

# Car Fuel Economy Prediction

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# What is Car Fuel Economy

- Amount of distance a car can travel in a certain amount of gas
- Units in miles per gallon
- Two tests are conducted: city driving and highway driving
- Factors affecting: weather, speeding, weight, maintenance
- Helps save money and reduces emissions

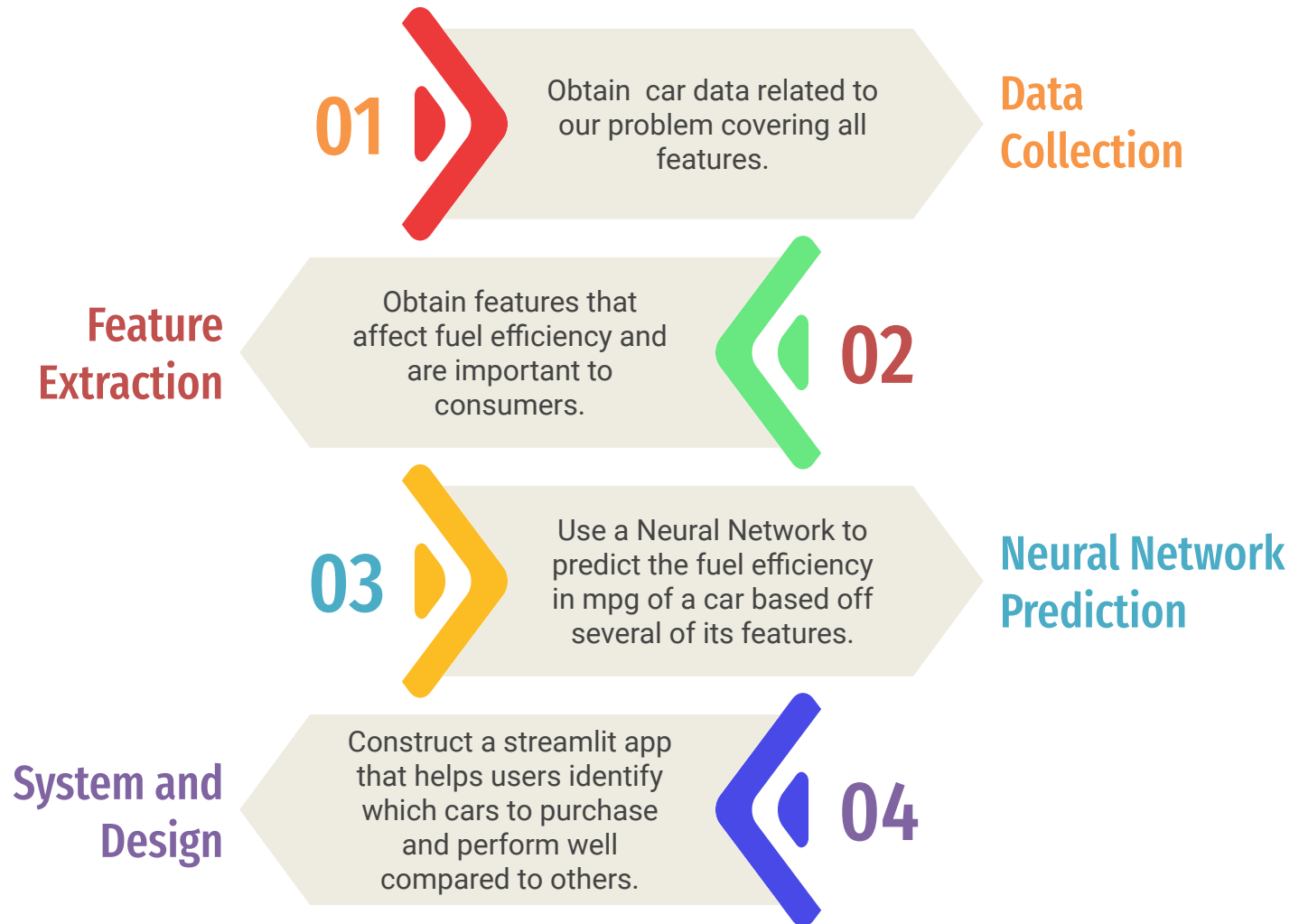


# System and Design

- Make a Car recommendation website which asks the user for input in terms of what sort of car they are looking for such as seats, price, safety, and mpg and outputs the best cars that fit the criteria
- Produce a car fuel economy model that can reliably predict mpg given several input car parameters to help determine which cars are more safe and valuable for the money spent



# Steps



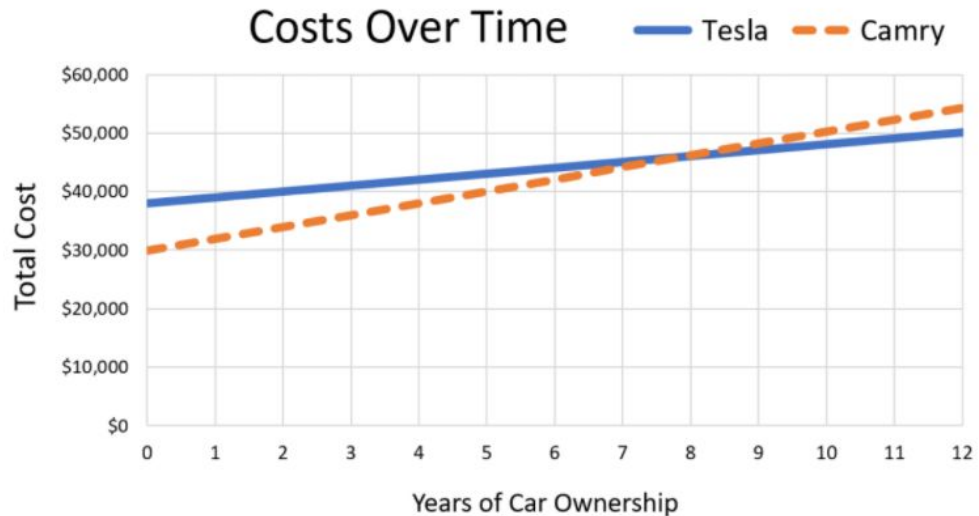
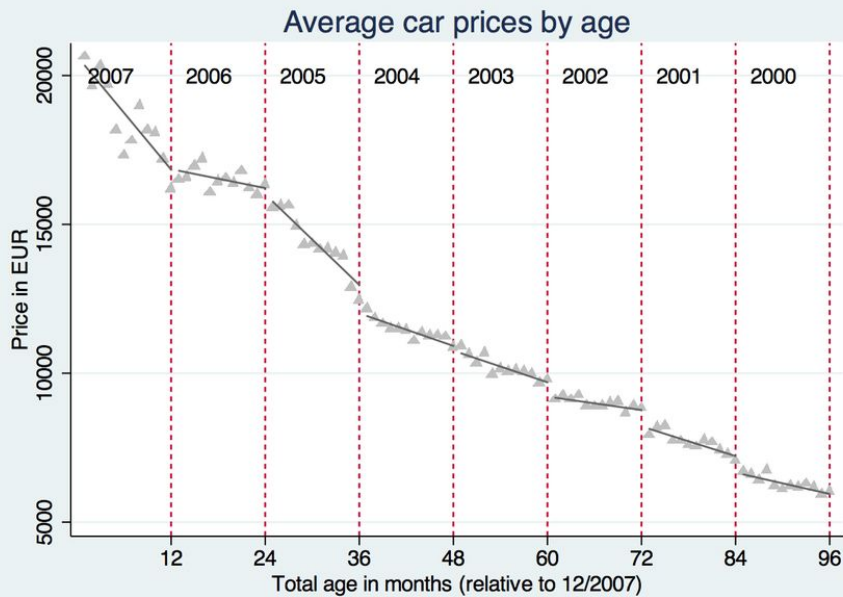
# Purpose

- Fuel costs ~\$3000 per year for an average US Citizen
- Consumers mainly consider pricing, seating, safety, and mpg
- Car fuel efficiency changes year by year along with driver skill
- Predict fuel efficiency for any car
- Compare cars on features such as mpg or price



# Car Depreciation

- As time goes on, fuel efficiency stays the same as long as car's components are maintained well.
- As time goes on, car price decreases exponentially




# Data Collection

- Large dataset from EPA containing over 40 brands of car parameters including horsepower, mpg, weight, model from 1984-2021. We are currently analyzing data from 2020, however, we have access to larger amounts of data.
- Additional features of seating, car price, and safety obtained from usnews.

## 2020 Mazda Mazda3

Review Photos Configurations Performance Interior



**Search Used Listings**  
Enter your zip code to search used Mazda3 listings in your area.

**\$22,863 - \$29,988** Avg Price Paid  
~~\$21,500 - \$28,900~~ Original MSRP

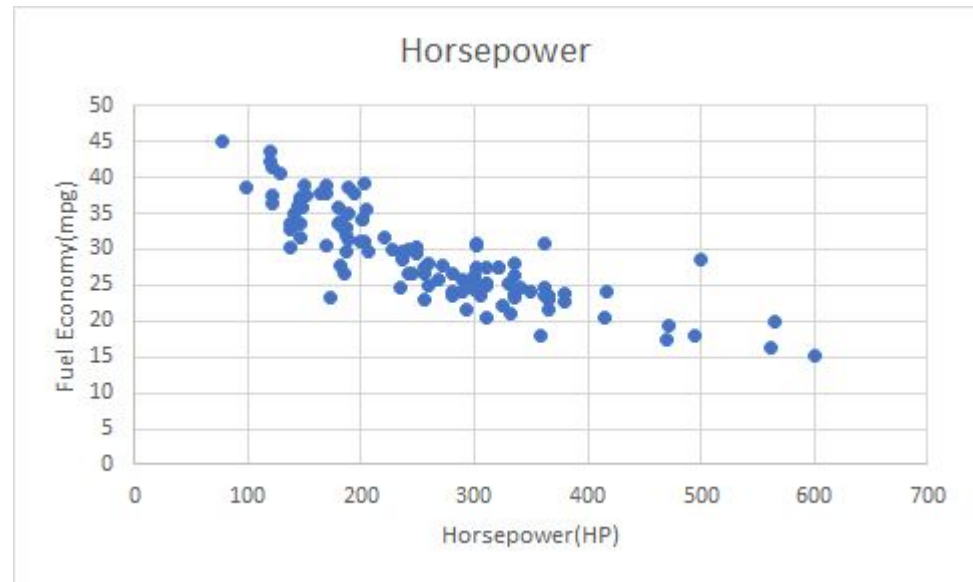
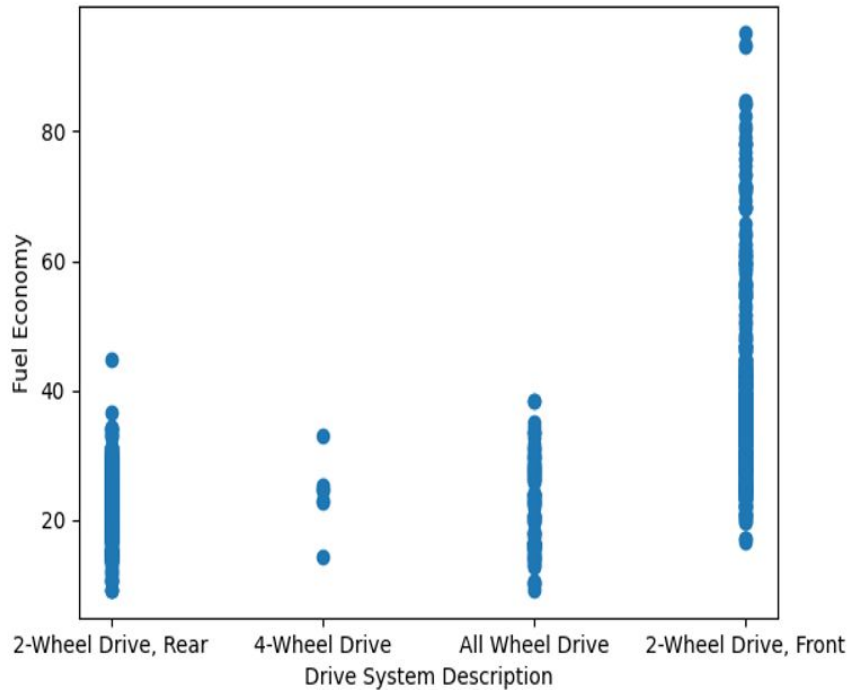
Zip Code  [View Local Inventory](#)

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# Feature Extraction

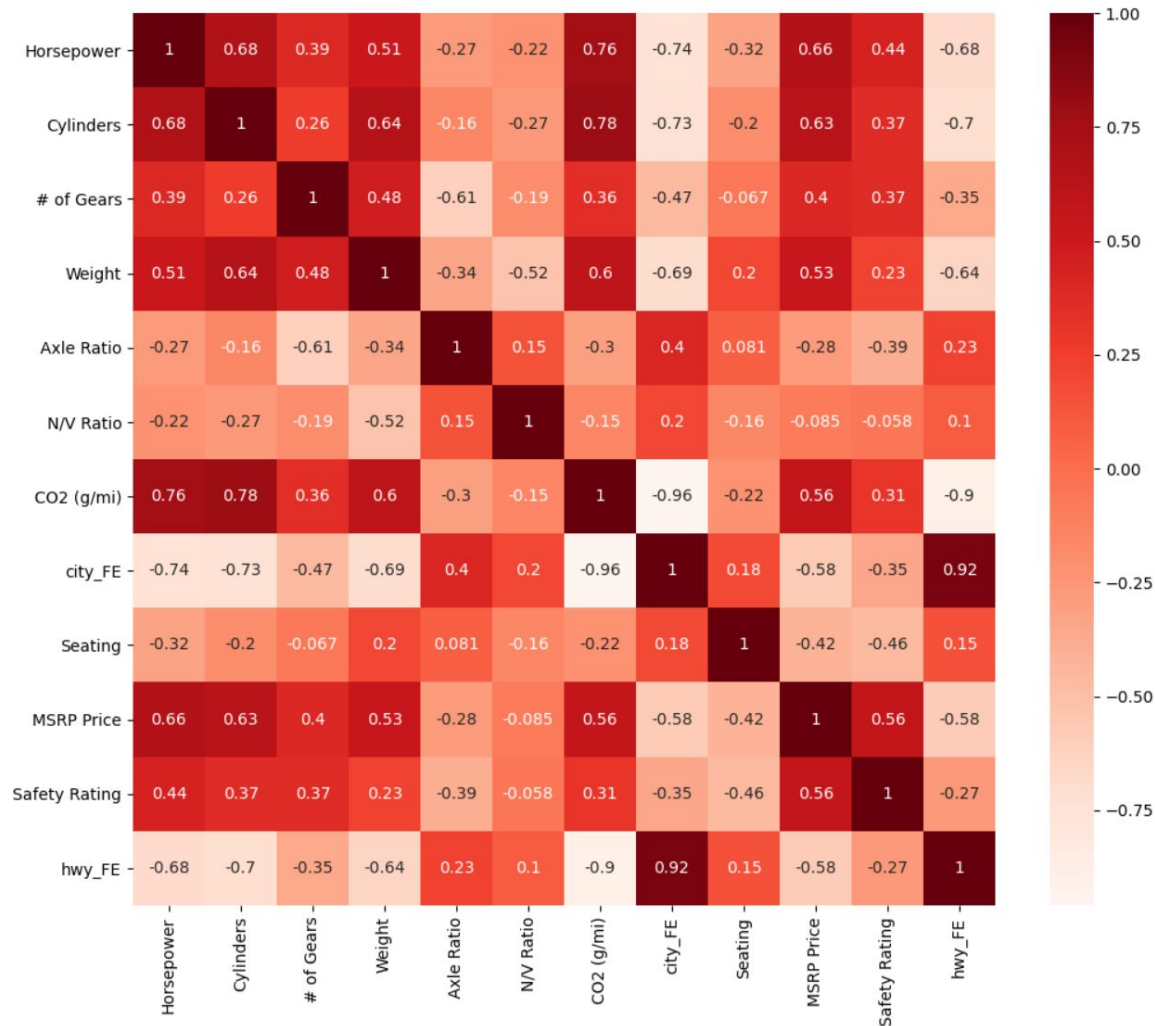
We conducted a sensitivity analysis on many features to identify which ones affect fuel economy the most.





# Feature Extraction

We used pearson correlation to identify any strong correlations between fuel economy and other identified features.



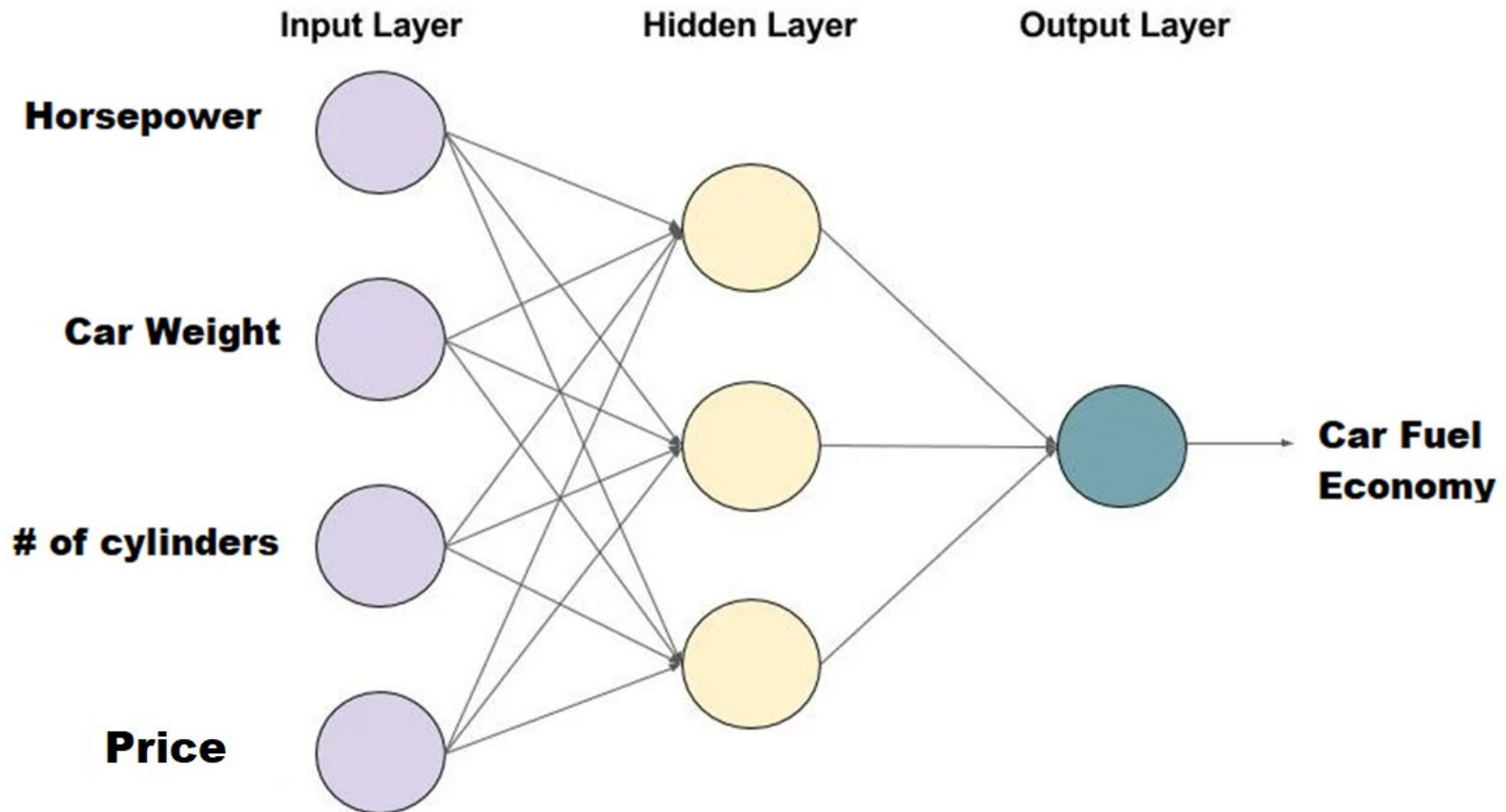
# Feature Extraction

After performing sensitivity analysis, we ended up with several features that consumers care most and several features that affect the car fuel economy or mpg.

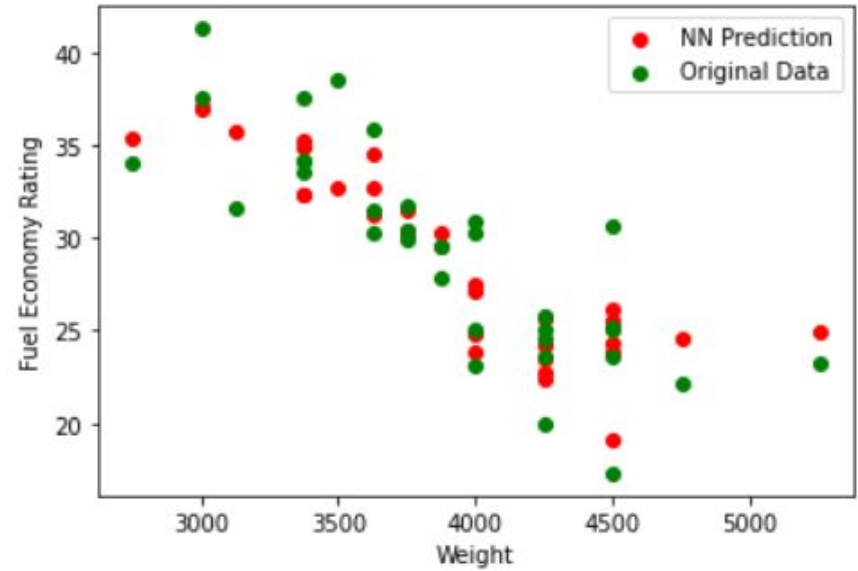
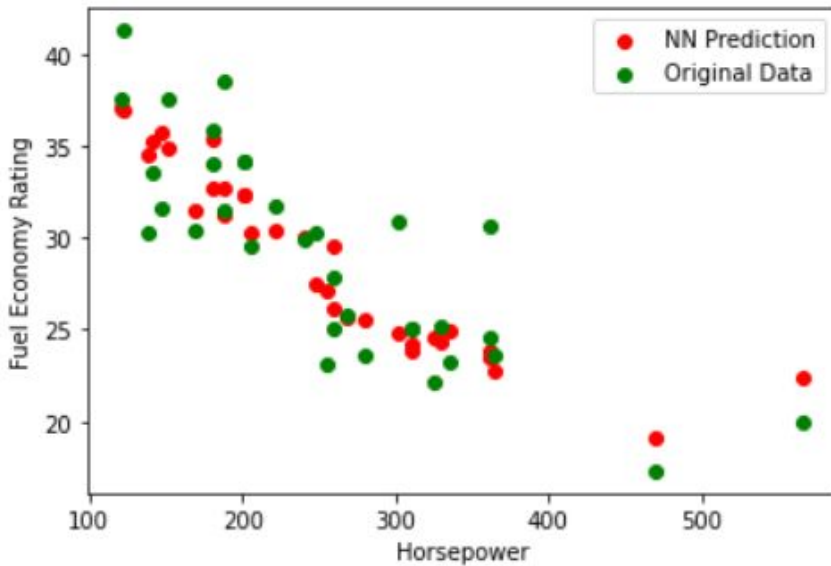
features consumers care about	features affecting car fuel economy
# of seats	# of Cylinders
price	Horsepower
safety	Drive system
mpg	Weight

# Neural Networks

Using a feed forward neural network, one where information only goes forward, with currently 4 inputs and 1 output. This is used to predict the car fuel economy or mpg given a cars attributes.



# Neural Networks



Mean absolute error: 0.07  
 Mean squared error: 0.01  
 R-Squared: 0.76

5-fold Cross Validation:

	Group 1	Group 2	Group 3	Group 4	Group 5
Mean Absolute Error	0.08	0.06	0.09	0.08	0.07
R-Squared	0.66	0.80	0.71	0.63	0.78

# Streamlit Web App

- Streamlit: an open-source python framework for building web apps for Machine Learning and Data Science

**Car Criteria Filter**

Sort by Fuel efficiency (mpg) or price

highway fuel efficiency ▾

Select minimum number of seats

4

2 8

Select maximum number of seats

5

2 8

Please write the minimum safety rating from 0 to 10

9.00 - +

Select minimum price

42435

1 150000

Select maximum price

106579

1 150000

Select minimum mpg

25

1 50

Input: Specify user parameters

Output: Top 5 car recommendations fitting user parameters

## Car feature filter and recommender

Top 5 cars according to highway fuel efficiency

### 1. Mercedes-benz cla 250

Seating: 5

MSRP: \$50406

Safety: N/A

car city mpg: 31.7

car highway mpg: 51.5



### 2. Audi a4

Seating: 5

MSRP: \$43650

Safety: 9.5/10

car city mpg: 35.1

car highway mpg: 50.3



### 3. Audi a3

Seating: 5

MSRP: \$44750

Safety: 9.3/10

car city mpg: 32.9

car highway mpg: 50.3



# References

1. Young-saver, Dashiell. “Gas or Electric? Thinking ALGEBRAICALLY about Car Costs, Emissions and Trade-Offs.” The New York Times, The New York Times, 16 Feb. 2021, [www.nytimes.com/2021/02/16/learning/gas-or-electric-thinking-algebraically-about-car-costs-emissions-and-trade-offs.html](http://www.nytimes.com/2021/02/16/learning/gas-or-electric-thinking-algebraically-about-car-costs-emissions-and-trade-offs.html).
2. Stowasser, Till & Englmaier, Florian & Schmöller, Arno. (2016). Price Discontinuities in an Online Market for Used Cars. Management Science. 64. 10.1287/mnsc.2016.2714.
3. U.S. News & World Report, U.S. News & World Report, [cars.usnews.com/cars-trucks](http://cars.usnews.com/cars-trucks).