Trace3

GREENDRIVE

Optimizing Fuel Efficiency: GreenDrive Automotive MPG Analysis

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Defining the Challenge

GreenDrive aims to leverage AI for optimizing fuel efficiency while addressing cost concerns and validating data-driven vehicle design decisions

Can MPG be predicted using vehicle specifications?

Which factors most impact fuel efficiency?

What are the optimal specifications for maximizing MPG?

Data limitations and assumptions we had to made

Why Invest in AI?

Optimized Data Driven Decision-Making

AI identifies key design factors impacting fuel efficiency, enabling data-driven decisions to improve MPG.

Cost Savings and Efficient

Reduces R&D expenses by minimizing physical prototyping through virtual AI assisted simulations.

Why Invest in Fuel Efficiency?

Consumer Demand for Fuel-Efficient Vehicles

83% of Americans expect each new generation of vehicles to be more fuel-efficient than the last

Consumer Report

74% [Americans] are willing to pay extra for a more fuel-efficient vehicle

Consumer Report

Impact of Fuel Prices on Vehicle Sales

A study found that a $1 increase in gasoline prices results in a 20.5% increase in the market share of the most fuel-efficient vehicles and a 23.9% decrease in the market share of the least fuel-efficient ones

ECONSTOR.EU

Dataset Overview

Target Variable
MPG (Miles Per Galon)

Engine Specification

- **Cylinder (3,4,5,6,8)**
- **Displacement (cubic inches)**
- **Engine Horsepower**
- **Acceleration (0-60 mph)**

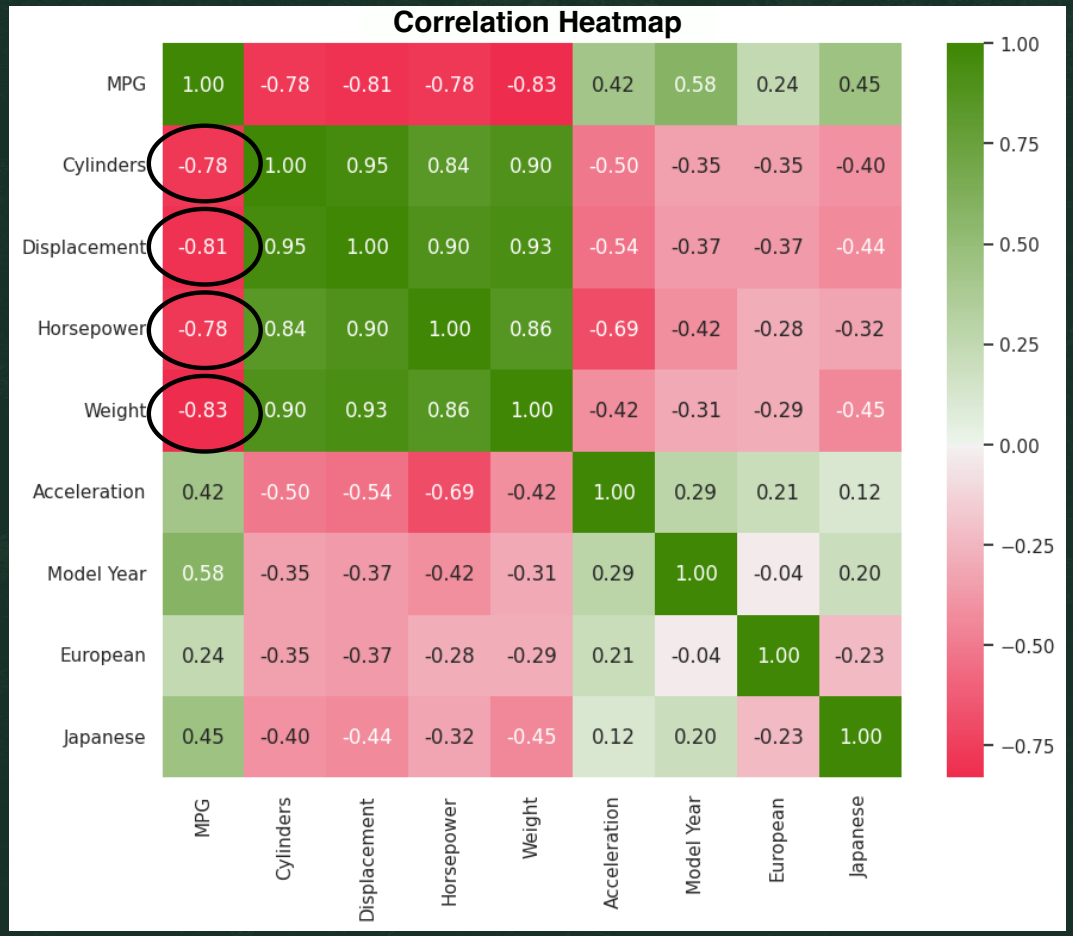
Vehicle Specifications

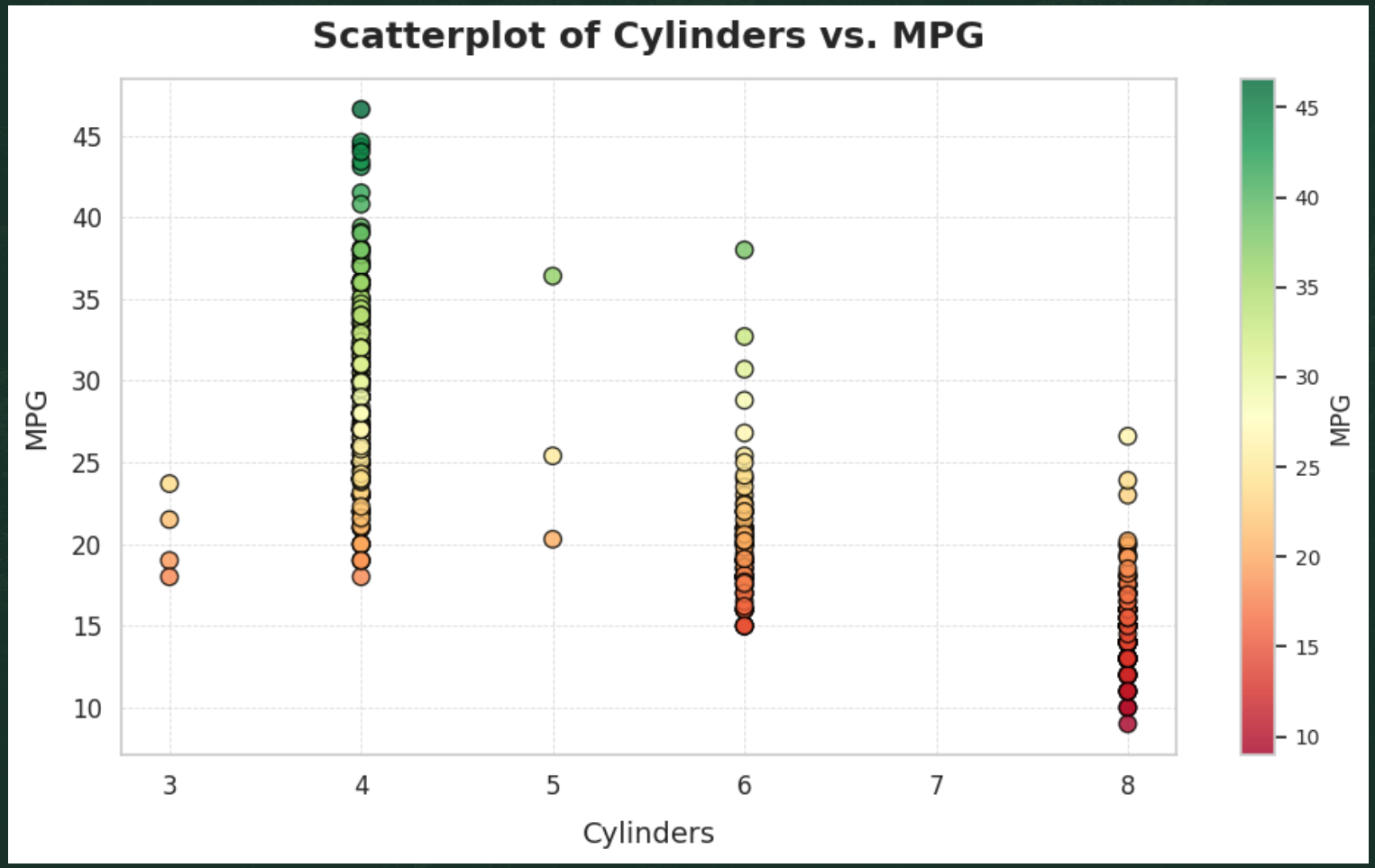
- **Weight (in Pounds)**
- **Origin** (Japanese, American European)
- **Car Name**
- **Model Year**

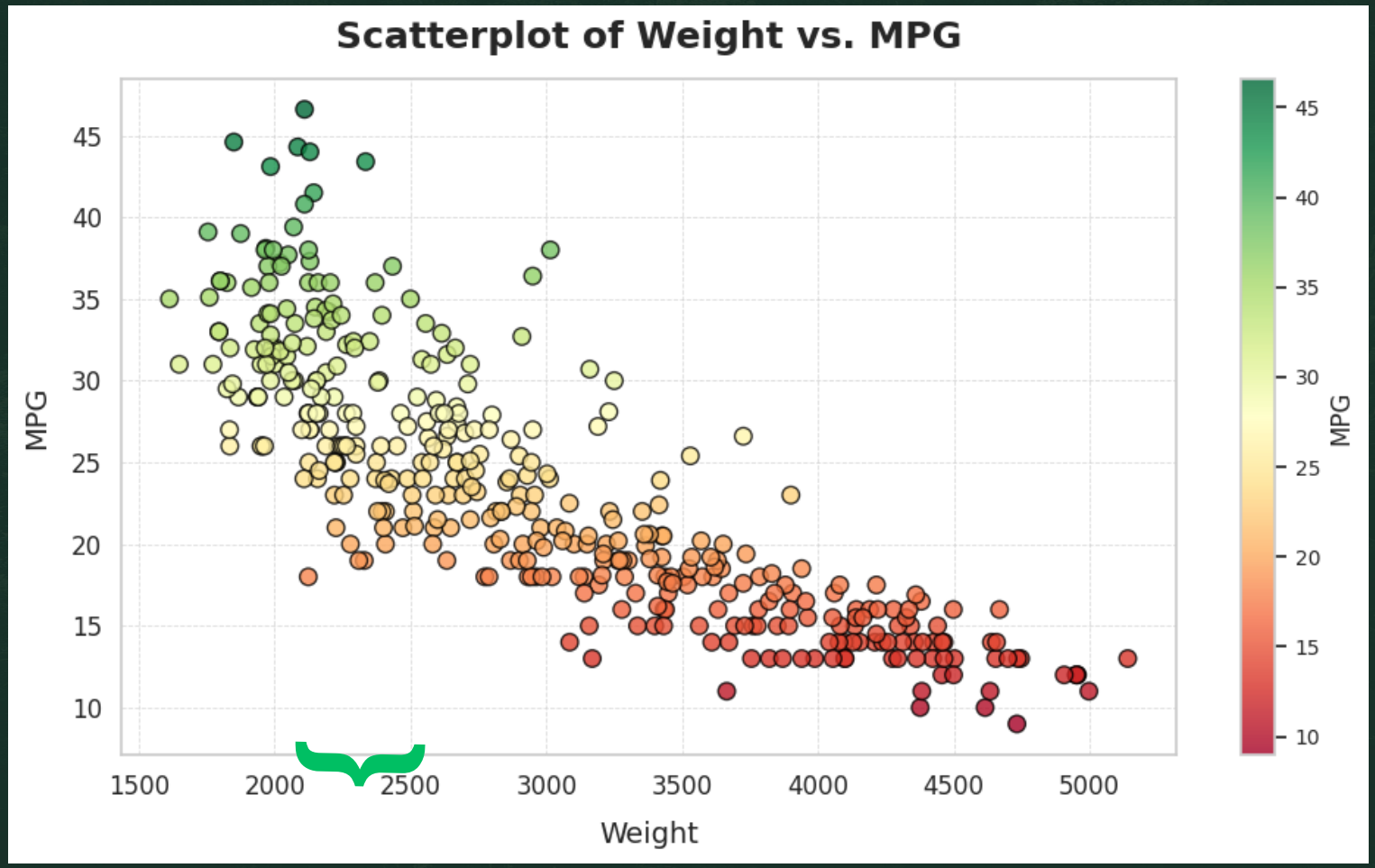
	MPG	Cylinders	Displacement	Horsepower	Weight	Acceleration	Model Year	Origin	Car Name
0	18.0	8	307.0	130.0	3504.0	12.0	70	1	chevrolet chevelle malibu
1	15.0	8	350.0	165.0	3693.0	11.5	70	1	buick skylark 320
2	18.0	8	318.0	150.0	3436.0	11.0	70	1	plymouth satellite
3	16.0	8	304.0	150.0	3433.0	12.0	70	1	amc rebel sst
4	17.0	8	302.0	140.0	3449.0	10.5	70	1	ford torino

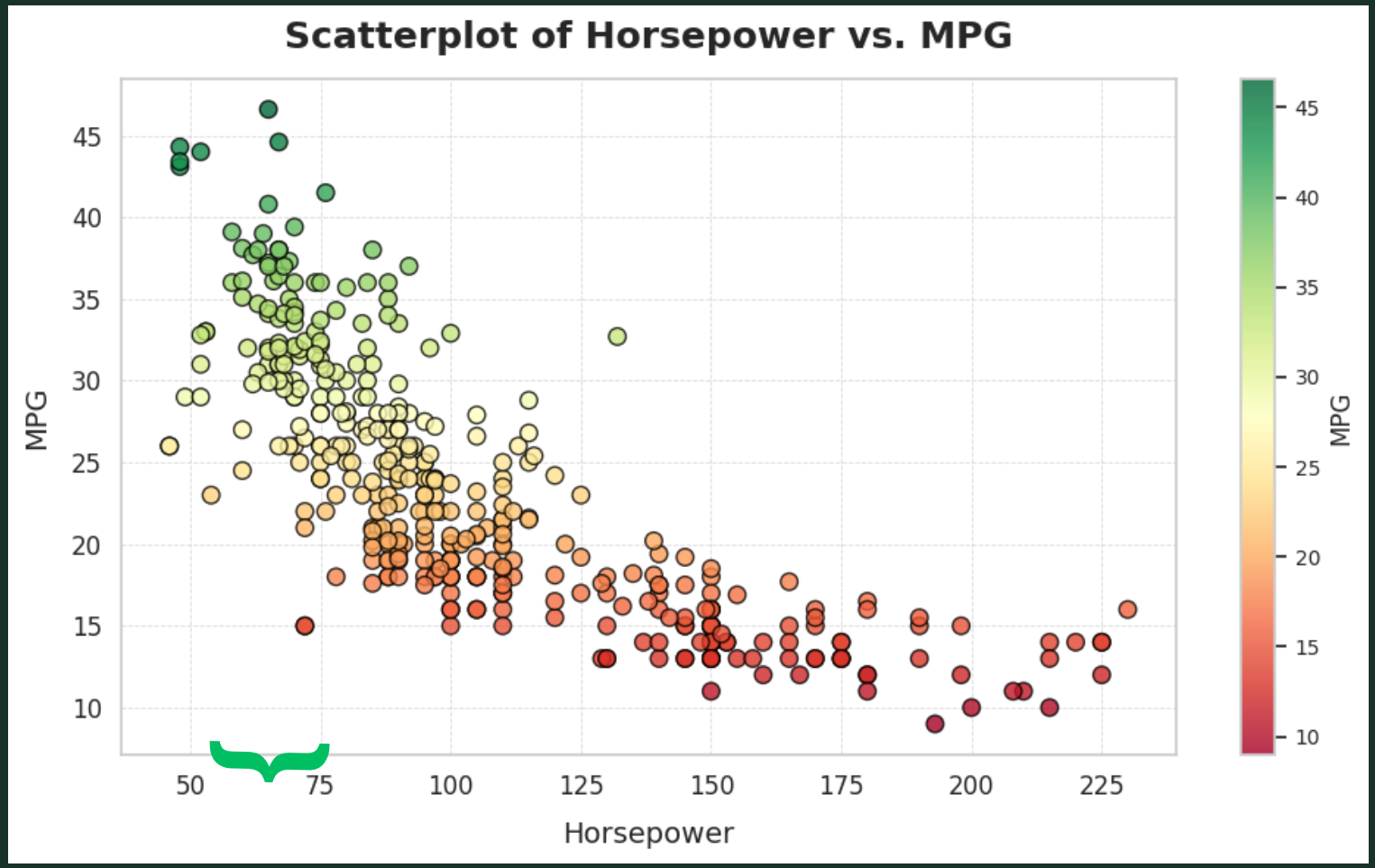
Analyst Assumptions

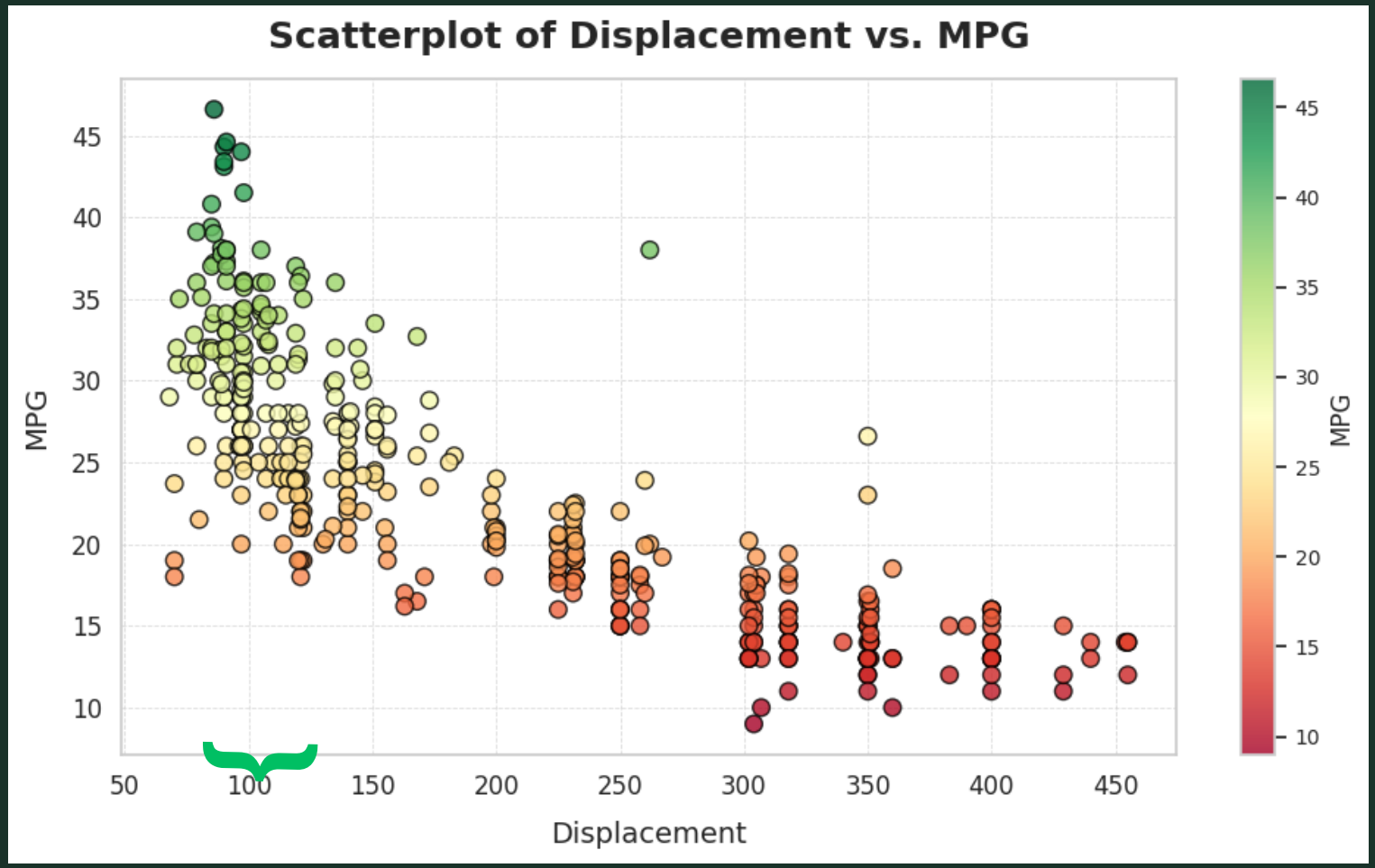
Strong Negative Correlation with MPG

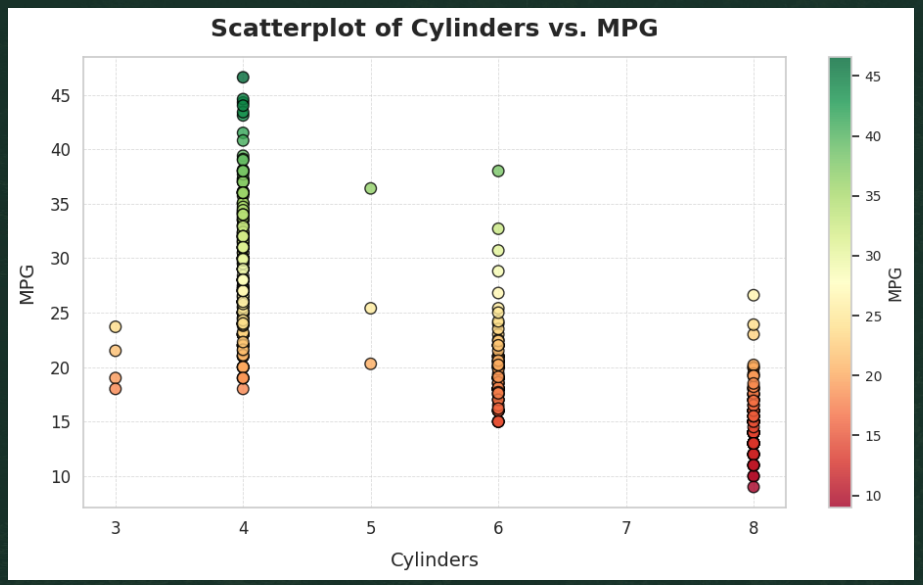


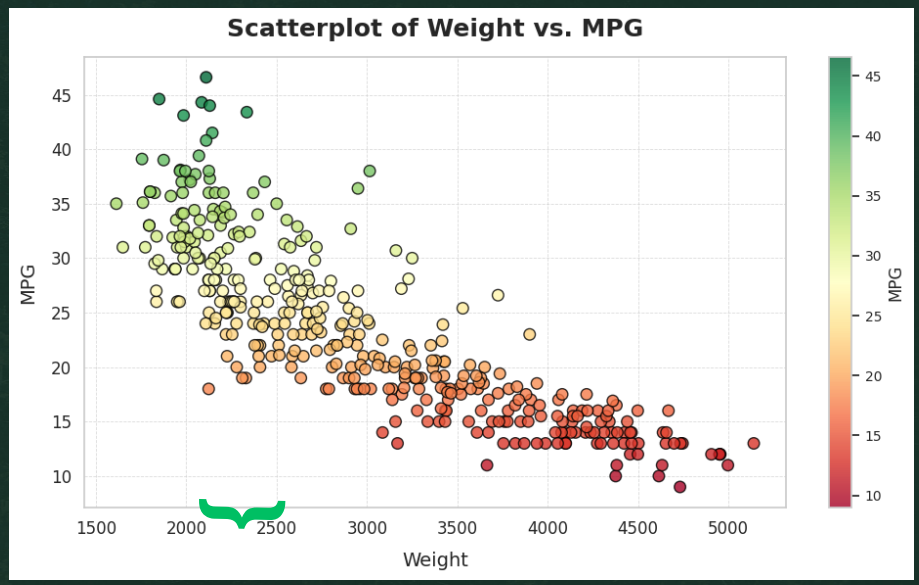

Scatterplot of Cylinders vs. MPG
MPG
45
40
35
30
25
20
15
10
3
4
5
6
7
8
Cylinders
MPG
45
40
35
30
25
20
15
10

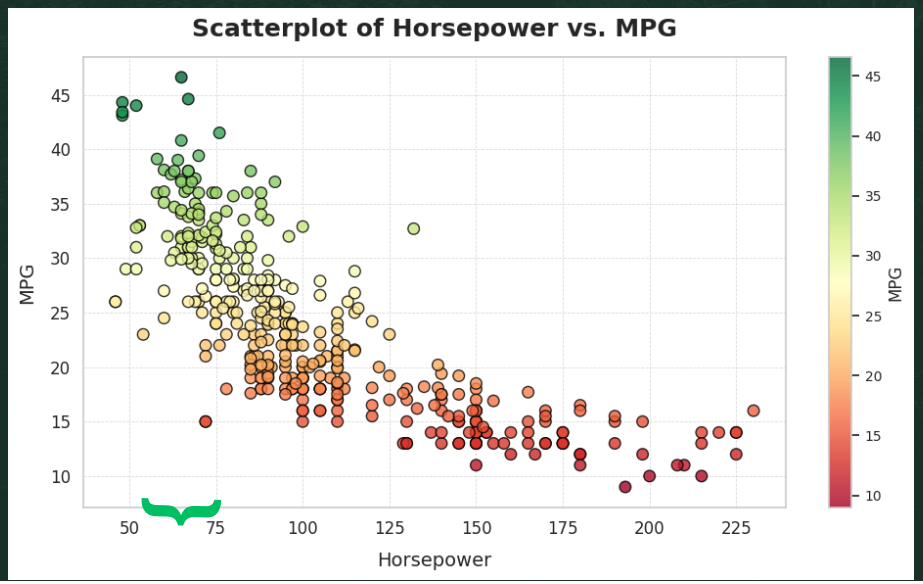

Scatterplot of Weight vs. MPG
MPG
45
40
35
30
25
20
15
10
1500
2000
2500
3000
3500
4000
4500
5000
Weight
MPG
45
40
35
30
25
20
15
10

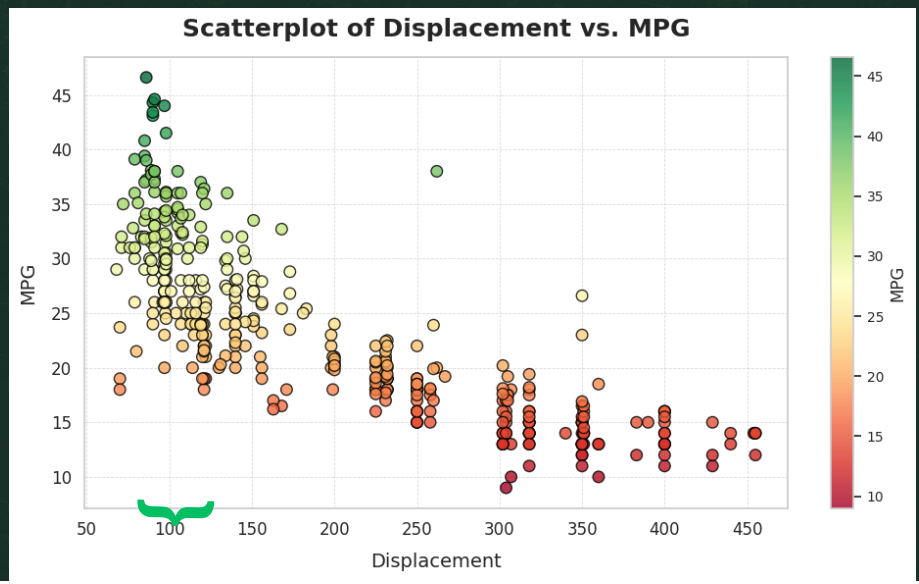

Scatterplot of Horsepower vs. MPG
MPG
45
40
35
30
25
20
15
10
50
75
100
125
150
175
200
225
Horsepower
MPG
45
40
35
30
25
20
15
10


Scatterplot of Displacement vs. MPG
MPG
45
40
35
30
25
20
15
10
50
100
150
200
250
300
350
400
450
Displacement
MPG
45
40
35
30
25
20
15
10


Scatterplot of Cylinders vs. MPG
MPG
Cylinders
MPG


Scatterplot of Weight vs. MPG
MPG
Weight
MPG


Scatterplot of Horsepower vs. MPG
MPG
Horsepower
MPG


Scatterplot of Displacement vs. MPG
MPG
Displacement
MPG

46.6
MPG

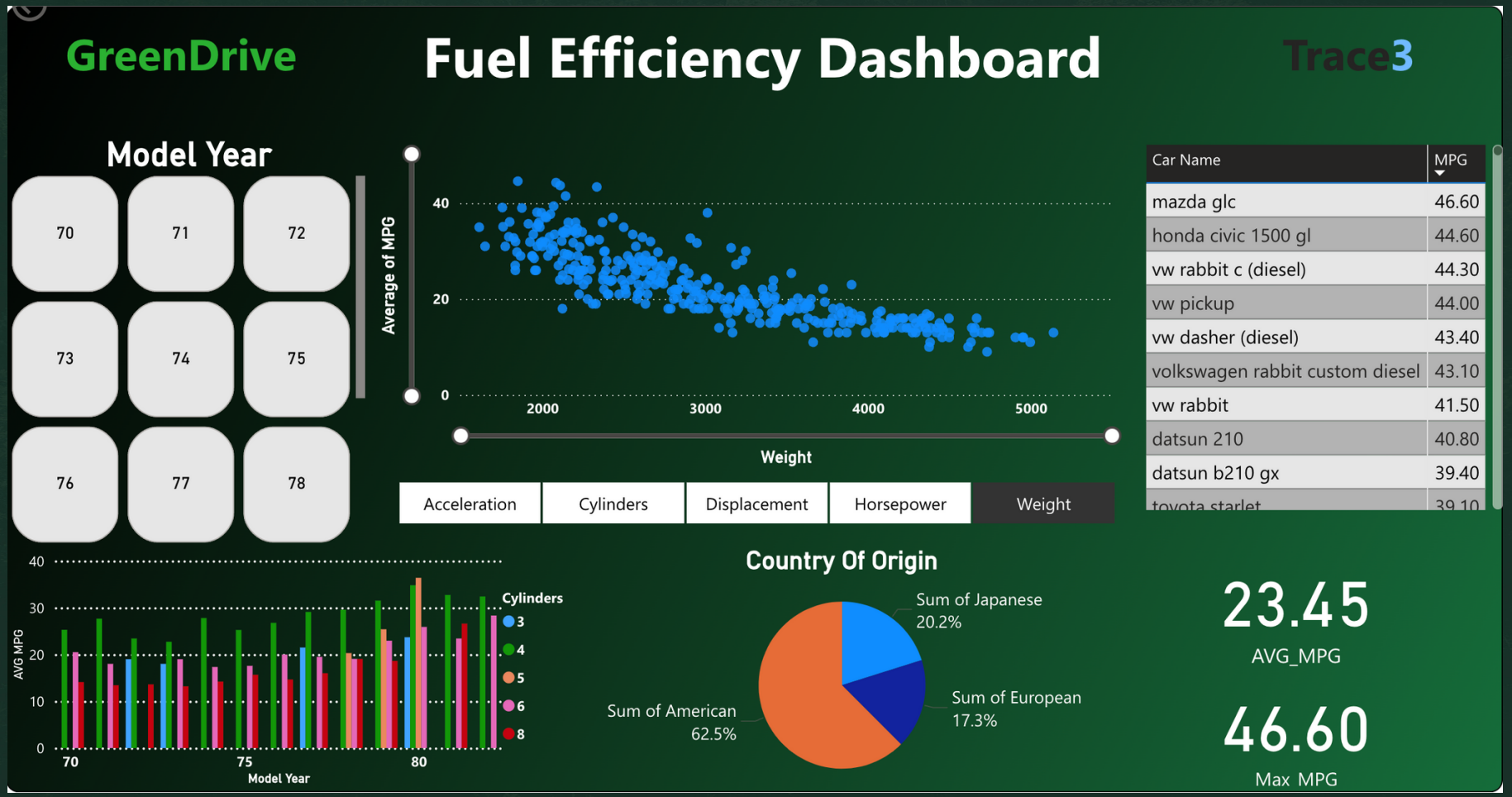
4
Cylinders

65.0
Horsepower

86.0 cubic in.
Displacment

2110.0 lbs

Mazda GLC 1980



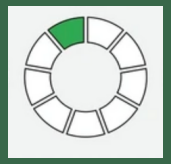
PowerBI Dashboard

Approach and Predictive Modeling

Data Preparation and Processing

- Handling Missing Values
- Scaling Data
- Ensuring Correct Data Types
- Encoding Data

Splitting the Data

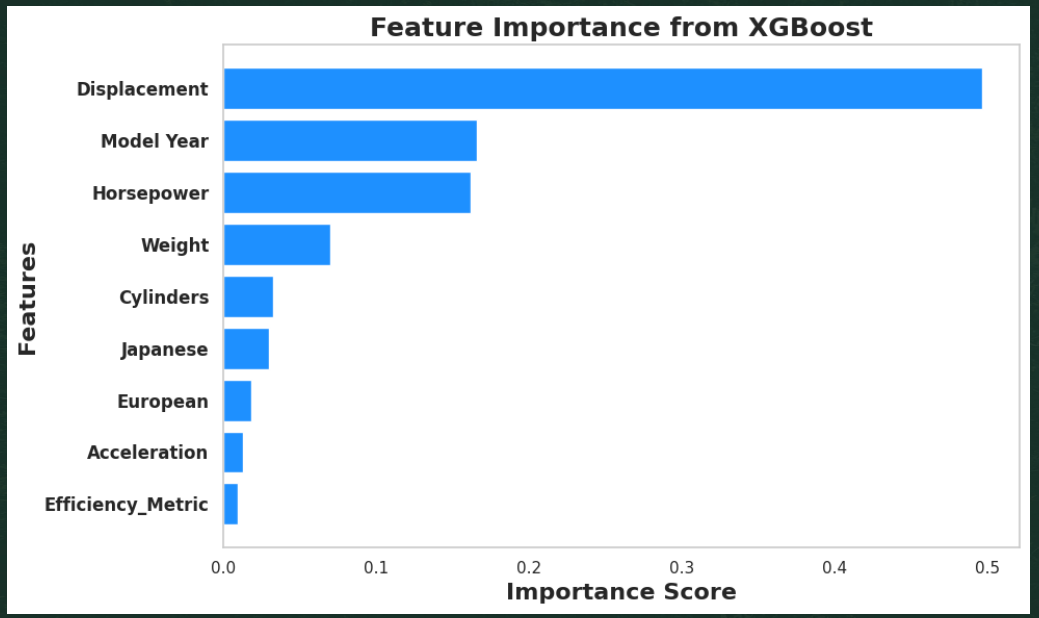


Taget-Training Features (1:8)
Train - Test Split (80:20)

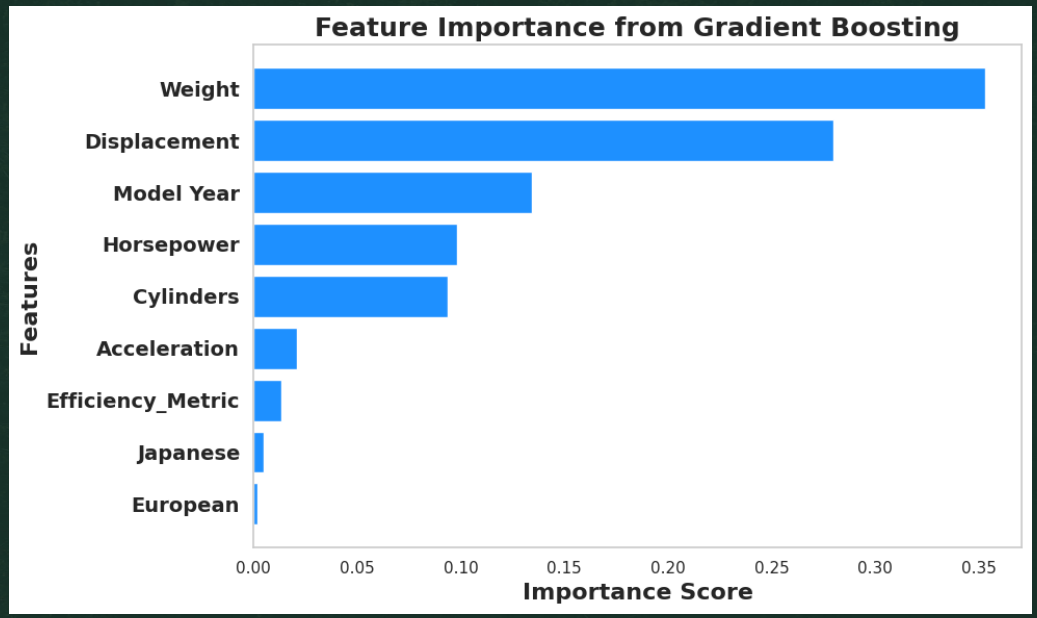
Train ML Models

Linear Regression
Decision Trees I Random Forest
Gradient Boosting I XGBoost

Findings from our Models



R^2 Score: 0.90
90% Accuracy



R^2 Score: 0.89
89% Accuracy

With these trained models, we can input vehicle specifications and obtain an estimated MPG with a margin of error of ±2.1 MPG.

Solutions for GreenDrive

Reduce Weight

Use lightweight materials (carbon fiber or aluminum) to improve MPG.

Ford’s F-150

Switched to military-grade aluminum, cutting 700 lbs!

Fuel economy improved by 5-20%.

Sales grew 6% YoY
Maintaining best-seller status.

Prioritize 4-Cylinder Engines

Prioritize turbocharged four-cylinders for better efficiency.

BMW 328i Engine Shift

Switched from 3.0L six-cylinder to 2.0L four-cylinder turbo.

Fuel efficiency improved by 15%.

Helped BMW meet stricter CO2 limits.

Solutions for GreenDrive

Reduce horsepower

Use cylinder deactivation and better powertrain calibration to match power to real needs.

Cummins B6.7 Engine

Increased torque by 30% and power by 5%.

Fuel use dropped by 8% without losing performance.

Fleet costs fell by 12%, boosting ROI.

Optimize Displacement

Use smaller, turbocharged engines to maintain power while improving efficiency.

Ford’s F-150

Replaced 1.6L engine with 1.0L turbocharged EcoBoost.

Fuel efficiency improved by 20%.

60% of F-150 sales came from EcoBoost models.

Problems and Solutions to the dataset

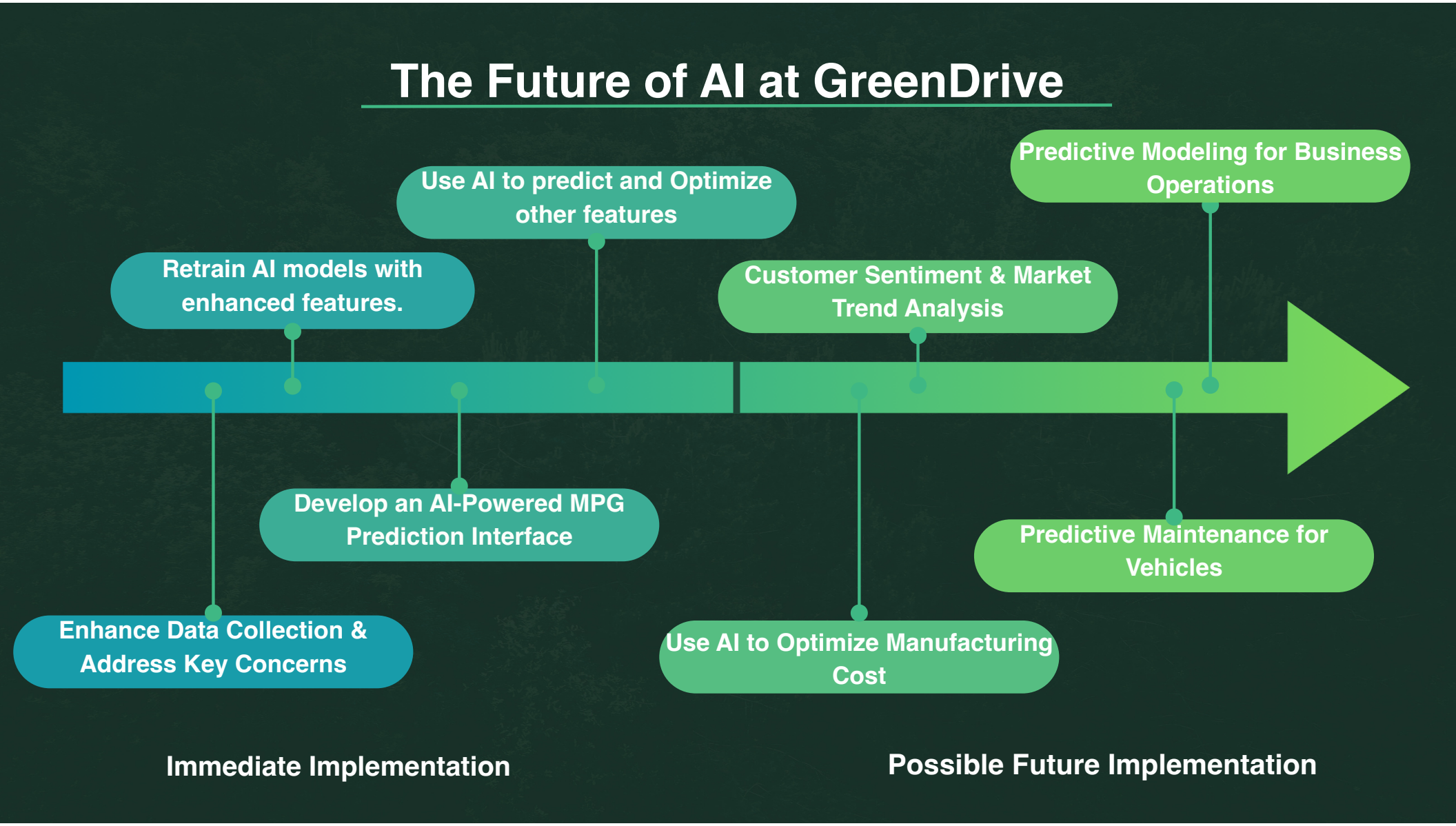
Problem

1. Outdated Dataset (Data Collected in the 1970s-80s)
2. Small Dataset (Only 398 Vehicles)
3. Limited Features in the Dataset
4. No Data on Cost of Manufacturing

Solution

1. Obtain real world modern vehicle data
2. Expand the dataset Simulate and generate synthetic data
3. Gather data on other efficiency-related features
4. Collect Data on cost of Materials and Manufacturing

The Future of AI at GreenDrive



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THANK YOU!

Questions?