Analyzing State-Level Electric Vehicle Adoption in Relation to Vehicle Performance Characteristics

Abstract:
This project aims to analyze the relationship between electric vehicle (EV) performance characteristics and their adoption rates at the state level in the United States. It employs the Random Forest machine learning algorithm to uncover complex patterns within the data.

Introduction and Aim:
The project focuses on understanding the impact of EV performance characteristics on adoption rates across different U.S. states, intending to provide insights for manufacturers and policymakers in the EV sector.

Objective and Key Features:
The objective is to identify the influence of various EV performance characteristics on state-level adoption rates. Key features analyzed include range, battery life, charging time, and price from EV performance data, alongside adoption rates from state-level EV registration data.

Dataset Description:

1. State-Level EV Registration Data: Comprises data on the number of EVs registered in each state, indicating adoption rates.
   DataSet:
   https://www.kaggle.com/datasets/divyanshugupta95/cars-dataset-with-battery-pack-capacity
2. EV Performance Data: Includes detailed specifications of EVs such as battery capacity, range, charging time, etc.
   DataSet: https://www.atlasevhub.com/materials/state-ev-registration-data/#data-format

Algorithm Approach:
The Random Forest algorithm is chosen for its ability to effectively analyze the complex relationship between EV performance characteristics and state-level adoption rates. Its strength in handling both numerical and categorical data from our diverse datasets is essential. Particularly, the feature importance aspect of Random Forest aligns with our goal to identify the most influential factors driving EV adoption. This approach balances accuracy and generalizability, making it well-suited to extract meaningful insights for our analysis.

Limitations:
The study's limitations are primarily rooted in the data and methodology:
Data Completeness and Quality: There may be inherent limitations in the state-level EV registration data and EV performance data, such as missing values or inconsistencies in how data is reported across different states.
Generalizability: Given the rapidly evolving nature of EV technology and market preferences, the findings are specific to the U.S. and the study's time frame and thus may not be directly applicable to other countries or future scenarios.

Conclusion:

The study is expected to offer valuable insights into the factors driving EV adoption across states, aiding in informed decision-making in EV policy and manufacturing strategies.