Final Project - DAT 301

Group L
29th April,2024

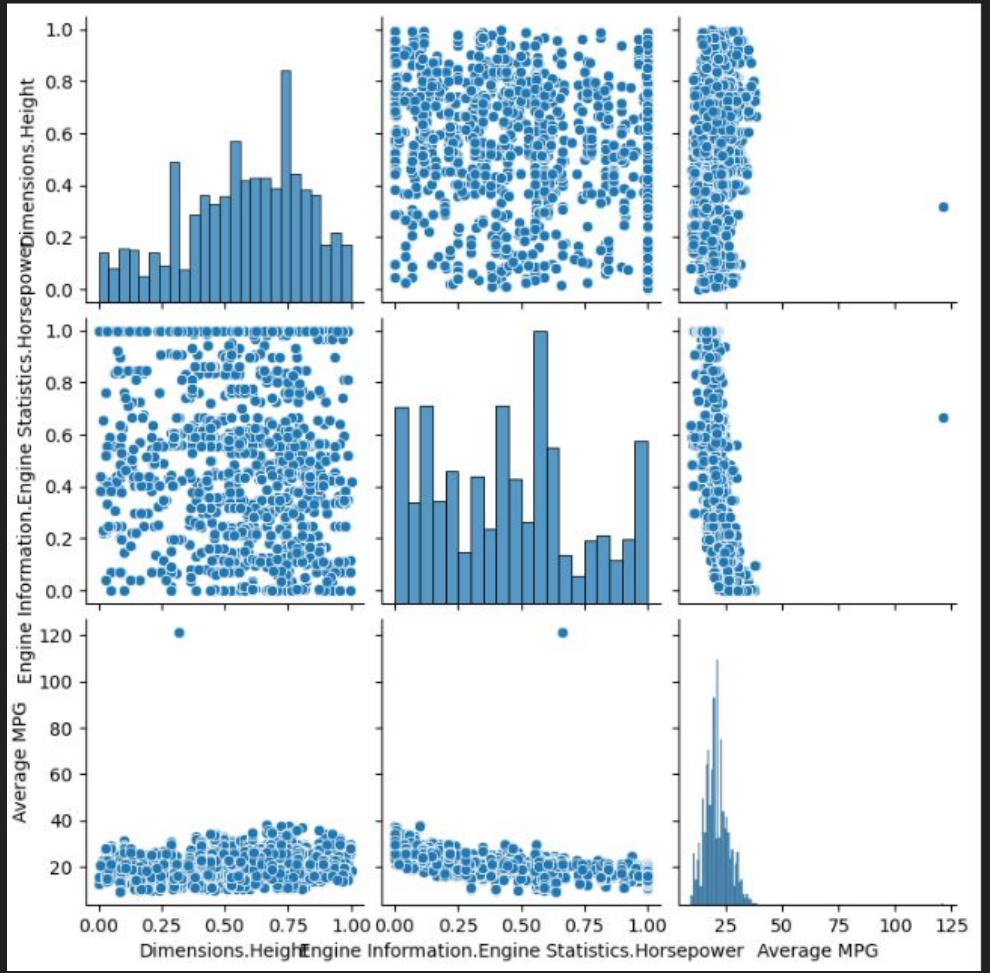
Problem

- How do driveline types and transmission modes influence fuel efficiency and vehicle performance?
- What is the relationship between vehicle features, such as the number of gears and driveline types, and their impact on urban fuel efficiency (city MPG)?
- Can the effectiveness of predictive models in estimating fuel efficiency be linked to specific vehicle characteristics like horsepower, driveline type, and transmission mode?

Graphs of different attributes

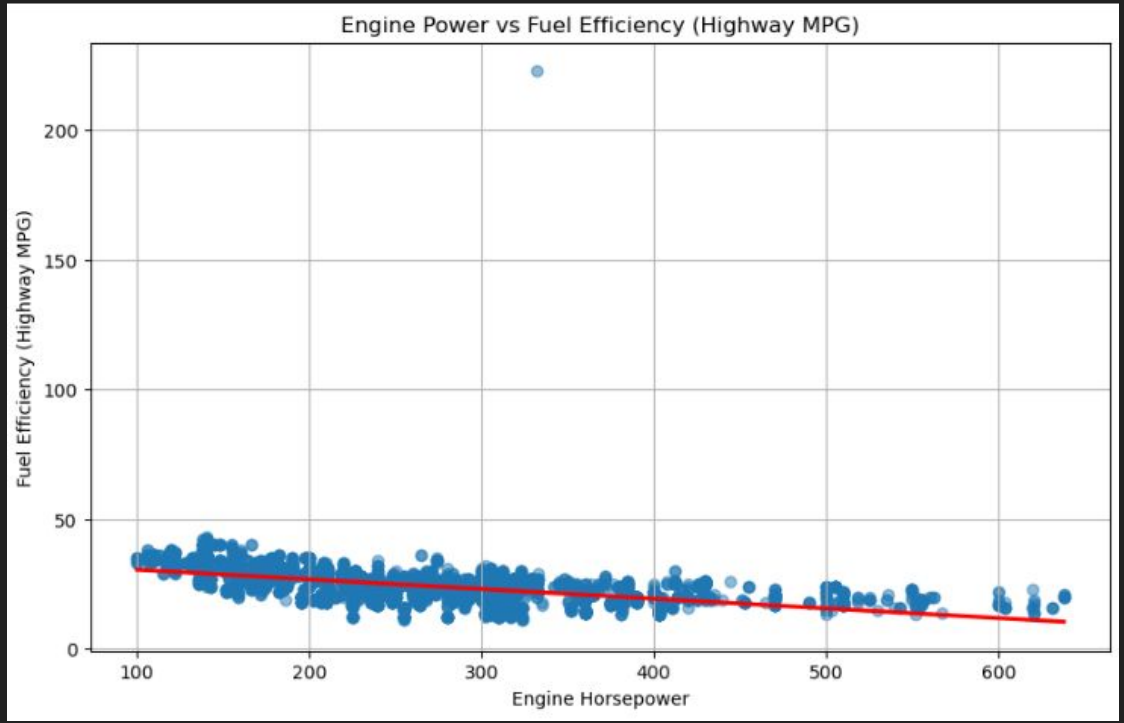
Bar Graph and scatter graph for all the resulting present.

This shows distribution of each attribute with Engine statistics and dimension.



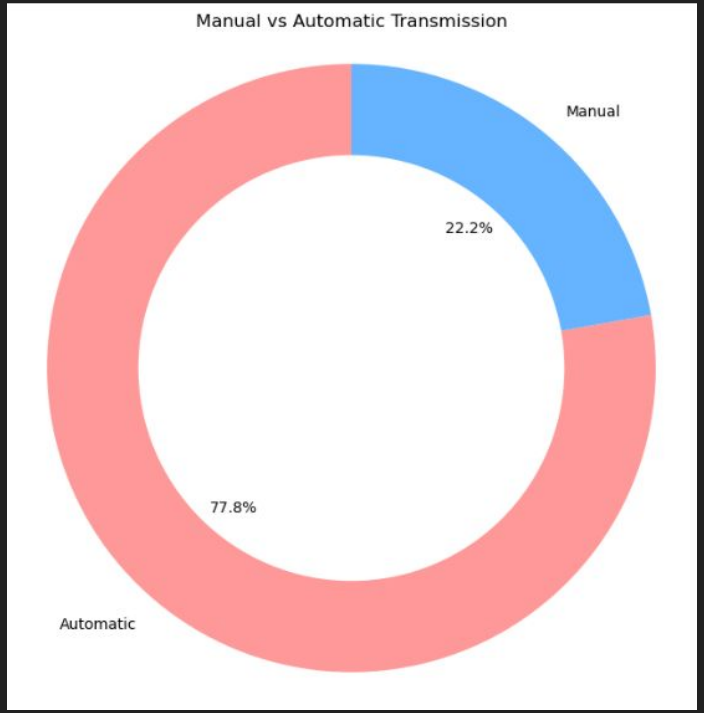
Scatter Plot of Engine Power vs Fuel Efficiency

Shows tight distribution and the best fit for horsepower with respect to fuel efficiency.



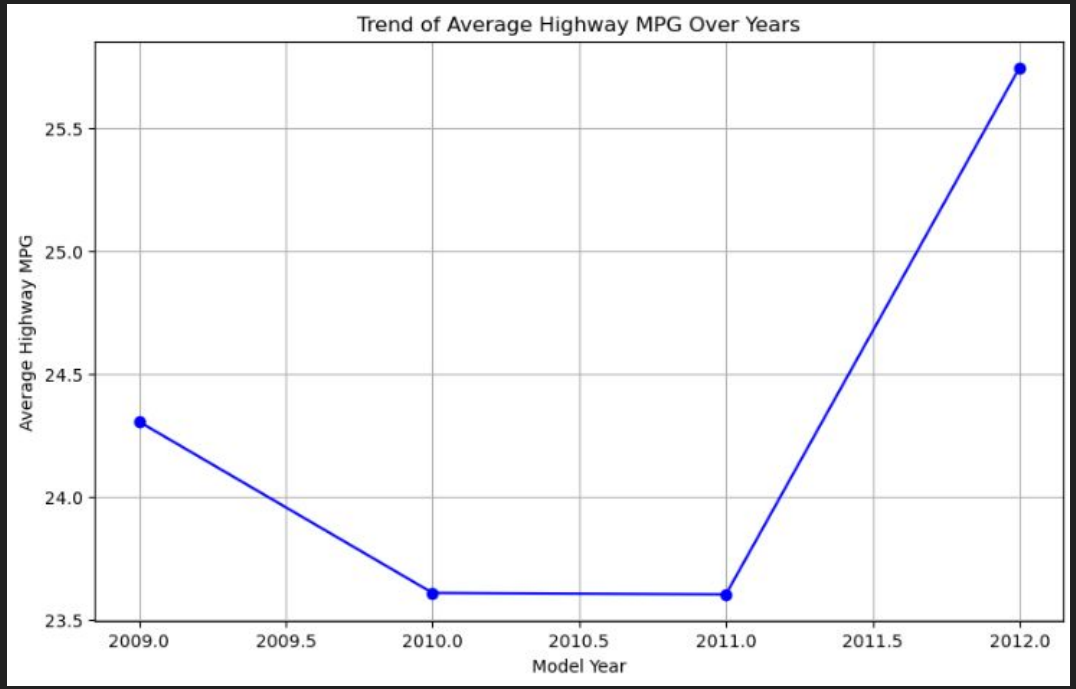
Pie Chart of Manual vs Automatic geared Vehicles

Representation of distribution between manual and Automatic. Automatic with 77.8% and Manual being 22.2%.



Line Graph of MPG with appropriate model year

This graph traces the trend of average highway miles per gallon over various model years, indicating the efficiency improvements over time.



Random Forest distribution

Shows the high performance and effectiveness of using Random Forest on features that is differed by categorical and numerical.

Model Features:

- Categorical: Driveline and Fuel Type
- Numerical: Horsepower, Torque, Number of Gears, Width, Height

Preprocessing:

- Numerical: Normalized using StandardScaler
- Categorical: Converted using OneHotEncoder

Model and Performance

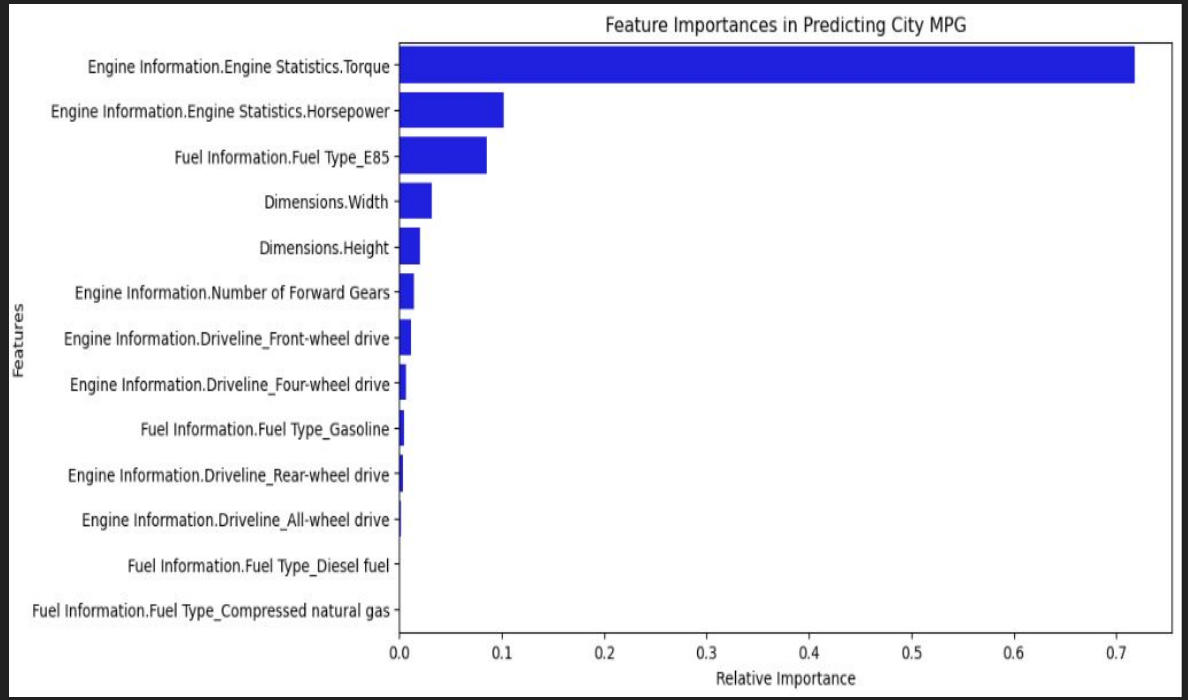
- Data Split: 80% training, 20% testing
- Mean Absolute Error (MAE): 0.4297 MPG
- R^2 Score: 97.22% (Highly predictive)

Significance:

- Accuracy: The model accurately predicts city MPG with minimal error, indicating high precision.
- Utility: Useful for automobile manufacturers for designing fuel-efficient vehicles and for consumers evaluating vehicle fuel efficiency.

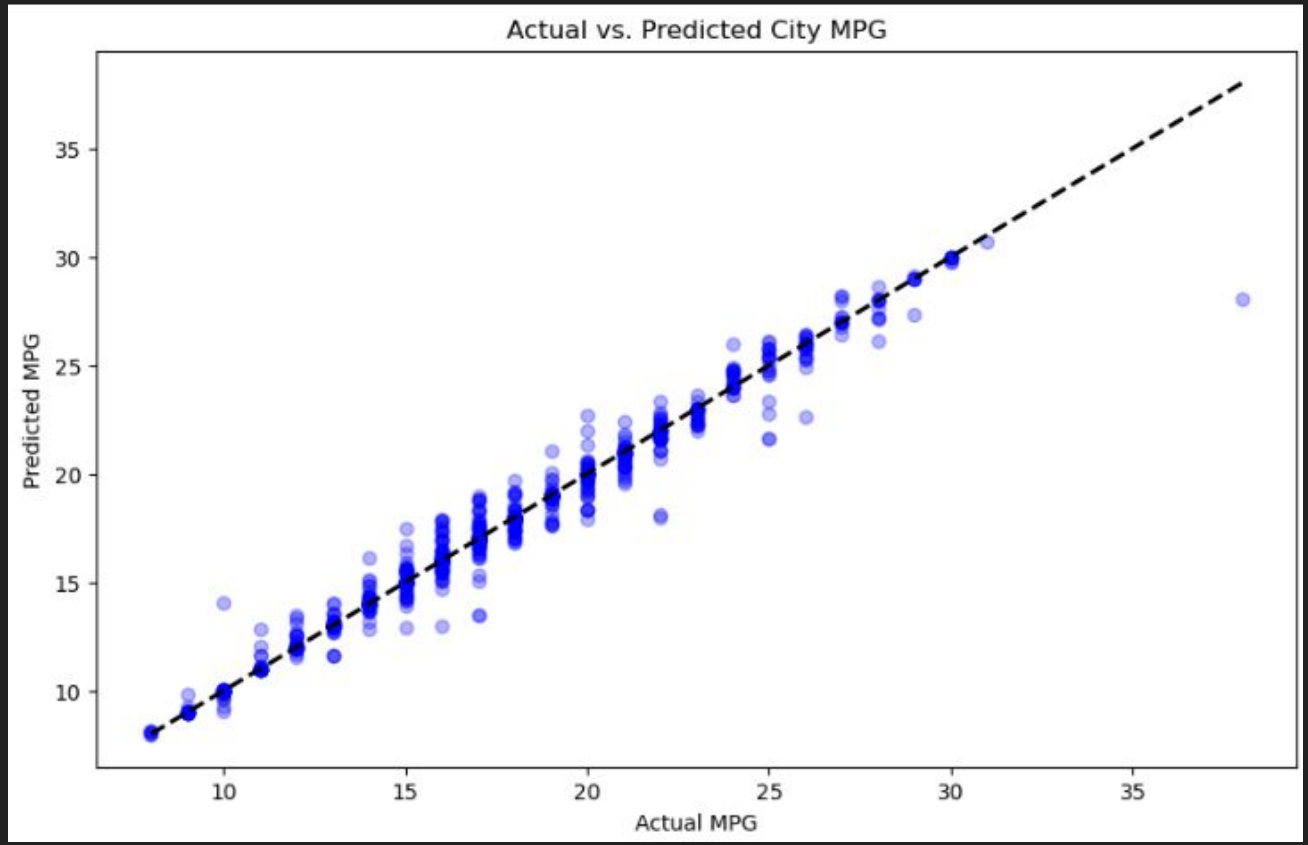
Horizontal stack bar graph

This graph compares the significance of various features on city MPG, showing how different features influence fuel efficiency.



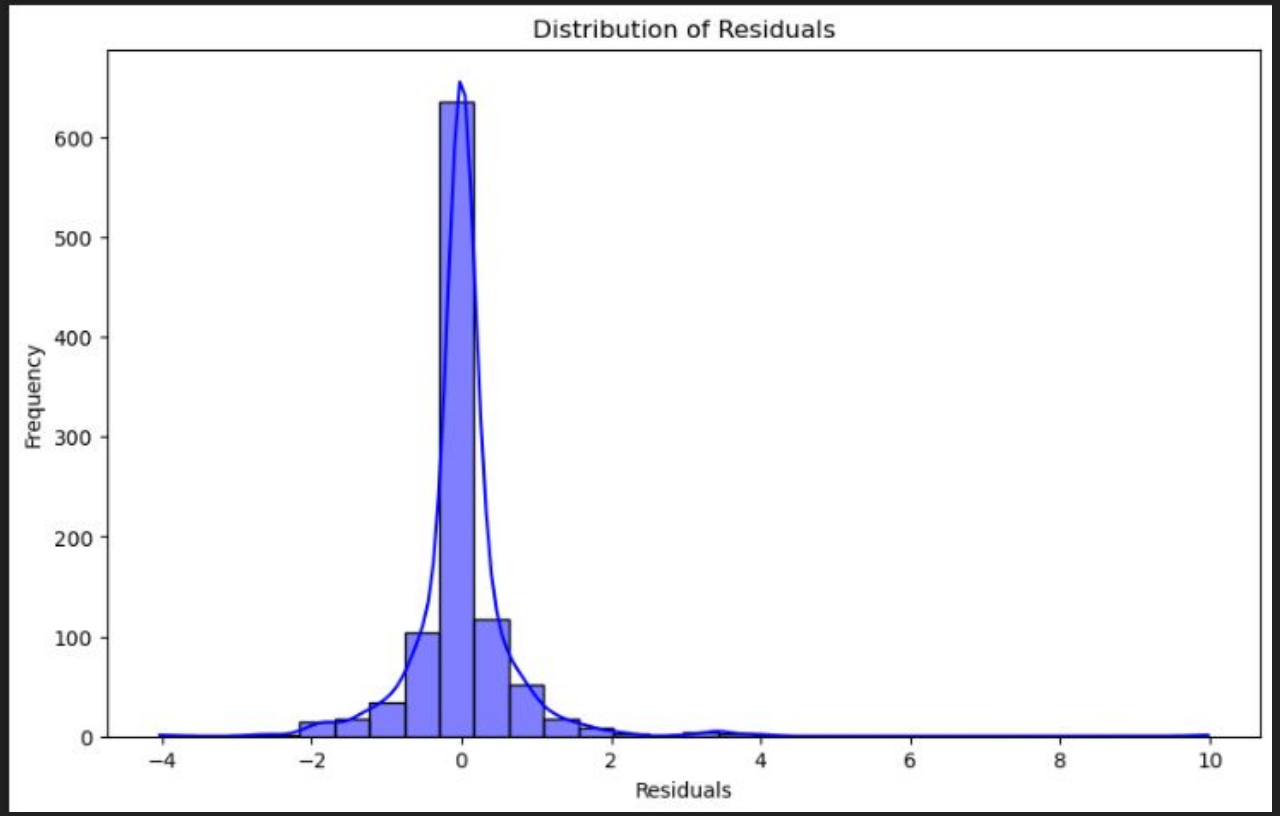
Actual vs Predicted Graphs of City MPG

Comparative graphs showing actual versus predicted MPG values in the city, illustrating model accuracy.



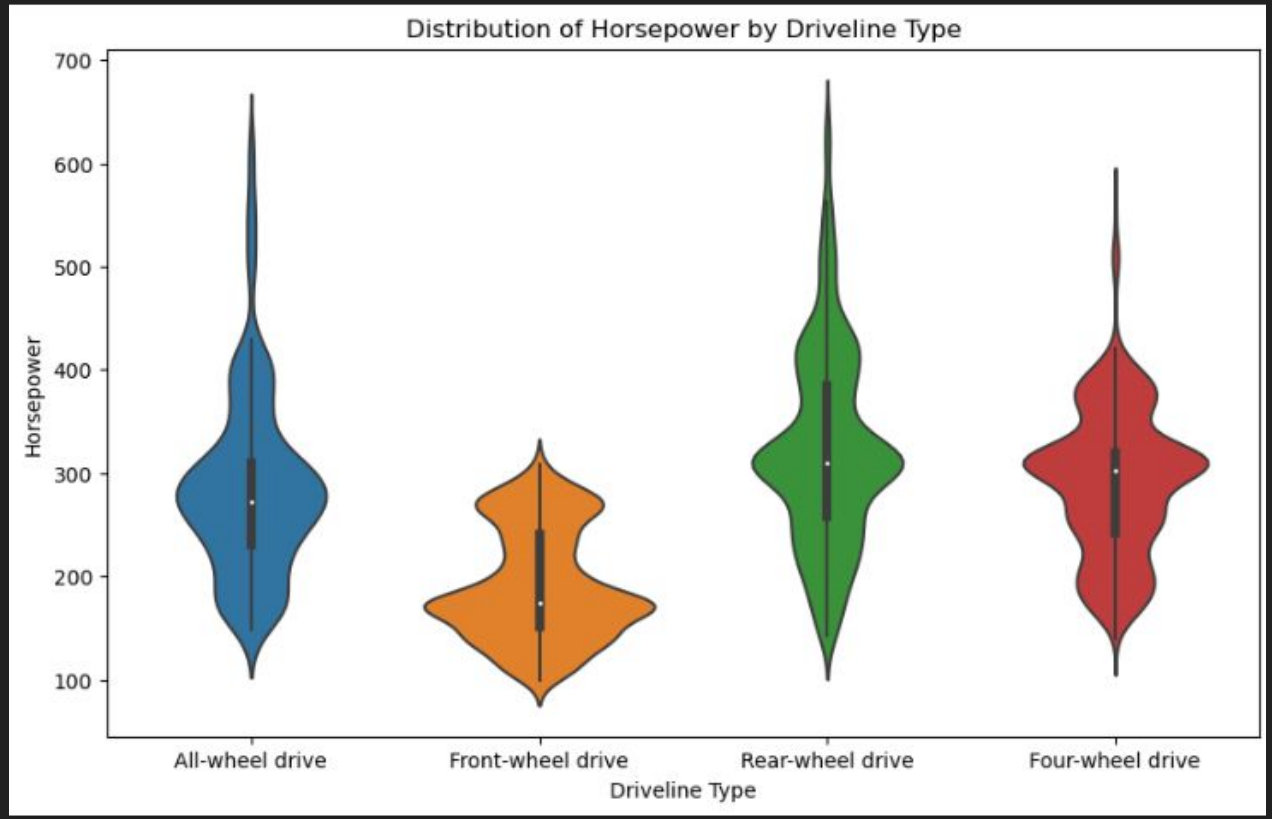
Residual Graph

This graph displays the residuals of the predictive model, providing insights into the prediction errors across different data points.



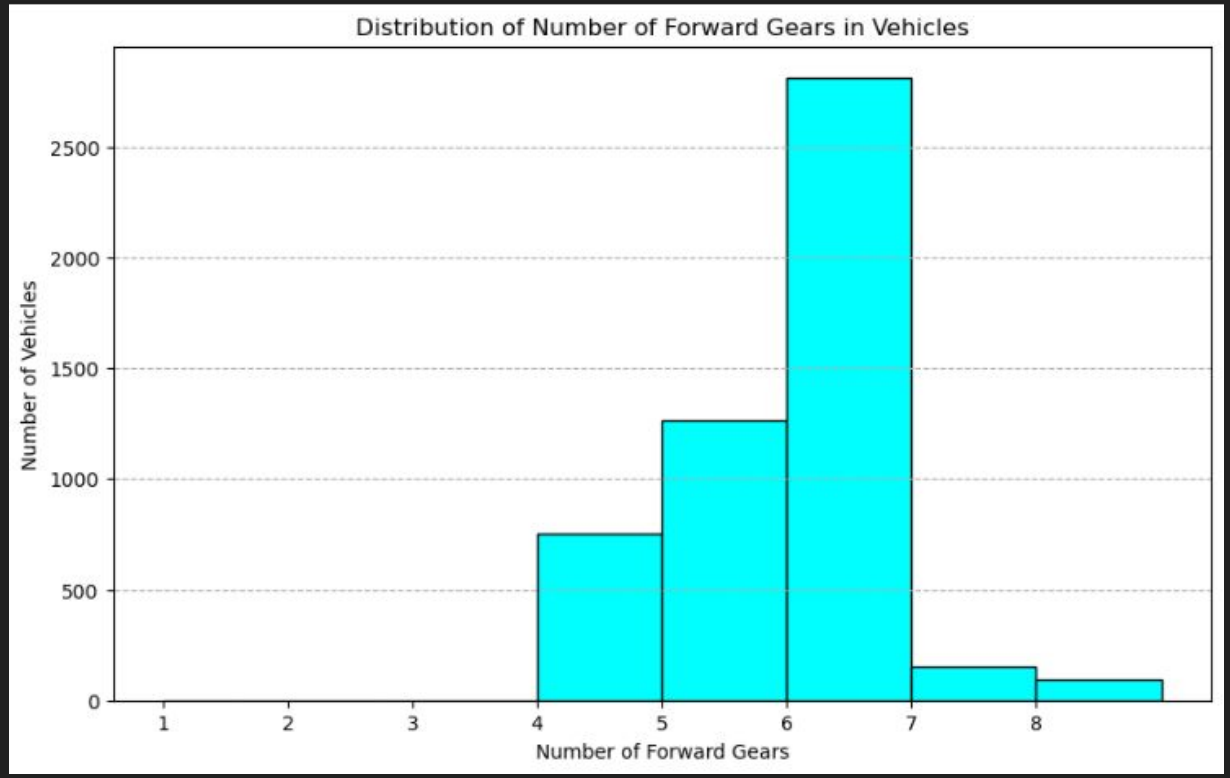
Violin Graph of horsepower and driveline type

A violin graph illustrating the distribution and range of horsepower across different driveline types.



Bar Graph of count on how many gears in a car

A graph showing the distribution of vehicles based on the number of gears, highlighting common gear configurations.



Conclusion

- Efficiency Trends: Advancements in technology over model years have improved fuel efficiency, with automatic transmissions and specific driveline types enhancing performance.
- Feature Impact on MPG: Attributes such as the number of gears and driveline configurations significantly influence urban fuel efficiency. Automatic and rear-wheel drives are notably more efficient.
- Model Predictions: The Random Forest model demonstrates strong predictive accuracy (R^2 = 0.9758) for city MPG based on characteristics like horsepower and transmission mode. Residual graphs highlight areas for model refinement.
- Strategic Insights: Manufacturers should prioritize optimizing driveline and transmission technologies to boost efficiency. Predictive analytics can guide design decisions to meet consumer and environmental demands.