

# PREMIUM CAR PRICING

MMA 867: Predictive Modelling

September 14, 2024



Team Beijing





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# INDUSTRY OVERVIEW



## High Competition

The global automotive market is highly competitive, with prices fluctuating based on various factors.



## Emerging Trends

While electric vehicles (EVs) are gaining momentum, traditional gasoline-powered cars still dominate, especially in the car rental industry where EV infrastructure may be limited.



## Optimized Pricing

Predictive pricing models help manufacturers, dealers, and second hand buyers optimize pricing strategies to adapt to changing market dynamics.



## Better Decision-Making

This project is critical in providing pricing insights, especially for non-EV cars in markets like rentals, enabling data-driven decisions that benefit consumers and industry players alike.



## Project Scope

# UNVEILING THE KEY DRIVERS BEHIND CAR PRICING

### ✓ Data Analysis

Analyzed 26 key variables to ensure comprehensive data coverage for accurate predictions.

### ✓ Feature Selection

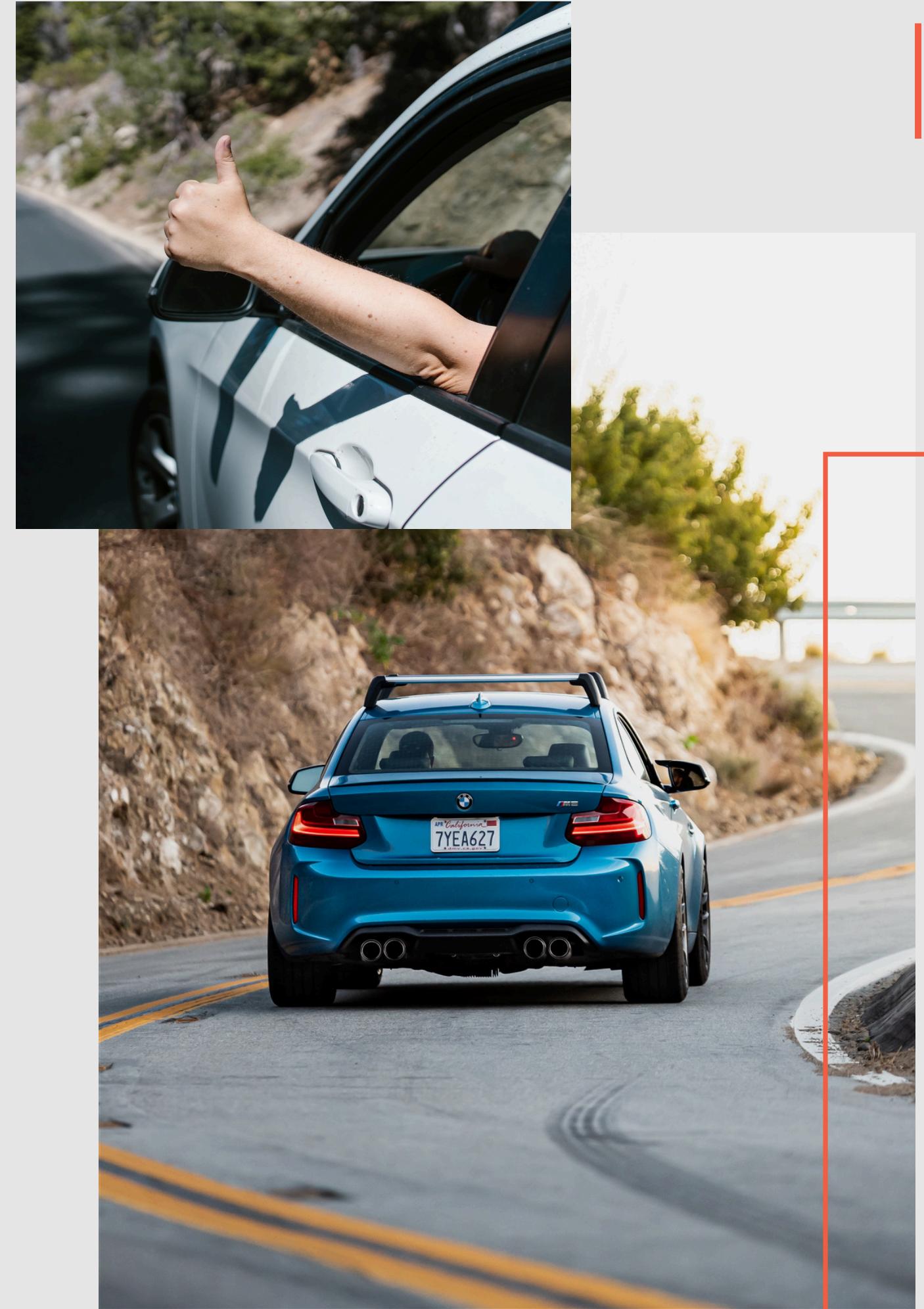
We focused on identifying the most significant predictors of car prices through statistical techniques.

### ✓ Model Development

Built a robust predictive model using multivariate and Lasso regression, enhancing accuracy by selecting key features and minimizing complexity.

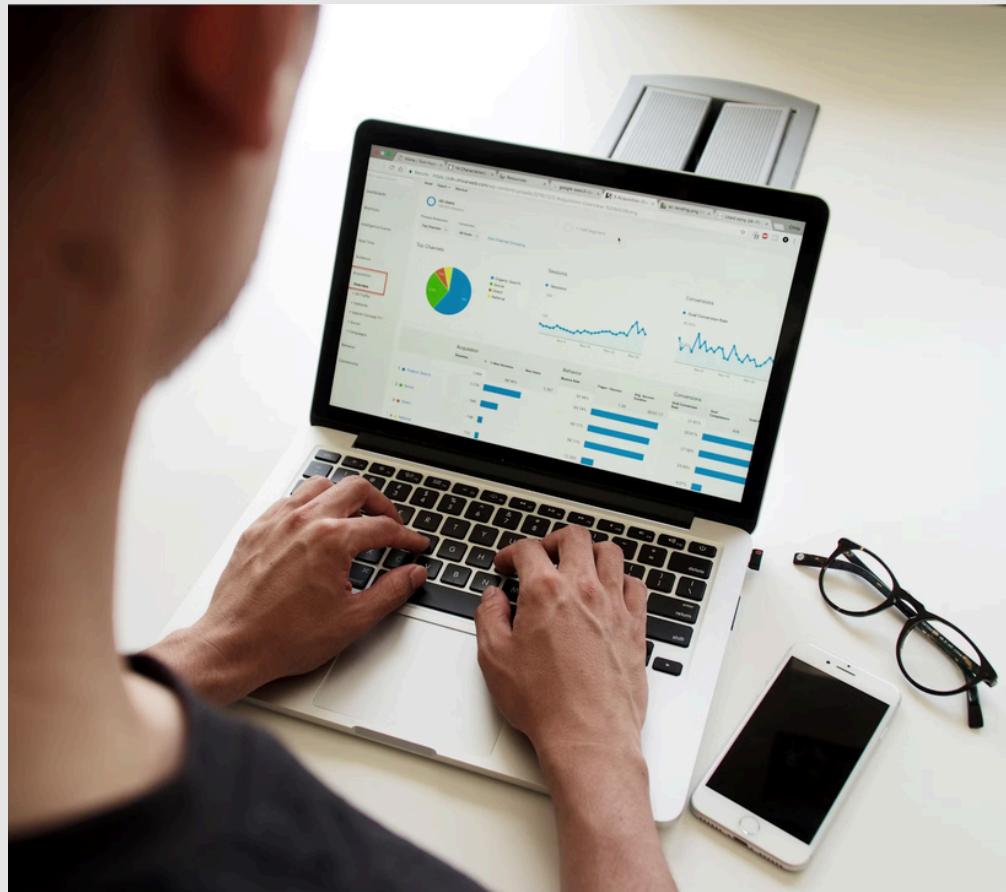
### ✓ Insights & Applications

The model provided actionable insights to improve pricing strategies for manufacturers, dealers, buyers and rental companies.





# MODEL METHODOLOGY



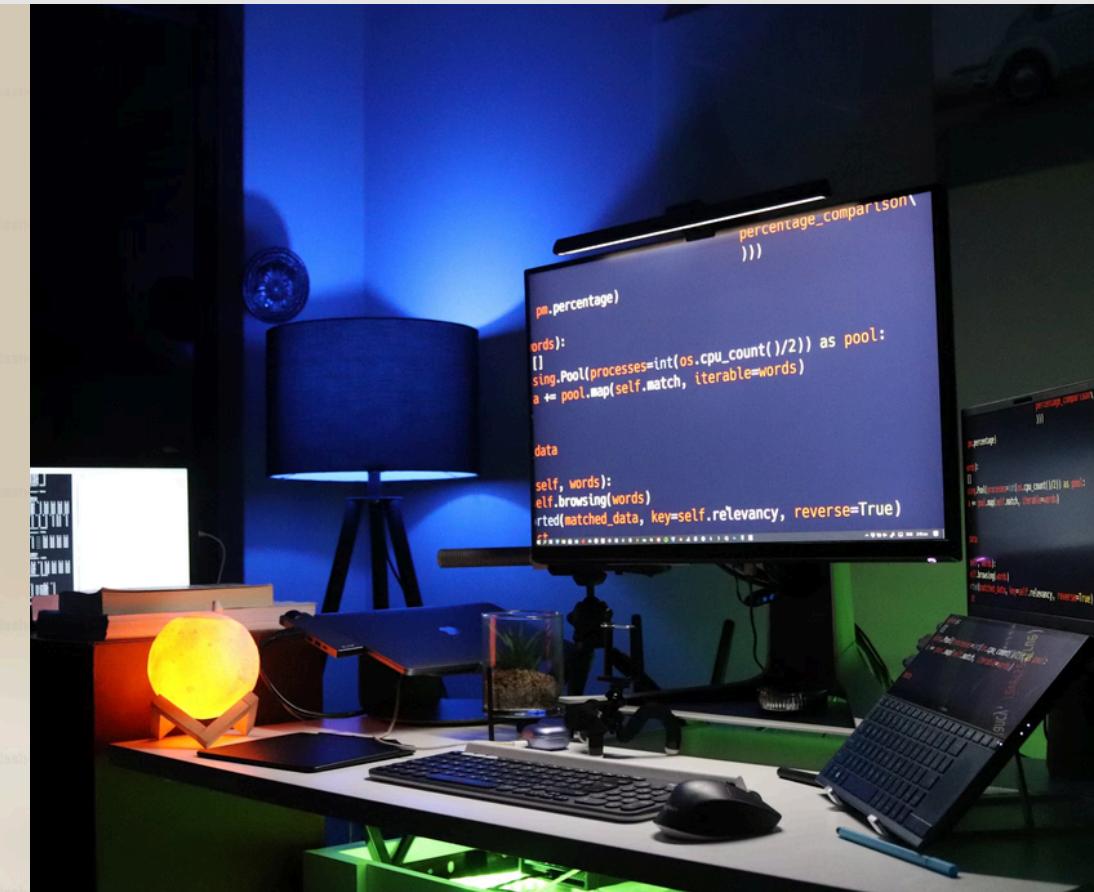
## Data Preprocessing and Feature Engineering

- Dropped irrelevant columns and corrected data inconsistencies.
- Transformed CarName to CarMake and added Brand Reputation as a new feature.
- Encoded categorical variables and standardized numerical features.



## Regularization with Lasso Regression

- Applied Lasso regression with an L1 penalty to perform feature selection.
- Used GridSearchCV to optimize the regularization parameter (alpha).
- Identified key features by examining non-zero coefficients after regularization.



## Model Evaluation

- Evaluated model performance using RMSE, R<sup>2</sup> score, and MAPE.
- Compared predicted prices with actual values to assess accuracy.
- Analyzed feature importance to understand which factors most influence predictions.



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# MODEL ASSESSMENT

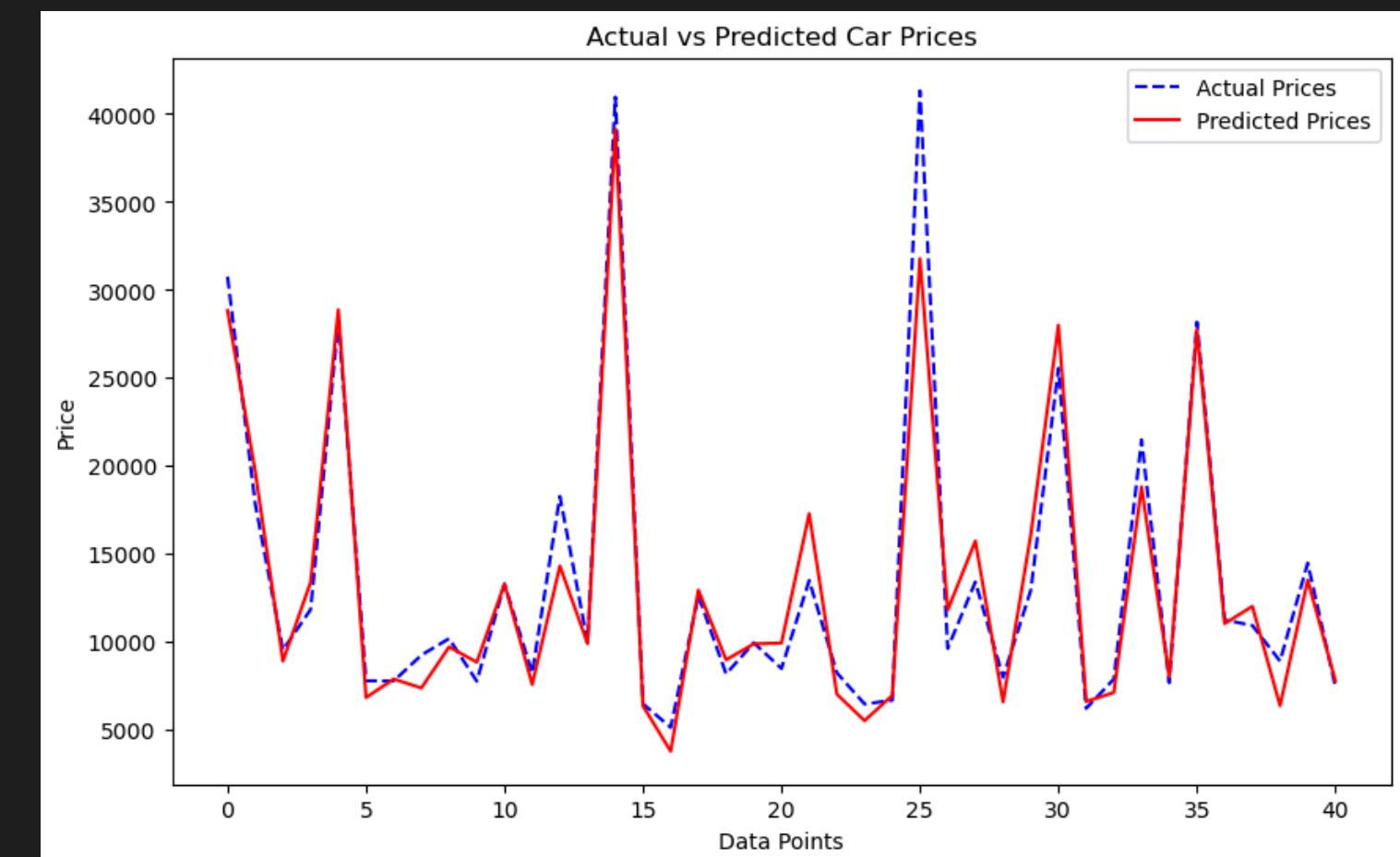
With a MAPE of 10.76, the model's predicted car prices are, on average, 10.76% different from the actual prices



## Model Metrics:

- Training R<sup>2</sup>: 0.9551
- Testing R<sup>2</sup>: 0.9404
- Training RMSE: 1578.20
- Testing RMSE: 2278.34

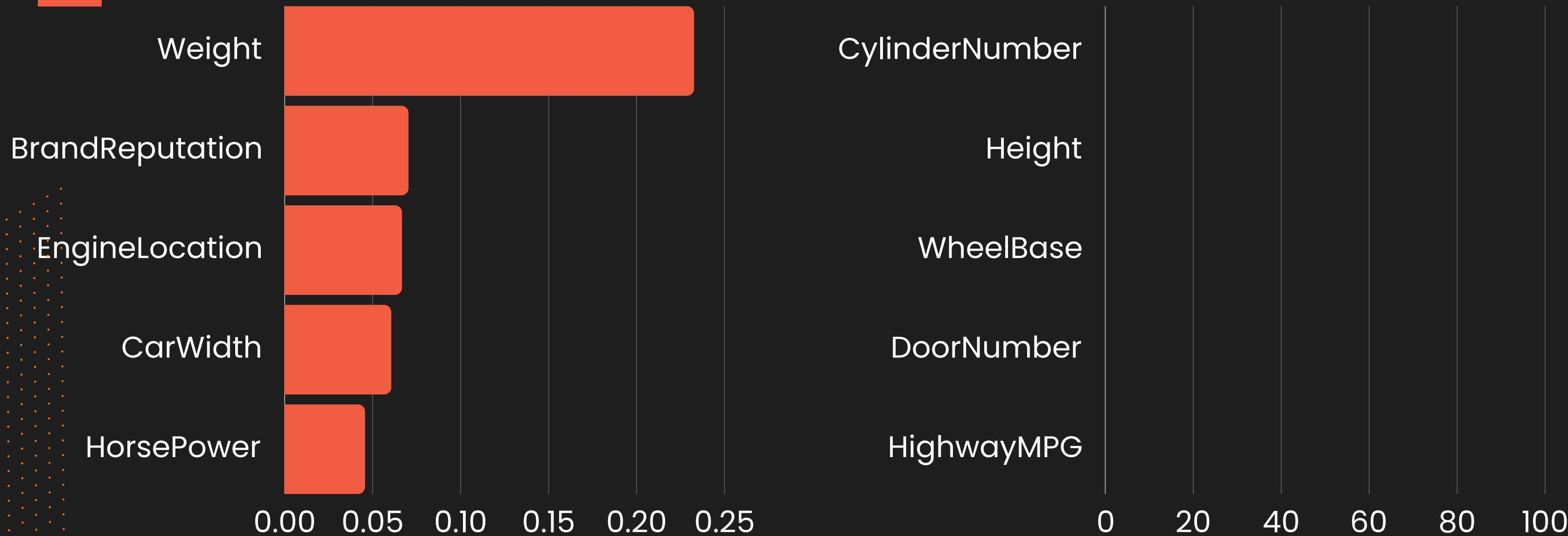
	Actual Price	Predicted Price
15	30761.000	28835.972225
9	17860.167	19689.972663
100	9550.000	8918.863333
132	11851.000	13404.779260
68	28249.000	28878.324982
95	7800.000	6847.138985
159	7789.000	7899.124246
162	9259.000	7391.112581
147	10199.000	9725.059429
182	7776.000	8854.931670





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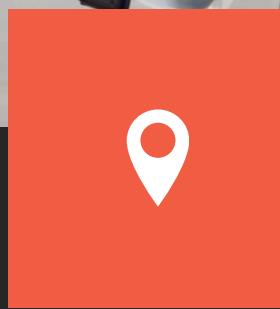
# WHAT CAR SPECIFICATIONS MOST/LEAST INFLUENCE PRICE CHANGES?





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# MODEL LIMITATIONS



## Sensitivity to Feature Scaling:

Lasso requires standardized features, and improper scaling can hurt performance.



## Over-Simplification of the Model

Lasso may discard important features by shrinking their coefficients to zero.



## Feature Dependence on the Provided Dataset

The model could have been more robust and provide more cars.



## Next Steps

# DRIVING INNOVATION THROUGH FRESH IDEAS

### ✓ Model Refinement

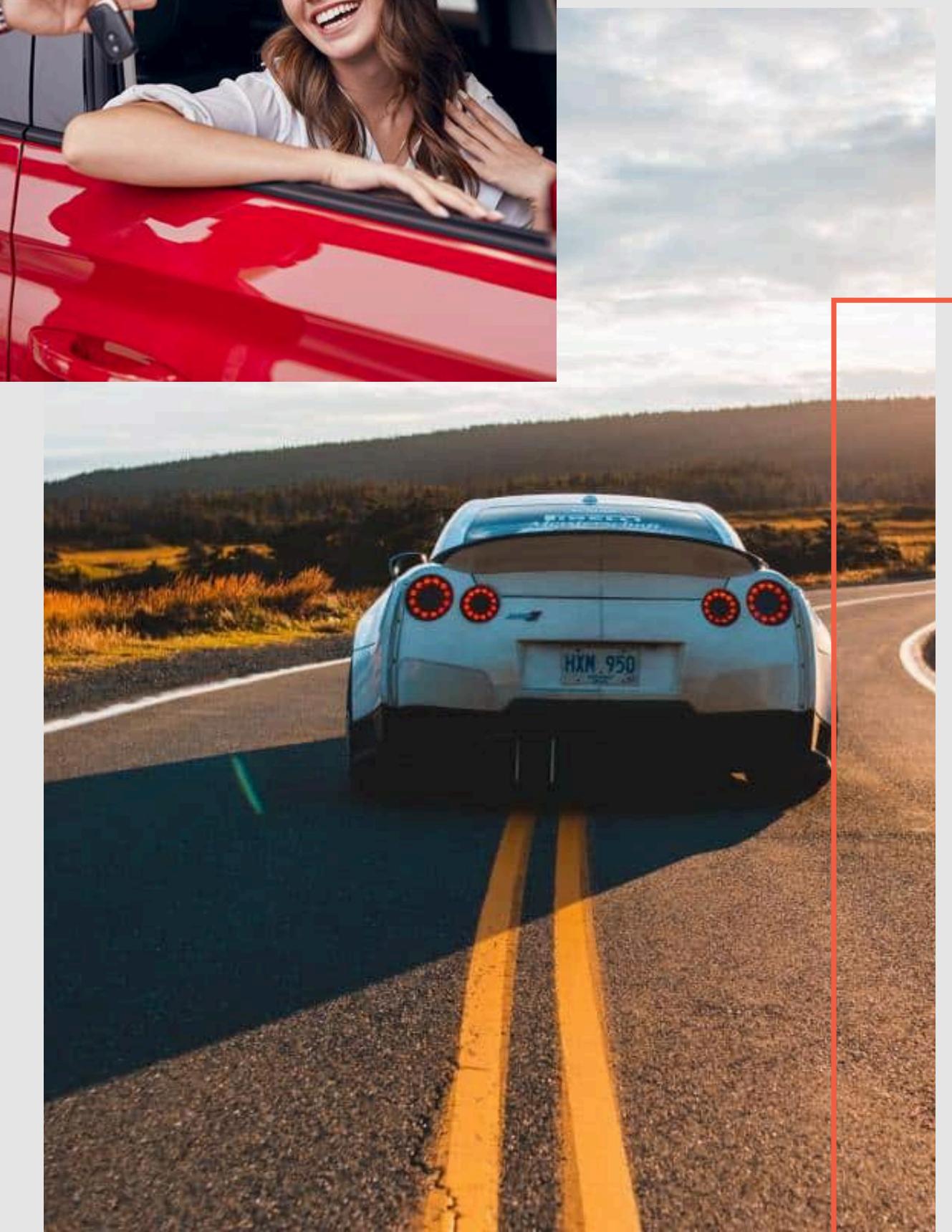
Optimize the model to improve MAPE accuracy and fine-tune the selection of key features that drive car pricing.

### ✓ Scenario Analysis

Conduct scenario analysis to test the model across different market conditions and car features, ensuring its reliability and adaptability.

### ✓ Car Pricing Calculator

Build an easy-to-use car pricing calculator that allows users to input car features and instantly receive a price estimate.





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# THANK YOU!

