This report explores the factors influencing fuel efficiency in automobiles through an analysis of the "Auto MPG" dataset, which contains data on various car attributes. Employing machine learning techniques such as Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), Naive Bayes, Logistic Regression, and K-Nearest Neighbors (KNN), the study aims to classify cars into high or low fuel efficiency groups.

Initial exploratory data analysis revealed that displacement, horsepower, and weight are strongly associated with fuel efficiency. These insights were further validated through various classification methods, with LDA showing the lowest misclassification rate, suggesting it as the most effective model for predicting fuel efficiency.

The results underscore the impact of car attributes on fuel efficiency, with heavier and more powerful cars generally exhibiting lower mpg. The findings from this analysis can guide automotive design and consumer choices towards more fuel-efficient vehicles.

For future research, it is recommended to explore additional variables like CO2 emissions and vehicle maintenance history, and to consider advanced modeling techniques to improve predictive accuracy and applicability.