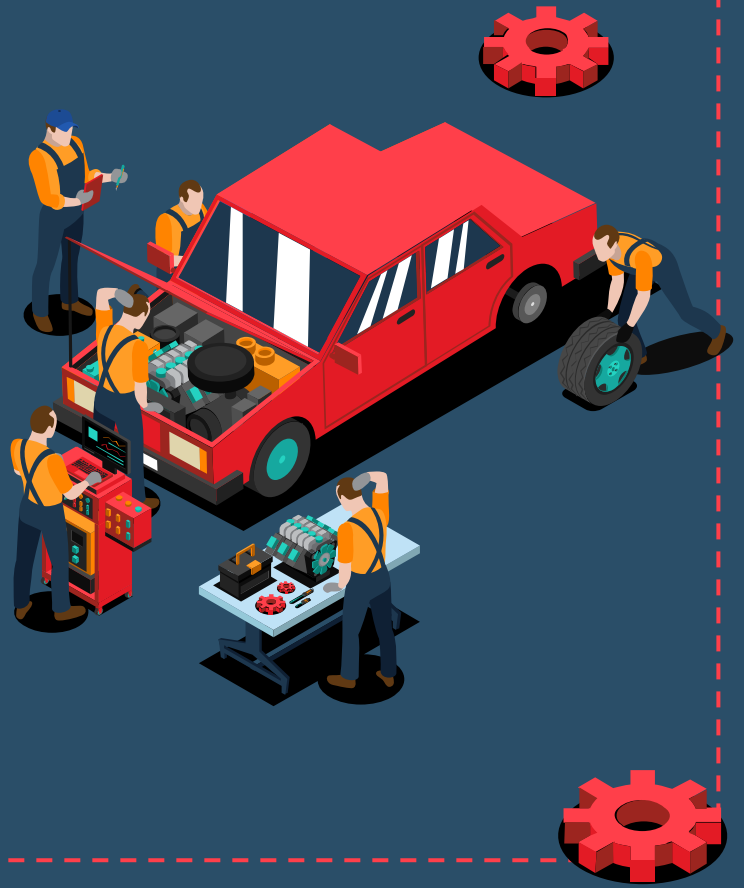
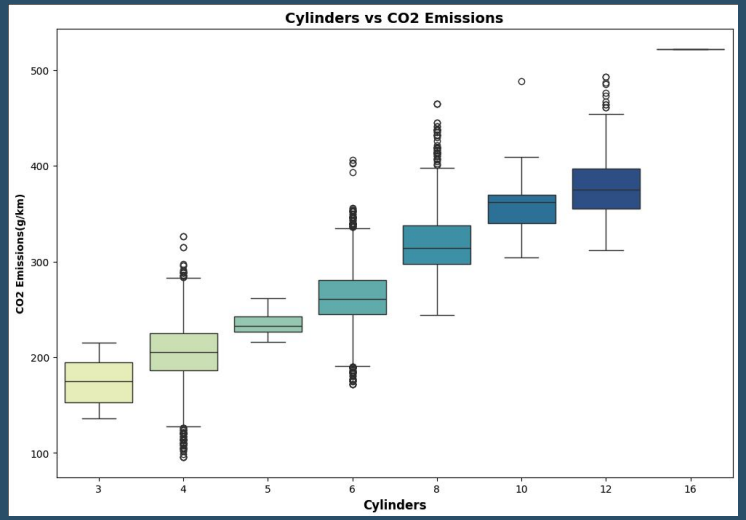
VEHICLE CO2 EMISSIONS

Analysis and Modeling

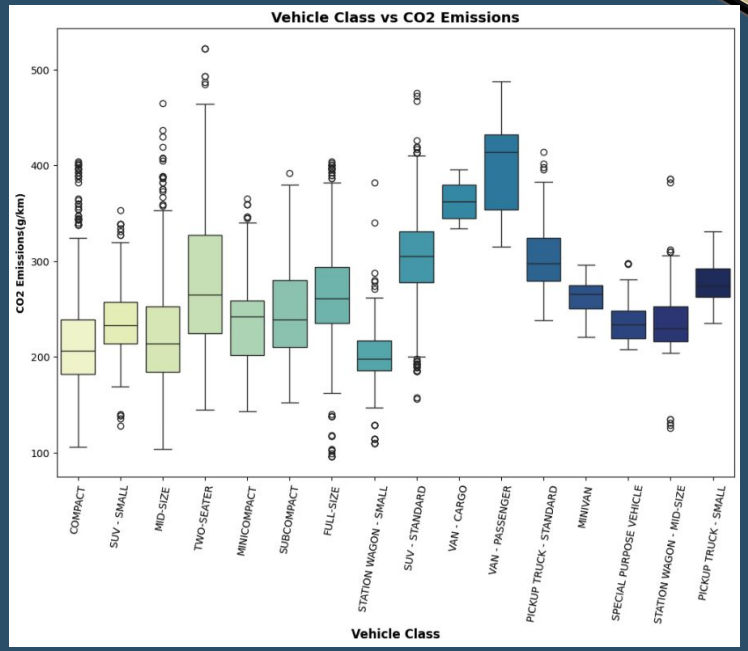


Edric Ma

VEHICLE SPECIFICATIONS

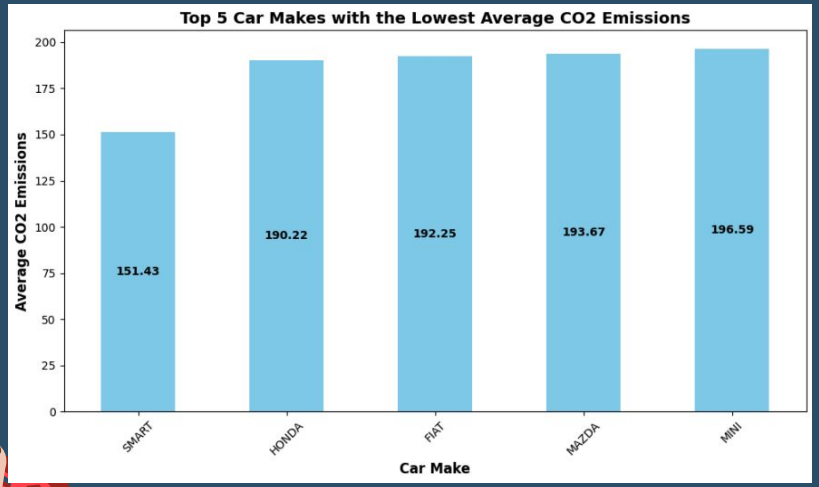


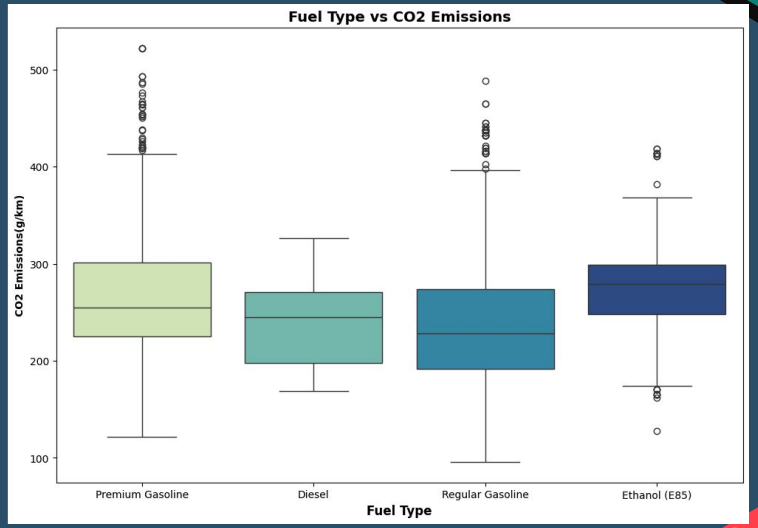
The number of cylinders in an engine seems to have a positive correlation with CO2 emissions. The more cylinders in the vehicle's engine, the higher its CO2 emissions levels are.



Vehicle class (can sort of be interpreted as size) seems to affect the level of CO2 emissions. General trends of "smaller" vehicles showing lower CO2 emissions.

VEHICLE SPECIFICATIONS CONT.

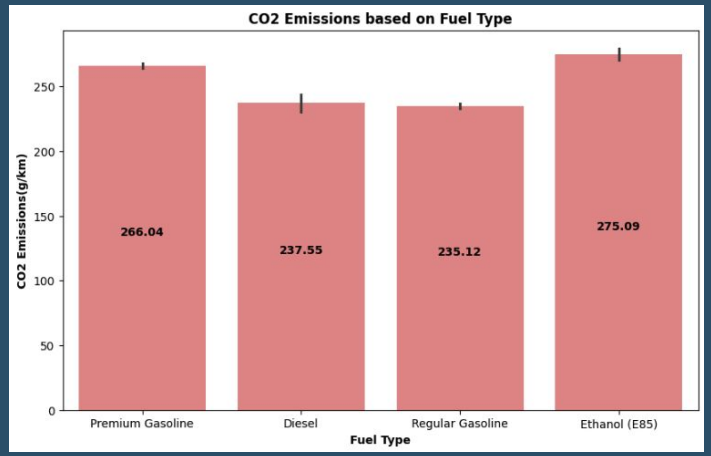




HONDA had a very low average CO2 emission among all car makes while having over 200 different car models.

There seems to be noticeable visual differences in CO2 emissions between the four different fuel types.

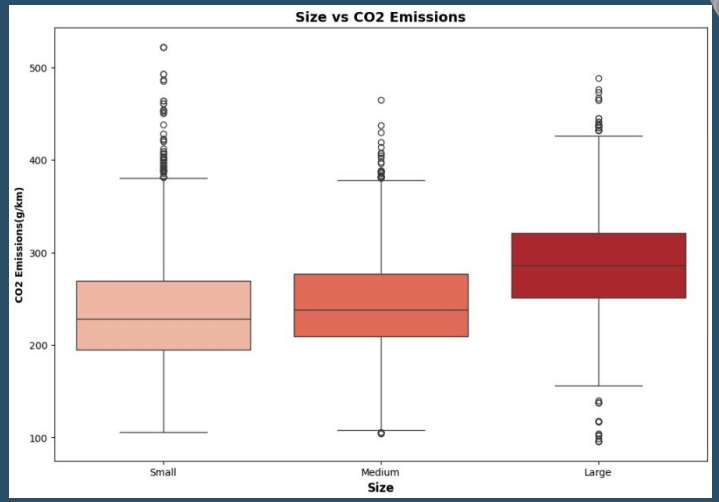
INFERENTIAL ANALYSES



Null Hypothesis: There is no significant statistical difference in CO2 emissions between the fuel types.

Alternative Hypothesis: Different fuel types exhibit different levels of CO2 emissions.

THERE IS SUFFICIENT STATISTICAL EVIDENCE TO REJECT THE NULL HYPOTHESIS. THERE IS A STATISTICAL DIFFERENCE IN CO2 EMISSIONS BASED ON FUEL TYPE.

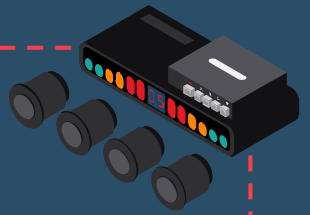


Null Hypothesis: There is no significant statistical difference in CO2 emissions between three vehicle sizes.

Alternative Hypothesis: Different vehicle sizes exhibit different levels of CO2 emissions.

THERE IS ENOUGH EVIDENCE TO REJECT THE NULL HYPOTHESIS, MEANING THERE IS A STATISTICAL DIFFERENCE IN CO2 EMISSIONS BASED ON VEHICLE SIZE.

MACHINE LEARNING MODEL



TEST MODELS

- Features: Vehicle Size, Engine Size, Fuel Type, Cylinders, Fuel Consumption
- 6 regression base models (KNeighbors, DecisionTree, LinearRegression, etc.)
- Relatively high R^2…

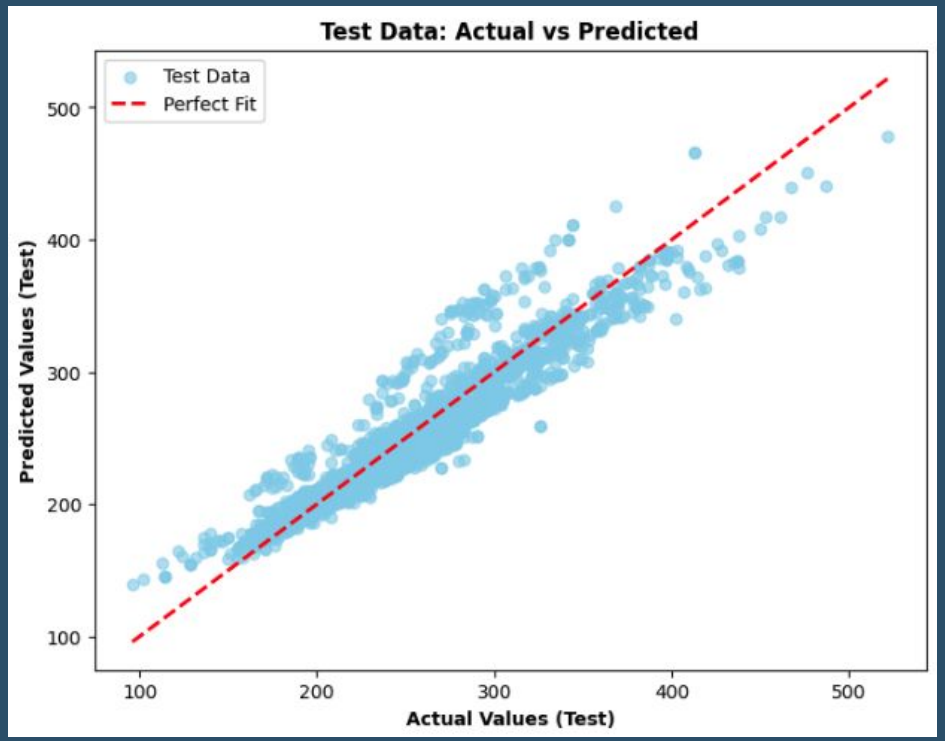
OVERFITTING

- Compared training R^2 & MSE against the testing R^2 & MSE
- Encountered threats of overfitting
- Certain models already achieved and R^2 value over 0.99

MODEL FITTING

- Utilized Cross-Validation
- Regularization Techniques
- Ridge Regression

MACHINE LEARNING MODEL CONT.



R^2: 0.891

The model can do a respectable job of predicting CO2 emissions of a vehicle when given the vehicle specifications and features.

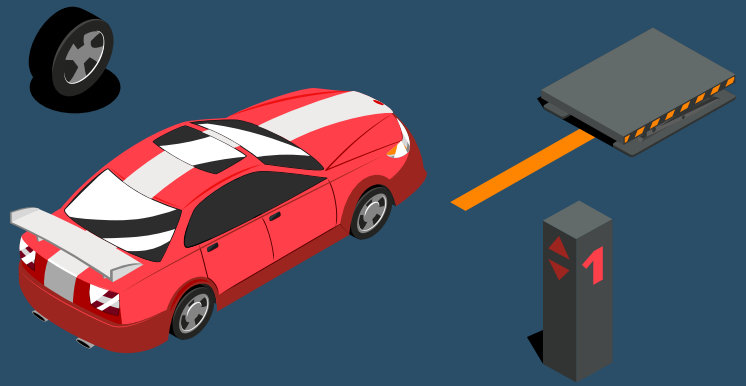
EXTERNAL RESOURCES

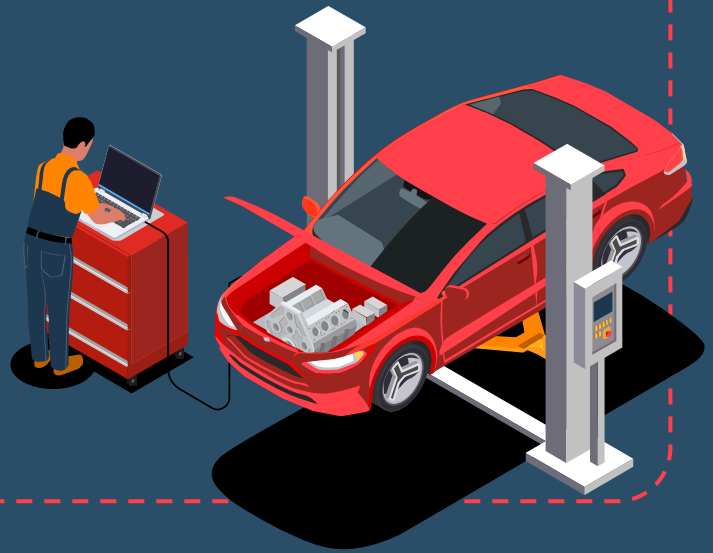
Slides:

https://slidesgo.com/theme/automotive-mechanics-project-proposal#search-vehicle&position-1&results-218&rs=search

Vehicle background research:

https://afdc.energy.gov/data/10380





Thanks!