

USED CAR PRICE PREDICTION USING MACHINE LEARNING

Prepared by Er Ning
for General Assembly Data Analytics Immersive Programme





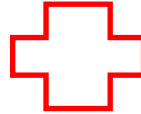
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RECOMMENDATIONS

Why are cars so expensive in Singapore?



Open Market Value (OMV) = Original cost of car



~ \$90, 000
from the latest round of
COE bidding

Certificate of Entitlement



~ \$20,000

Additional Registration Fees (ARF)

100% of OMV for the first \$20,000
140% of OMV for the next \$20,000

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Other Costs:

VES Surcharge
Road Tax
Car Insurance Premium
Petrol Cost
Car Servicing & Maintenance



How do I get the best out of my used car?
Car is a depreciating asset...

PROBLEM STATEMENT

Two ways for car owners in Singapore to sell their cars:

Offline (Mainstream)



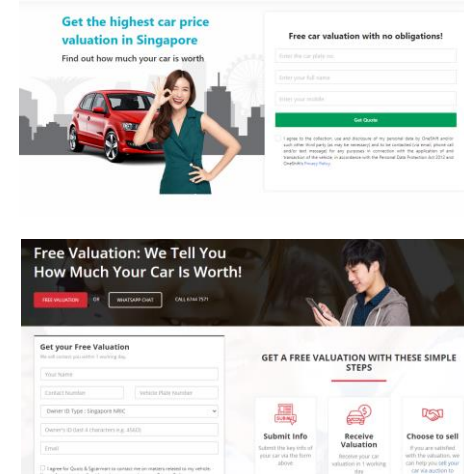
Car dealers, car rental companies

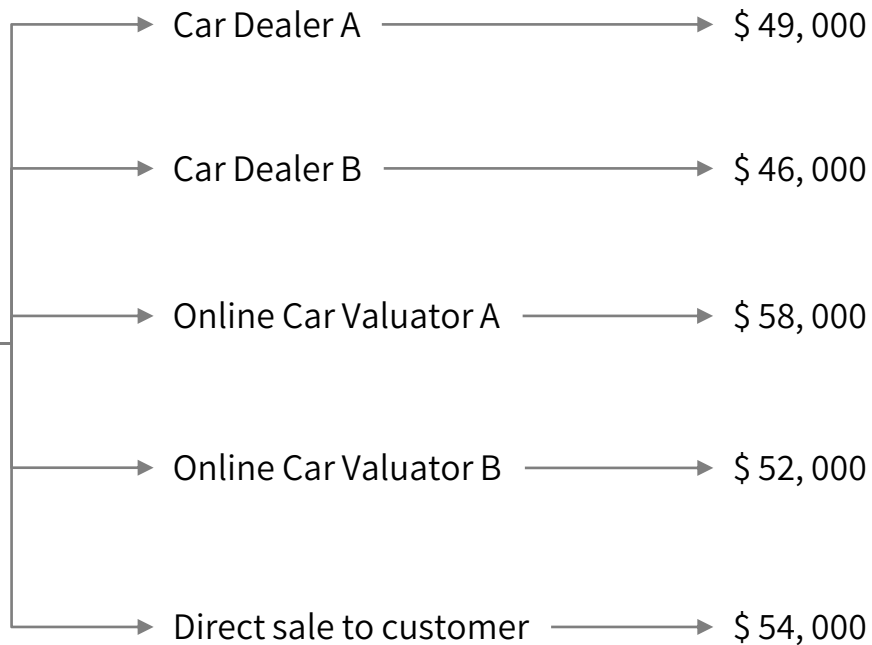
Car price is determined by car dealers. Selling price could vary greatly among different car dealers.

Online (Increasingly popular)

Online platforms such as SGCarMart, CARRO, Carousell, Carsome etc.

Car owners are able to benchmark selling price with similar listings, but still have to obtain a quote from the company.

Two screenshots of online car valuation services. The top screenshot is from a website titled 'Get the highest car price valuation in Singapore' and 'Find out how much your car is worth'. It features a red car and a woman. The form asks for 'Enter the car plate no.', 'Enter your full name', and 'Enter your mobile', with a 'Get Quote' button. The bottom screenshot is from a website titled 'Free Valuation: We Tell You How Much Your Car Is Worth!'. It has a 'FREE VALUATION' button and a 'CALL 8144 1011' button. Below this is a 'Get your Free Valuation' section with a form asking for 'Your Name', 'Contact Number', 'Vehicle Plate Number', 'Owner's Type (Singapore NRIC)', 'Owner's ID Card # (Singapore NRIC #)', and 'Email'. To the right of the form is a section titled 'GET A FREE VALUATION WITH THESE SIMPLE STEPS' with three steps: 'Submit Info', 'Receive Valuation', and 'Choose to sell'.



Is there a better way to precisely predict the value of an used car?

COMMERCIAL VALUE



Methodology

Machine-learning
powered methodology
to accurately predict
used car price



First mover

First in the market in
Singapore to employ
such methodology



Simplify process

Instantaneous car price
estimation and omit any
manual process

DATA WORKFLOW



KEY ASSUMPTIONS

1



is a leading online car marketplace. Therefore, data scraped from the website should be representative of the used car price in the current market

2

The car information listed on the website is **validated and true**.

3

The listing price is **close to the actual sale price**. Actual sales data could not be obtained from the website. Therefore listing price is presumed to approximate sale price.

DATA SCRAPING FROM SGCARMART

sgcarmart Login | Sign up

New Cars Used Cars Rental Cars Sell My Car Directory Products Insurance Articles Forum Resources

Enjoy a cool, smooth journey to growth with this **quick and easy business loan**. **APPLY NOW**

Car Make / Model Price Range Depreciation Year Reg Mid-Size Sedan Search Advanced Search

Home > Used Cars > GY Automobile Centre Pte Ltd > Toyota Corolla Altis 1.6A (COE till 11/2028)

Toyota Corolla Altis 1.6A (COE till 11/2028)

Overview Insurance Financial Accessories Similar Research Photos Map PREMIUM AD

GI
GI CARS FINANCING

Price **\$53,800**

Depreciation \$9,510 /yr **Reg Date** 25-Nov-2008 (3yrs 7mths 24days COE left)

Kilage 131,277 km (9.1k /yr) **Manufactured** 2008

Road Tax \$1,113 /yr **Transmission** Auto




Dereg Value \$16,786 as of today (change) **OMV** \$16,167

COE \$29,670 **ARF** \$16,167

Engine Cap 1,598 cc **Power** 80.0 kW (107 bhp)

Curb Weight 1,195 kg **No. of Owners** 3


Low Interest Rate In-House Loan by GI Cars Financing
Drive into the festive season with 3.28% p.a. by GI Cars Financing!


\$	Price Road Tax Paid Per Year Deregistration Value (aka Scrap Value) Open Market Value (OMV) Additional Registration Fee (ARF) COE Premium Paid
Car	Car Brand Car Model Mileage Engine Capacity Curb Weight Power (kilowatt)
Bar Chart	Manufacture Year Number of Owner Registration Date COE Validity Period Seller

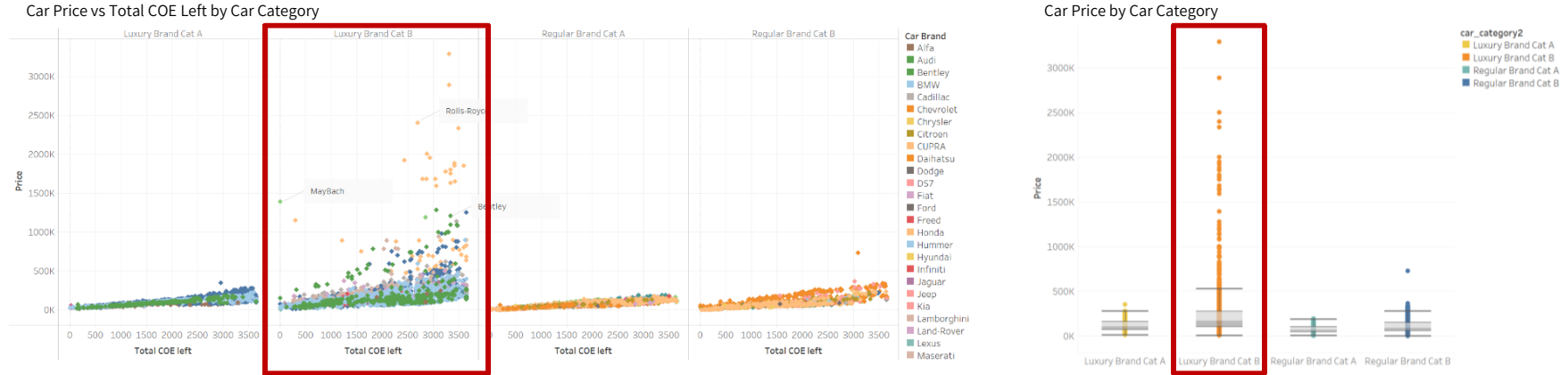
11,212
listings
scraped

SELECTED FEATURES FOR MODELING

Original	<ol style="list-style-type: none">1. Road Tax Paid Per Year2. Deregistration Value (aka Scrap Value)3. OMV4. ARF5. Total Mileage6. Power (kilowatt)
Created 	<ol style="list-style-type: none">7. Total COE Left (Number of Days)8. Car Age (Number of Years)9. Car Category: Brand Category + COE Category<ul style="list-style-type: none">• Luxury Brand Cat A• Luxury Brand Cat B• Regular Brand Cat A• Regular Brand Cat B



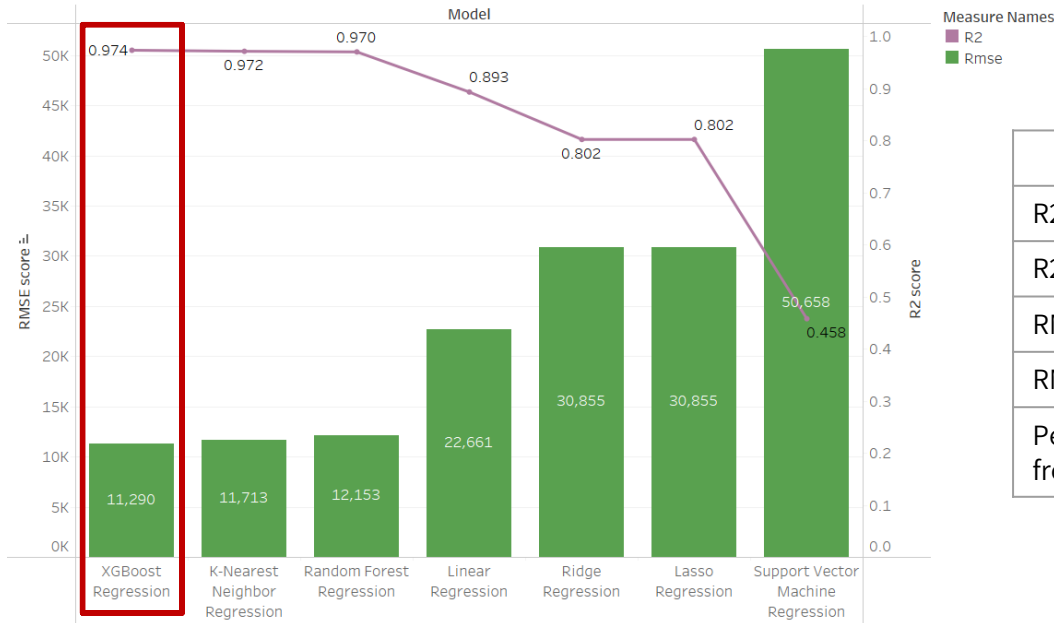
SCOPE FOR PREDICTIVE MODELLING



- High price variation in Luxury Brand Category B and cars above \$500,000
- Listings above \$500,000** and of certain car brands (**Bentleys, Rolls-Royce and Maybach**) were excluded (~300 listings)

Luxury Brand	Regular Brand	COE Category A	COE Category B
Mercedes, BMW, Audi, Volvo, Porsche etc.	Toyota, Honda, Mazda, Hyundai, Nissan, etc.	$\text{cars} \leq 1,600\text{cc or } 110\text{kW}$	$\text{cars above } 1,600\text{cc or } 110\text{kW}$

XGBoost is the best model for prediction of used car price



XGBoost Regression	
R2 for test	0.974
R2 for train	0.99
RMSE for test	11,289.67
RMSE for train	1,890.20
Percent difference from average car price	10.54%

STREAMLIT



How Much Is Your Car Worth?

Car Brand

BMW

COE Category

Category B

Road Tax Paid Per Year (SGD)

1570.00

Deregistration Value as of Today (SGD)

24447.00

Open Market Value (SGD)

28395.00

Additional Registration Fee (SGD)

28395.00

Total COE Left (Number of Days)

2561.00

Power (kW)

100.00

Age of Car (Number of Years)

13.00

Total Mileage (kilometers)

65000.00

Submit

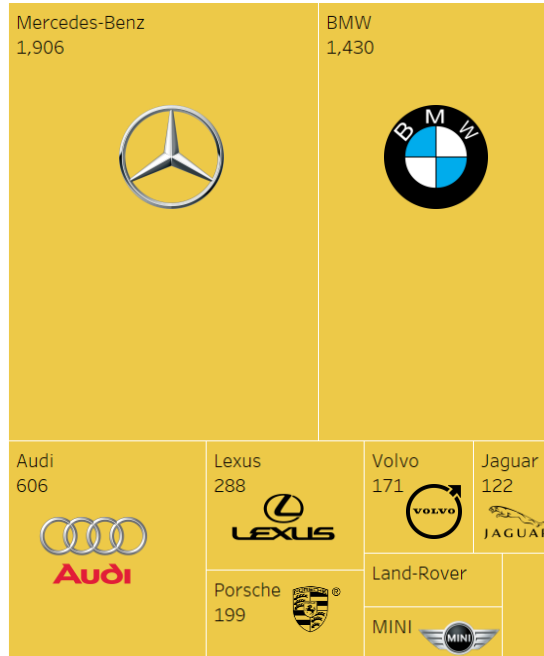
Predicted Price

Predicted Price

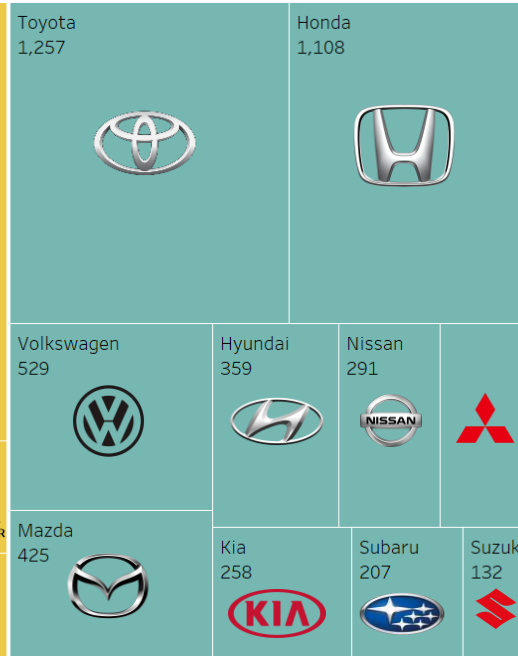
\$84104.0

A good range of car brands among the used car listings on SGcarmart

50.6% luxury brand

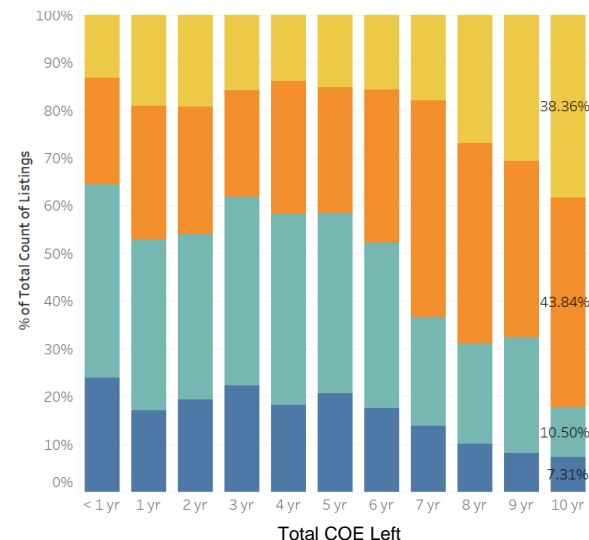
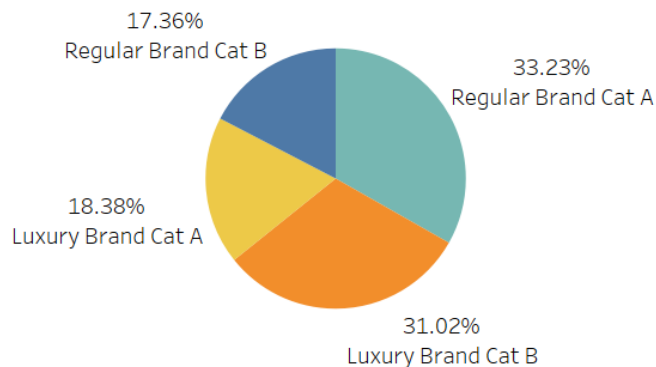


49.4% regular brand



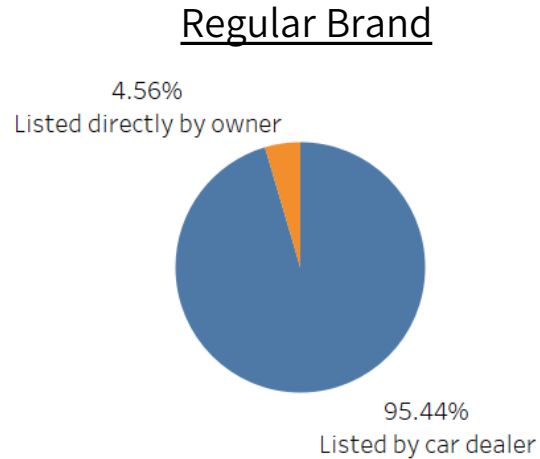
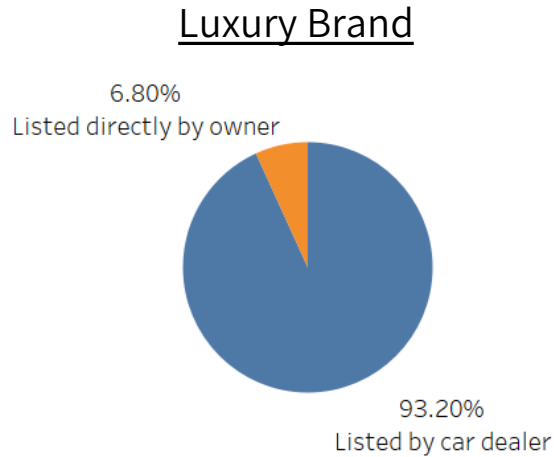
Luxury cars listed on SGcarmart have longer COE validity than regular cars

■ Regular Brand Cat A
■ Luxury Brand Cat B
■ Luxury Brand Cat A
■ Regular Brand Cat B



Luxury Brand	Regular Brand	COE Category A	COE Category B
Mercedes, BMW, Audi, Volvo, Porsche etc.	Toyota, Honda, Mazda, Hyundai, Nissan, etc.	cars \leq 1,600cc or 110kW	cars above 1,600cc or 110kW

Vast majority of the used cars listed on SGcarmart are from car dealers



KEY BUSINESS RECOMMENDATIONS

1

The use of machine learning in car valuation is highly attractive for the automotive industry as it has the potential to shorten the time needed for potential sellers to receive a quote for their car.



2

Increasing direct listings by car owners is necessary to outcompete newer but promising players such as Carro and Carousell. Both the diversity and volume of car listings are crucial drivers for an online car marketplace to stand out in an increasingly competitive market.



CONCLUSION

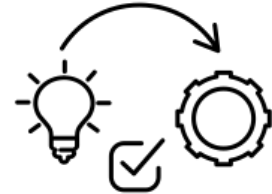
1

The RMSE score can be reduced if the model can be further fine-tuned with data on the **actual sales price**. The RMSE score of 10.5% of the average listing price could be an indication of high price variation observed on the market currently.



2

Overall, with an accuracy score of 97%, it is likely that this predictive model could be **ready for implementation** by the online car marketplace if the RMSE score can be reduced to less than 5% compared to the actual sales price.



THANK YOU!



[www.linkedin.com/in/
er-ning-582a3b12a](https://www.linkedin.com/in/er-ning-582a3b12a)



<https://github.com/NingDS>

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