Predicting the Price of Used Cars

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Part 01

Introduction

Introduction

Goal : Analyze the dataset and build a used cars' price predictor.

Online pricing services can offer better price estimates of a used car given some characteristics.

Dealers can better understand what features makes a car desirable and offer better services.

Individuals can make use of the model to better know the used cars market.

WHY? Any business value?

A Peek Into the Data

Dataset was originally built by using web crawlers on *carguru.com*

3M records

66 variables

27 numerical features

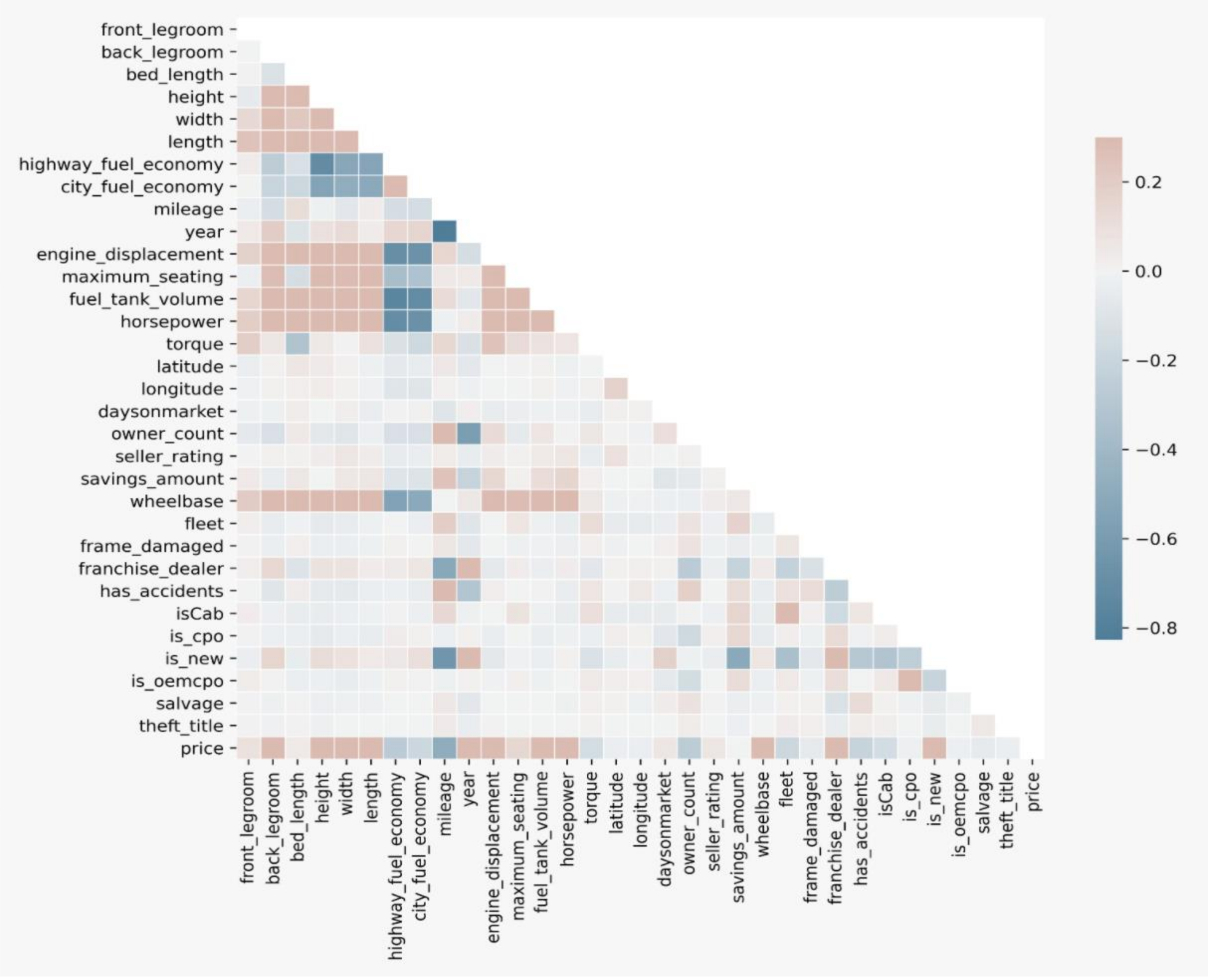
11 boolean features

24 categorical features

Information of cars and dealers.

Table of first few rows of data

Exploratory Analysis



The strongest correlation is between ***price*** and ***power*** (0.61) followed by ***mileage*** (-0.48) and ***year*** (0.41).

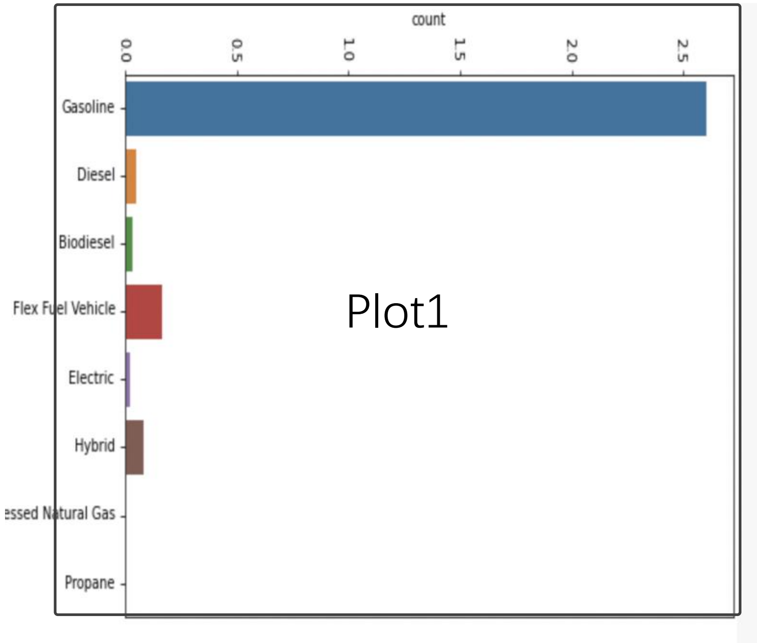
The target variable ***price*** is right skewed with exotic cars costing over 3m.

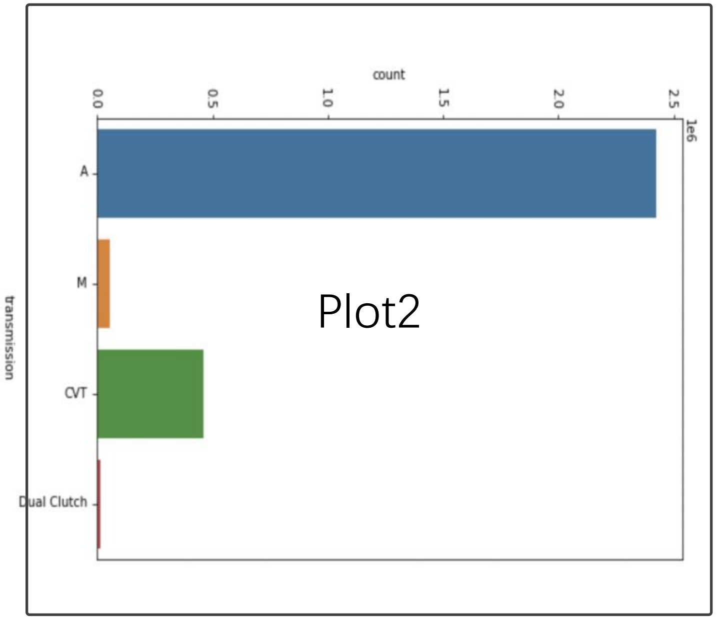
Price Dist Plot

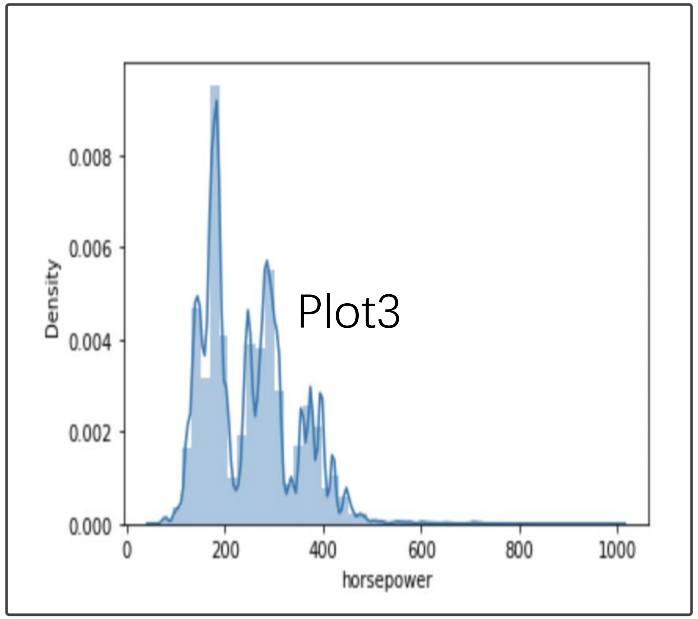
Exploratory Analysis

As the data is collected from US, most of the vehicles have automatic transmission and gasoline as fuel.

The ***horsepower*** ranges from 80 to 1001 and highest value corresponds to *Bugatti Veyron*.







Part 02

Feature Extraction and Preprocessing

Data Preprocessing

NA Analysis

16 variables have NA percentage as high as ***45%***

9 were dropped

7 were retained which will be imputed

NA Imputation

Continuous variables were imputed with mean.

Categorical variables were imputed with mode.

Deleting non-imputable records.

Special cases like electric cars were dealt separately.

Nonsense Variables

20 variables were dropped as they were not useful for the final model

2 variables were dropped because of duplicate information

Feature Engineering

Groupby Features

mean milage of each model in each year
number of cars of each model in each year
mean milage of each type of fuel
mean milage of each type of engine
...

Target Encoding

mean price of each model
mean price of each brand
mean price of each type of engine
mean price of each body type
...

Other Features

mileage per year
estimated fule spent in city
estimated fule spent on highway
...

9 new features generated

Part 03

Models

Models

Slow

- Random Forest Regressor
- Support Vector Regressor
- K Neighbors Regressor
- CatBoost

>30 min

Fast

- Decision Tree Regressor
- Linear Regressor
- Ridge Regressor
- Lasso Regressor

<10 min

Fast with GPU

- LightGBM
- XGBoost

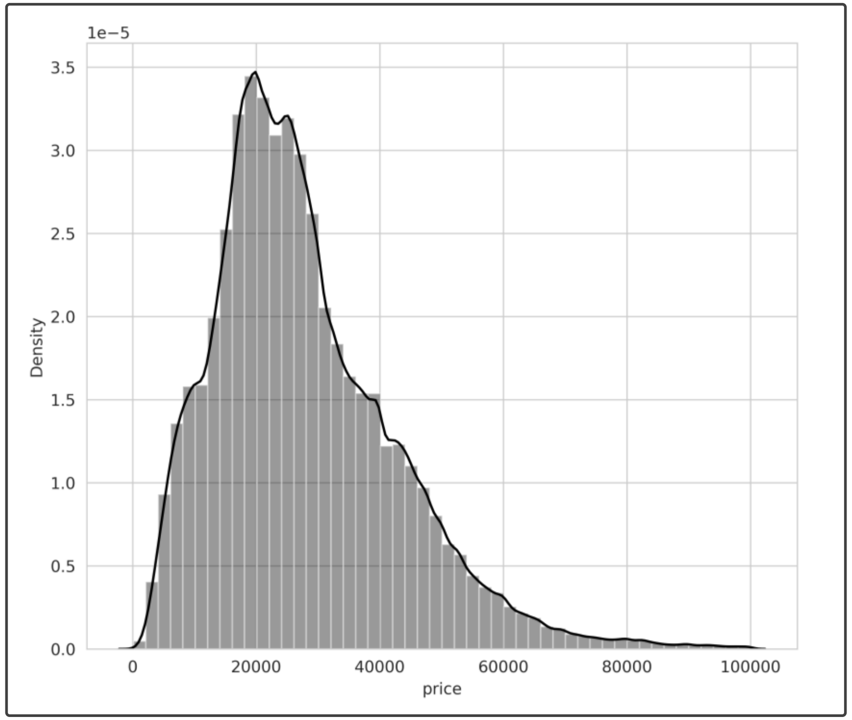
≈15 min

Part 04

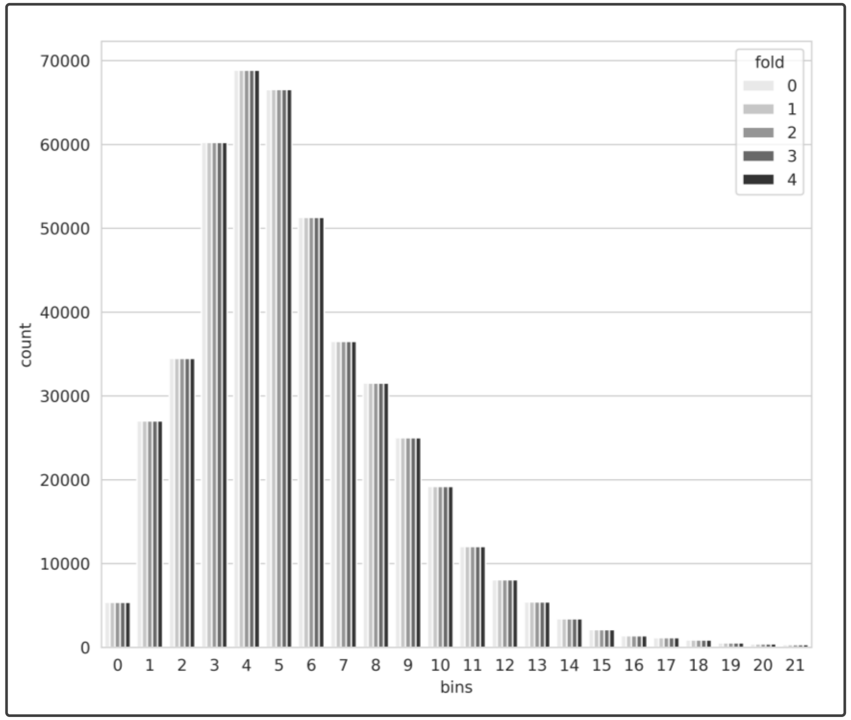
Experiments And Evaluation

Data Split

Target Distribution



Stratified Splits



1 **Target Binning**

2 **Create Splits**

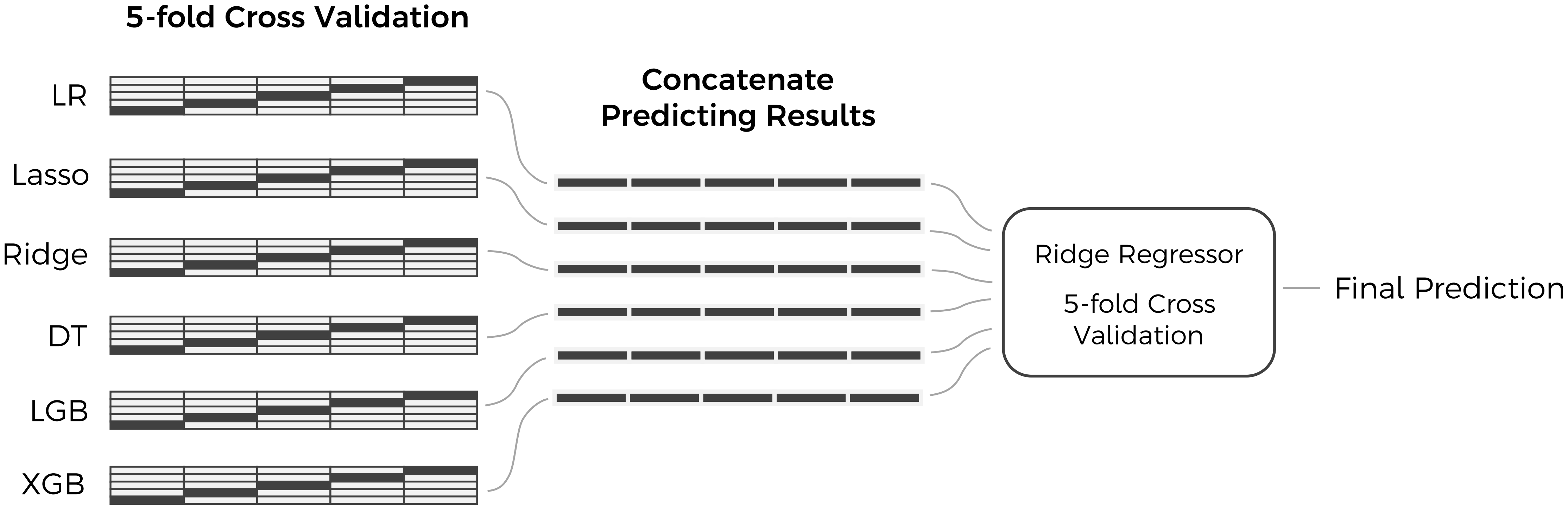
3 **Train-Test Split**
Train-Valid Split

Model Evaluation

Root Mean Square Error (RMSE)

Model Name	Baseline	Data Cleaning	Feature Engineering	Bayesian Parameter Estimation
Linear Regressor	14121	7039	4196	---
Ridge Regressor	14121	7039	4196	4196
Lasso Regressor	14121	7039	4197	4197
Decision Tree Regressor	7490	3242	3183	3051
LightGBM	7728	2942	3134	3007
XGBoost	7825	2938	2870	2852

Model Ensembling



5-fold Cross Validation

LR

Lasso

Ridge

DT

LGB

XGB

Concatenate Predicting Results

Ridge Regressor

5-fold Cross Validation

Final Prediction

Part 05

Summary

Summary

34 Features of Basic Car Information

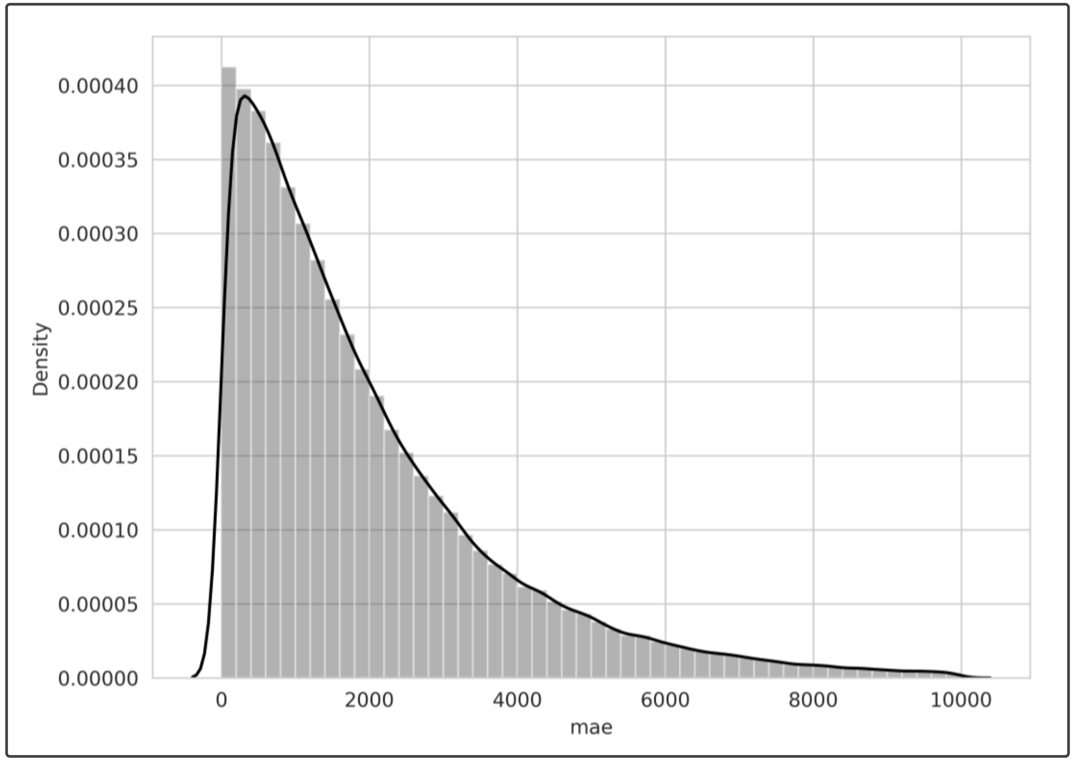
These features can be easily fetched thus letting our model have high applicability.

Ensembled 6 Different Models

Improved the precision and robustness of our predicting result

RMSE = 2851

Predicting **90%** of the variability in used cars with an average error of 4500$



Top important features

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THANK YOU

US Used Car Price Prediction | DS 5220 Final Project

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