on a number of characteristics, such as component status, usage patterns, maintenance history, and vehicle specs. Accurately predicting future maintenance requirements enables fleet managers and car owners to plan maintenance in advance, reducing downtime, avoiding expensive malfunctions, and improving safety.

2. Project Goals

Building a reliable and accurate predictive model that categorizes cars as needing repair or not is the major objective of this project. We try to accomplish the following goals:

- **Develop a high-performing classification model:** We aim for a minimum 90% accuracy on a held-out test set. Utilizing the machine learning algorithms covered in class, such as logistic regression, decision trees, etc. We will determine the most effective model for this prediction task.
- **Identify key features contributing to maintenance prediction:** We will determine which features have the strongest influence on the model's predictions. This can provide valuable insights into factors affecting vehicle maintenance and inform preventative maintenance strategies.

3. Data Source

This project will utilize the synthetic "Automotive Maintenance Dataset," which contains 50,000 records. This dataset provides a diverse range of features relevant to vehicle maintenance prediction, including:

- **Vehicle Information:** Vehicle_Model, Mileage, Vehicle_Age, Fuel_Type, Transmission_Type, Engine_Size, Odometer_Reading.
- **Maintenance History:** Maintenance_History, Last_Service_Date, Service_History.
- **Operational Data:** Reported_Issues, Fuel_Efficiency.
- **Component Condition:** Tire_Condition, Brake_Condition, Battery_Status.
- **Other:** Owner_Type, Insurance_Premium, Accident_History, Warranty_Expiry_Date.
- **Target Variable:** Need_Maintenance (1 = Yes, 0 = No).

Using a synthetic dataset allows us to control the data distribution and evaluate the model's performance under various scenarios. However, it is crucial to acknowledge that real-world data might exhibit different characteristics and require further model adaptation.

4. Expected Result

This project is expected to deliver a robust and accurate predictive model for vehicle maintenance. The model will enable vehicle owners and fleet managers to:

- **Reduce downtime:** Proactive maintenance scheduling minimizes unplanned breakdowns and associated downtime.

- **Optimize maintenance costs:** By predicting maintenance needs, unnecessary or premature maintenance can be avoided, leading to cost savings.
- **Improve safety:** Addressing potential issues proactively enhances vehicle safety and reduces the risk of accidents.
- **Enhance operational efficiency:** Predictive maintenance allows for better resource allocation and optimized maintenance schedules.

5. Conclusion

This provides an excellent chance to use machine learning methods to address a practical issue with broad ramifications. Our goal is to create a very precise and practical predictive maintenance model for automobiles by utilizing the available dataset and applying suitable machine learning techniques. This initiative has the potential to make a substantial contribution to the expanding field of predictive maintenance and provide fleet managers and car owners with real benefits.

6. References

Dataset:
https://www.kaggle.com/datasets/chavindudulaj/vehicle-maintenance-data/data