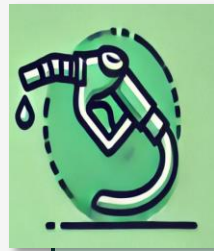# Fuel iQ: "Predict Optimize Save."

Fuel iQ leverages cutting-edge ML. We predict and classify vehicle fuel efficiency. Our solutions drive better decisions.

The Challenge in Car Rental Efficiency

Increased Fuel Expenses

Car rental companies are facing significantly increased fuel expenses due to inefficient vehicle usage and rising fuel prices.

Fuel Waste

Suboptimal driving behaviors and inadequate vehicle maintenance contribute to unnecessary fuel consumption.

Vehicle Mismatch

Renters frequently select vehicles that do not align with their specific needs, leading to increased fuel consumption.

Fuel iQ
Classification Algorithm

Predictive Analytics

ML-powered forecasts for fuel efficiency using diverse data sources.

Vehicle Classification

Smart categorization of vehicles based on fuel performance for optimal usage.

Data-driven Insights

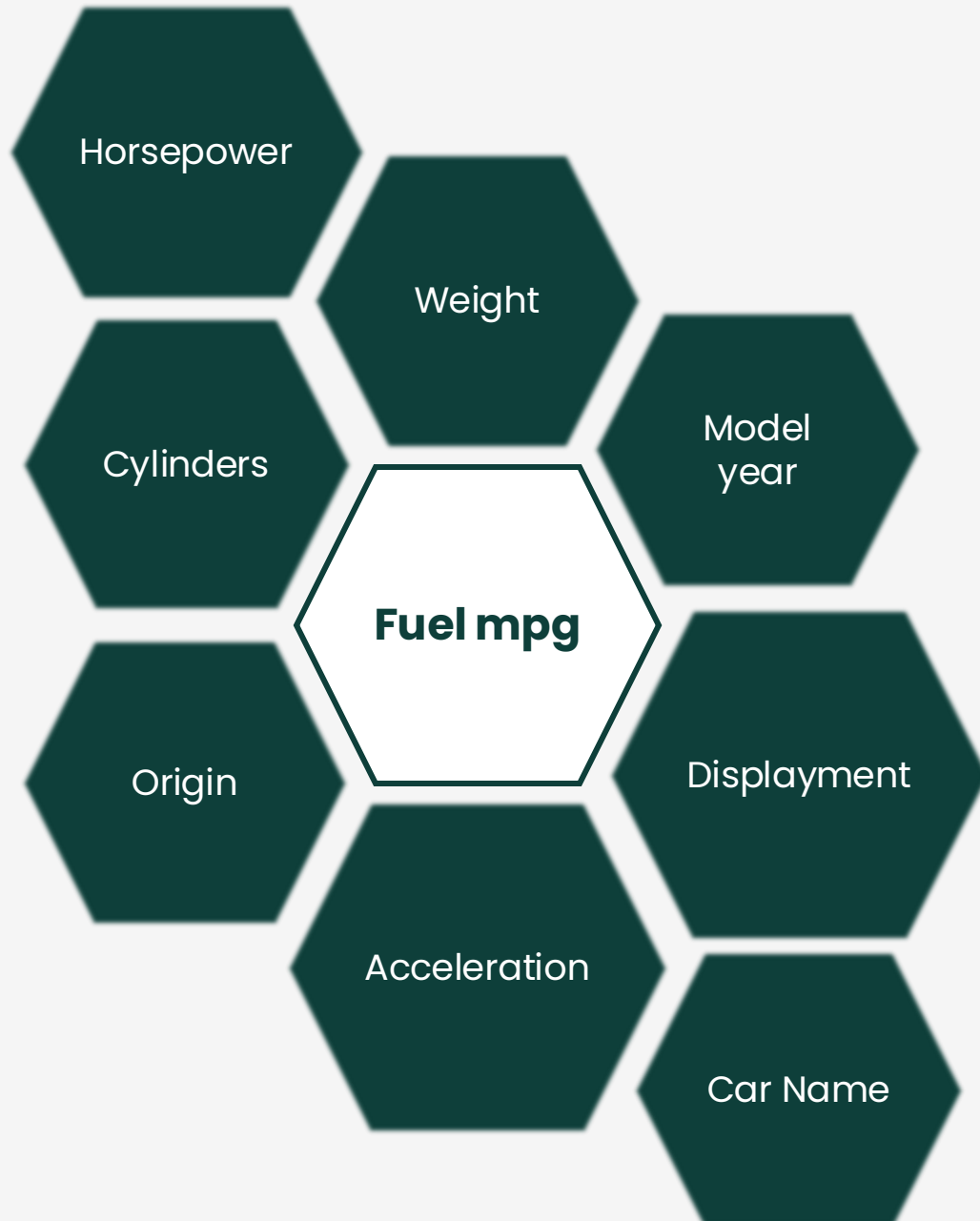Actionable visibility into fuel consumption patterns to drive efficiency.

How we build Fuel**iQ** – Timeline

Week 1	Week 2	Week 3	Week 4	Week 5
Dataset Description & Analysis	EDA	Data Preprocessing	Model Development & Training	Final Evaluation
Initial Project Meet & Task distribution	2nd Project Meet & Task Update on EDA	3rd Project Meet & Task Update on Preprocessing	4th Project Meet & Task Update on Models	5th Project Meet & Task Update on Models

Collaboration & Time management Tools

Microsoft Teams: Regular team meetings
Jira: Project & deliverables management
Slack: Team communication

Google Colab: Code collaboration
OneDrive: Team files sharing and storage
Github: Hosting Project

Dataset Description & Analysis

Horsepower

Weight

Model year

Cylinders

Fuel mpg

Origin

Displayment

Acceleration

Car Name

The dataset consists of **398 instances** with **8 attributes** that influence fuel efficiency.

Problem analysis
What attributes have a causal inference on fuel consumption?

What Fuel efficiency classes would be easy to understand by the end user (rental car driver) and easy to use by a rental business
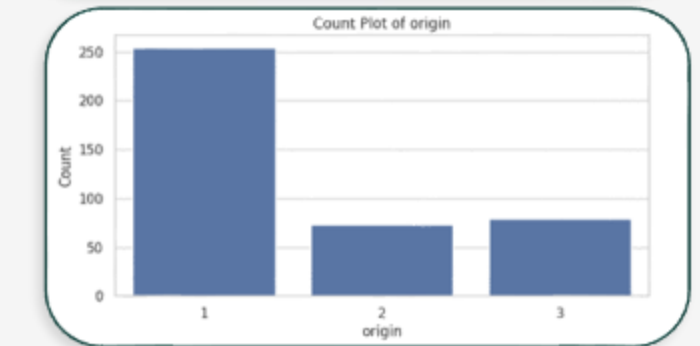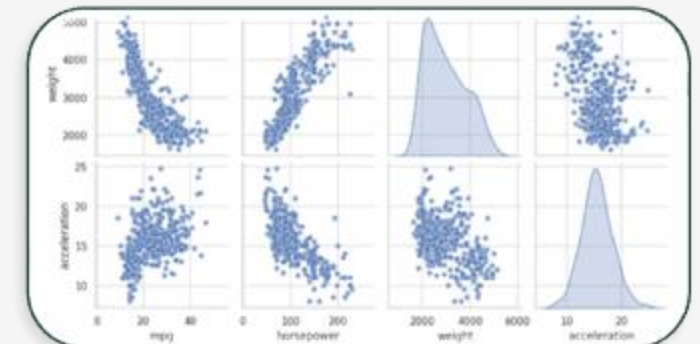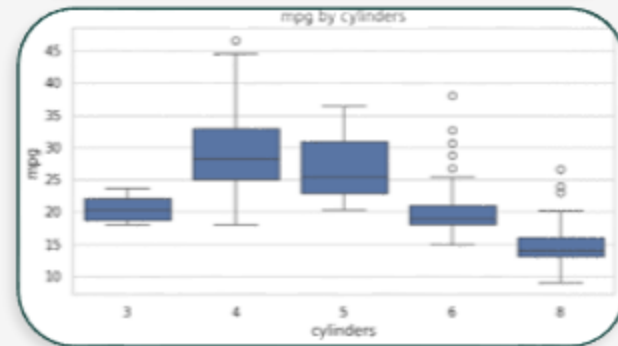
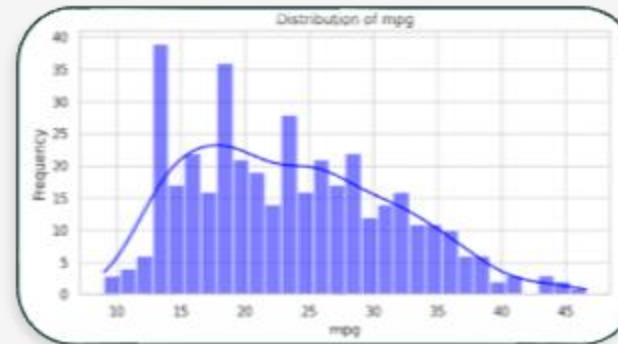# Exploratory Data Analysis (EDA)

✅ Missing values   ✅ Distributions & Outliers

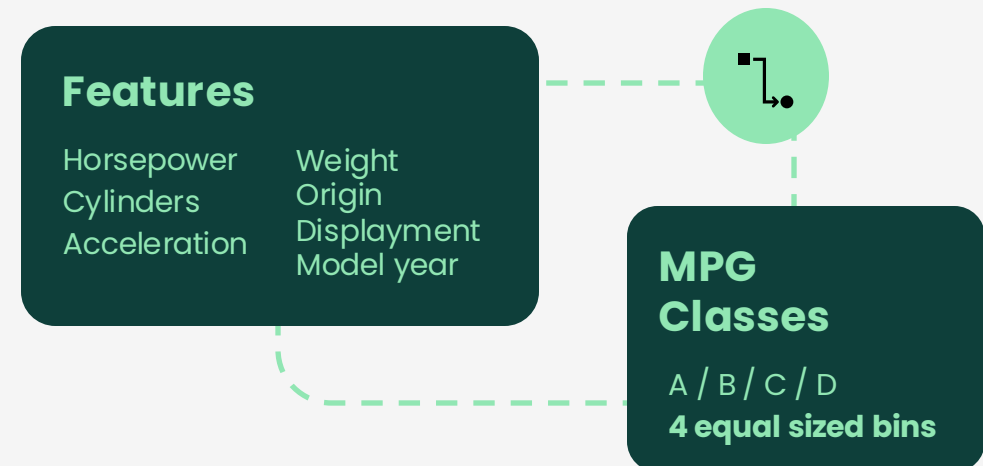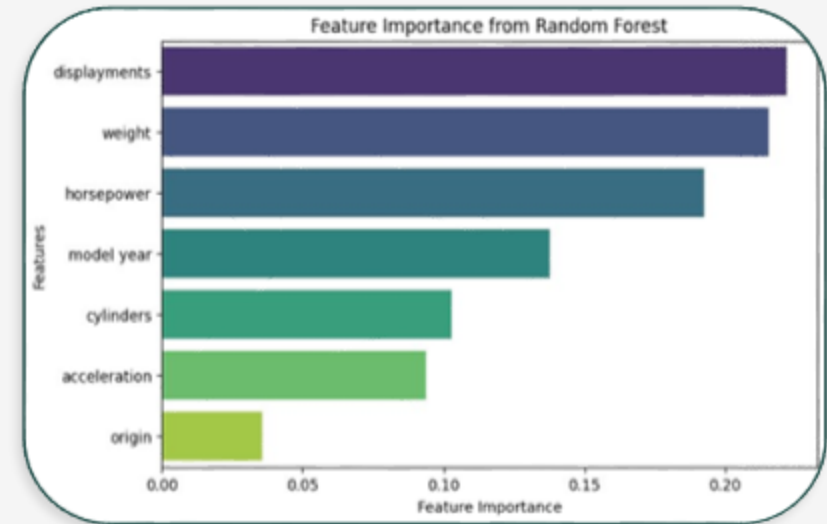✅ Correlations   ✅ Feature Insights

Data Preprocessing

Feature Importance from Random Forest
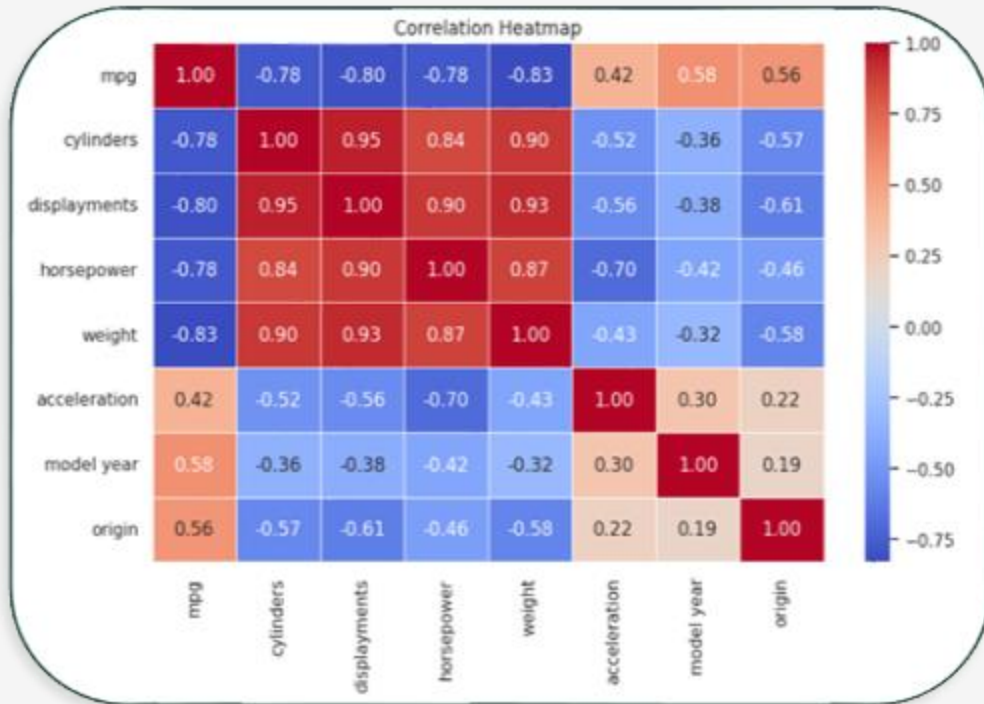
- Drop rows with missing values (mpg) on target variable
- Impute missing values (horsepower)
- Normalization min-max
- Handling Outliers
- Feature Selection
- Define classes
- Train-test split

Features

Horsepower   Weight
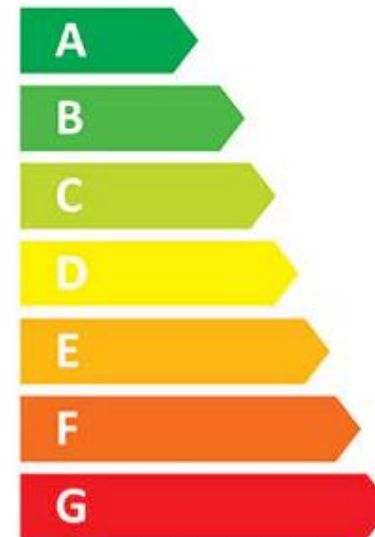Cylinders   Origin
Acceleration Displayment
              Model year

MPG Classes

A / B / C / D
4 equal sized bins

Fuel Consumption Classification

Our classification system

A - Eco Warrior Mode

B - Smart Saver Mode

C - Think before you fill

D - Fuel Monster

EU Energy classes (appliances, real estate etc.)

Model Development & Training

(1) **KNN**

Accuracy: 76.56%
Recall: 0.77
F-1 score: 0.76

(2) **Logistic Regression**

Accuracy: 78.12%
Recall: 0.78
F-1 score: 0.79

(3) **SVC**

Accuracy: 81.25%
Recall: 0.81
F-1 score: 0.80

(4) **Random Forest**

Accuracy: 87.5%
Recall: 0.84
F-1 score: 0.84
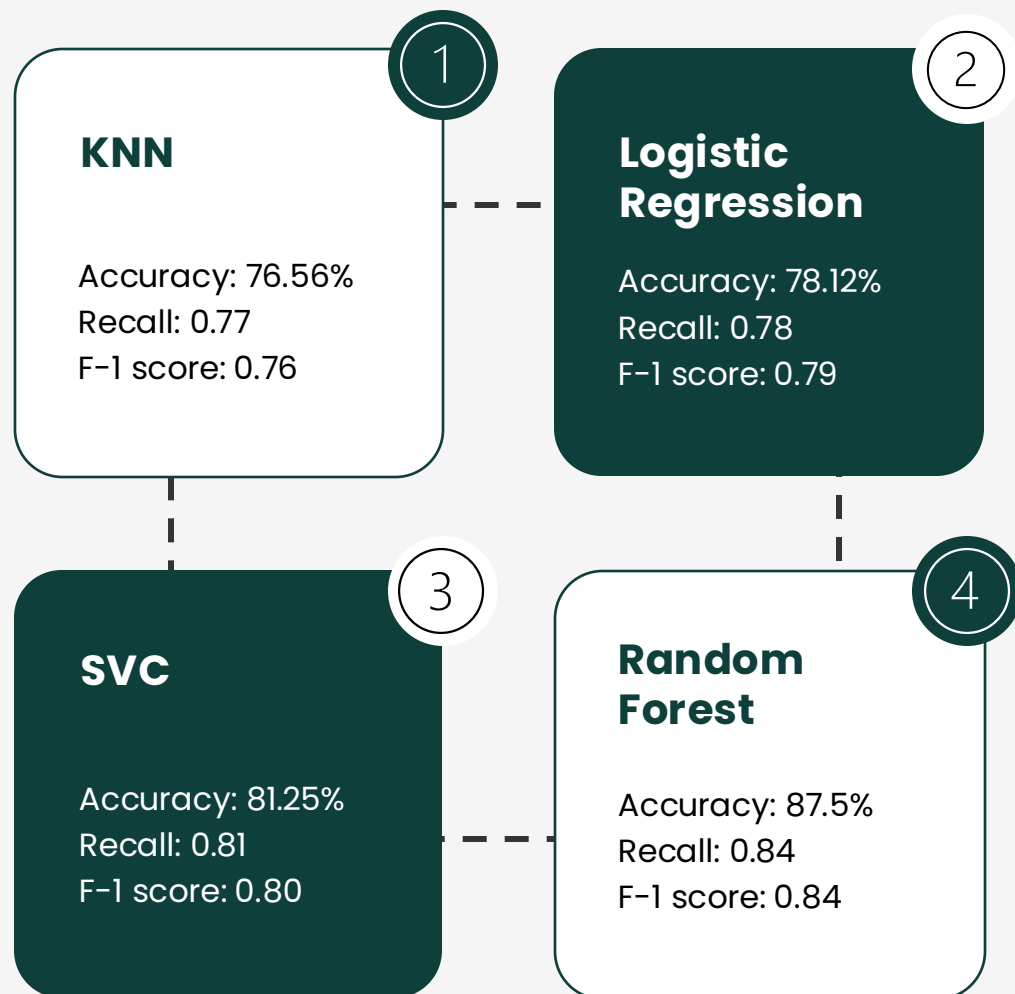
Evaluated various classification models: Random Forest, Logistic Regression, KNN, and SVC.

Focused on accuracy, precision, recall, and F1-score to evaluate model performance for each of the four fuel efficiency classes.

Also, computed a confusion matrix to further assess model misclassification tendencies.

Model Evaluation Random Forest

Confusion Matrix - Random Forest (Test Set)

- Random Forest correctly classifies **16/17** Class A samples, **15/17** Class C samples, and **15/16** Class D samples.
- The strong performance is due to our selected optimal hyperparameters: **max_depth=8** and **n_estimators=200**
- Our final model achieves an accuracy of 87.5%, with **precision at 88.3%** , **recall at 87.4 and F1-score**: **0.83.**
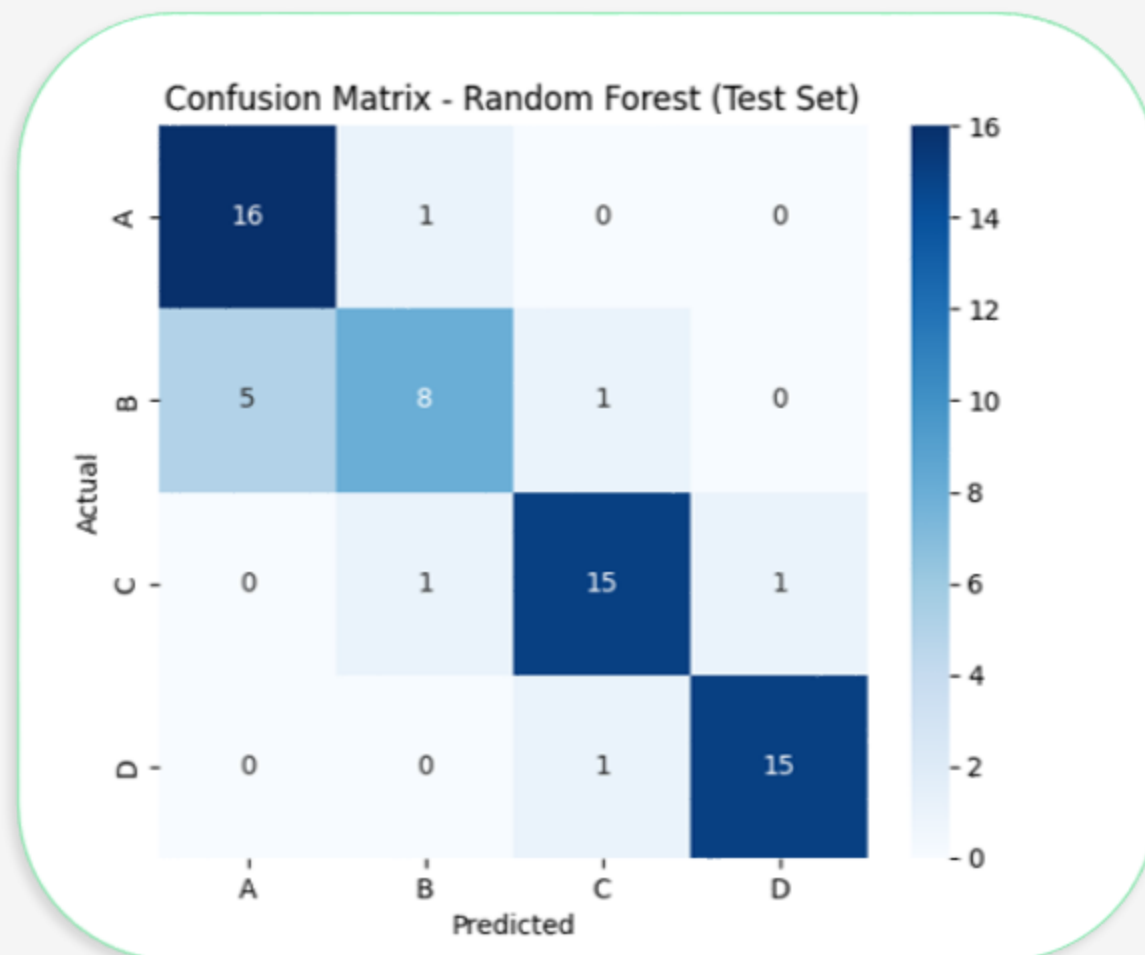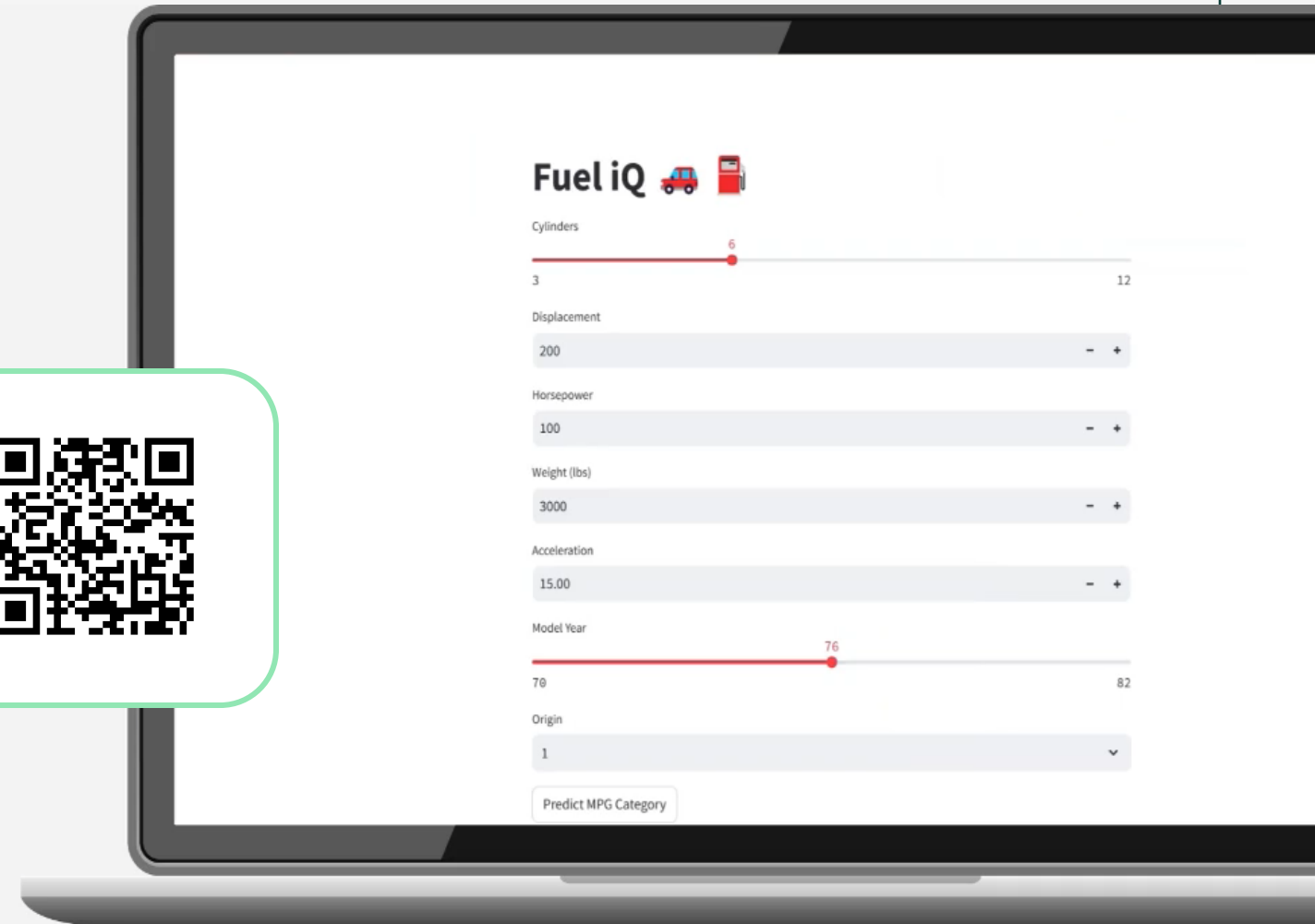
Test **Fuel iQ** yourselves!

By using our app you can adjust the values of key variables to predict your car's fuel efficiency class.

Get a real-time prediction!

[Test it live]

Meet the team

*"Collaboration **fuels** innovation."*

The Data Detective	The Data Sculptor	The Data Alchemist	The Model Maestro	The Model Whisperer
Eleni Kakouri	Maria Motsakou	Ioanna Delemissi	Margarita Meletlidou	Alexandra Vasileiadou

Thank you

Vasileiadou Alexandra
Delemissi Ioanna
Kakouri Eleni
Meletlidou Margarita
Motsakou Maria