

Professional Readiness for Innovation, Employability, and Entrepreneurship

PROJECT REPORT

Title : Car Resale Value Prediction
Team ID : IBM-EPBL/IBM-Project-44288-1660723753

TABLE OF CONTENTS

1. INTRODUCTION.....	3
Project Overview	3
Purpose.....	3
2. LITERATURE SURVEY	4
Existing problem	4
References	4
Problem Statement Definition	5
3. IDEATION & PROPOSED SOLUTION	6
Empathy Map Canvas.....	6
Ideation & Brainstorming	7
Proposed Solution.....	10
Problem Solution fit.....	11
4. REQUIREMENT ANALYSIS	13
Functional requirement	13
Non-Functional requirements	13
5. PROJECT DESIGN.....	14
Data Flow Diagrams.....	14
Solution & Technical Architecture.....	15
User Stories	15
6. PROJECT PLANNING & SCHEDULING.....	16
Sprint Planning & Estimation	16
Sprint Delivery Schedule	16
Project Tracker.....	17
Burndown chat	17
6.4 Reports from JIRA.....	17
7. CODING & SOLUTIONING.....	18
Home Page	18
Data Entry Page	20
Output Display Page.....	34
Model Selection & Hyperparameter Tuning	36
Flask Integration	47
8. TESTING	49
Test Cases Scenarios	49
User Acceptance Testing.....	49
UAT Report.....	50
9. RESULTS.....	51
Performance Metrics.....	51
10. ADVANTAGES & DISADVANTAGES	52
11. CONCLUSION.....	53
12. FUTURE SCOPE.....	54
13. APPENDIX	55
Source Code	55
GitHub & Project Demo Link	85

1. INTRODUCTION

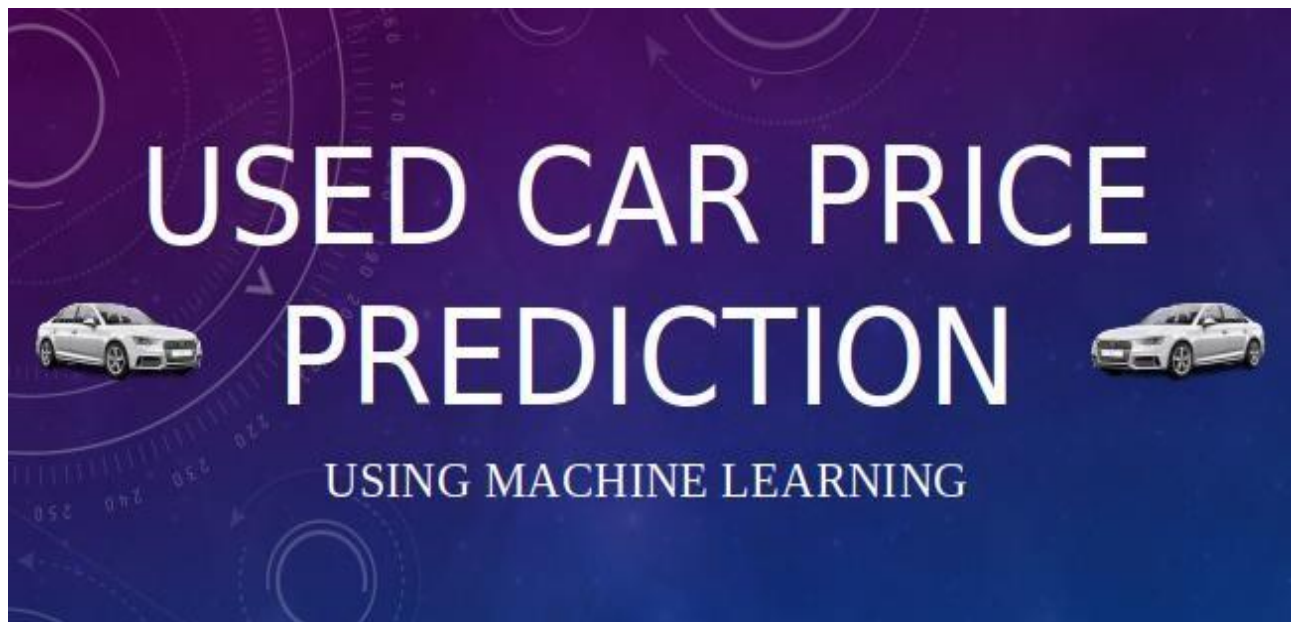
Project Overview

This system “Car Resale Value Prediction” aims to build a regression model to predict used cars' resale value based on multiple aspects, including vehicle mileage, year of manufacturing, fuel consumption, transmission, road tax, fuel type, and engine size. This model can benefit sellers, buyers, and car manufacturers in the used cars market. Upon completion, it can output a relatively accurate price prediction based on the information that user's input. Various regression methods, including linear regression, polynomial regression, support vector regression, decision tree regression, and random forest regression, were applied in the research to achieve the highest accuracy.

This system was implemented as a web application where the user enters the details of the car to get an estimation of the car's resale value.

Purpose

Car resale value prediction helps the user to predict the resale value of the car depending upon various features like kilometers driven, fuel type, etc. The purpose of this system is of commercial interest to sellers/financer to be able to predict the resale value of cars with better accuracy. The most essential elements for forecast are brand and model, period use of vehicle, mileage of vehicle, gear type and fuel type utilized in the vehicle just as fuel utilization per mile profoundly influences cost of a vehicle because of continuous changes in the cost of a fuel. In view of the differing highlights and factors, and furthermore with the assistance of master information the vehicle resale value forecast has been done precisely.



2. LITERATURE SURVEY

Existing problem

With difficult economic conditions, it is likely that sales of second-hand imported (reconditioned) cars and used cars will increase. In many developed countries, it is common to lease a car rather than buying it outright. After the lease period is over, the buyer has the possibility to buy the car at its residual value, i.e., its expected resale value. Thus, it is of commercial interest to sellers/financers to be able to predict the salvage value (residual value) of cars with accuracy.

References

Project Title	Author	Abstract
Price Prediction of Used Cars Using Machine Learning	Chuyang Jin	This work aims to build a model to predict used cars' reasonable prices based on multiple aspects. Various regression methods including linear regression, polynomial regression, support vector regression, decision tree regression, and random forest regression were applied in the work to obtain highest accuracy. Compared to previous research, the resulting model includes more aspects of used cars while also having a higher prediction accuracy.
Prediction of Prices for Used Car by using Regression Models (2018)	Nitis Monburinon, Prajak Chertchom, Thongchai Kaewkiriya, Suwat Rungpheung, Sabir Buya, Pitchayak Boonpou.	In this work, a model to evaluate price based on big data analysis is proposed. It takes advantage of vehicle data and vehicle transaction data to analyze the price data for each type of vehicles. The work uses optimized Back Propagation neural network algorithm.
Car Price Prediction Using Machine Learning (2019)	Enis gegic, Becir Isakovic, Dino Keccand, Zerina Masetic, Jasmin Kevric.	In this work, several distinct attributes are analyzed for the reliable and accurate prediction. The work is to build a model to predict the resale price of cars in Bosnia and Herzegovina
Used Car price prediction (2021)	Praful Rane, Deep Pandya, Dhawal Kotak.	In this work, machine learning models that can accurately predict the price of a used car based on its features was built. They have implemented and evaluated various learning methods on dataset consisting of the sale prices of different models.
Prediction of Used Car Price Based on Supervised Learning Algorithm (2021)	Feng Wang, Xusong Zhang, Qiang Wang	In this work, Extra Trees Regressor, Random Forest Regressor was used. Finally, the algorithm was optimized by using the hyperparameter function. The results show that $R^2 = 0.9807$ obtained from extreme random numbers is the best performance. The algorithm was obtained and validated with new data to derive the final algorithm model.

Problem Statement Definition

It is easy for any company to price their new cars based on the manufacturing and marketing cost it involves. But when it comes to a used car it is quite difficult to define a price because it involves it is influenced by various parameters like car brand, manufactured year etc. The goal of our system is to predict the best price for a used car in the based on the previous data related to sold cars using machine learning.

These factors range from **year of purchase, make, model, kilometers driven and overall condition of the car.**



3. IDEATION & PROPOSED SOLUTION

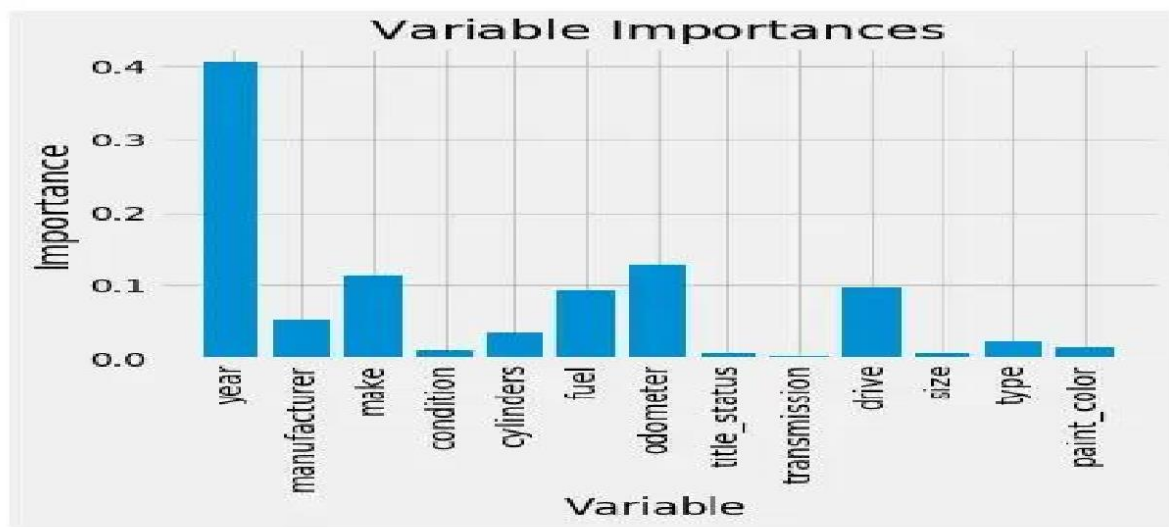


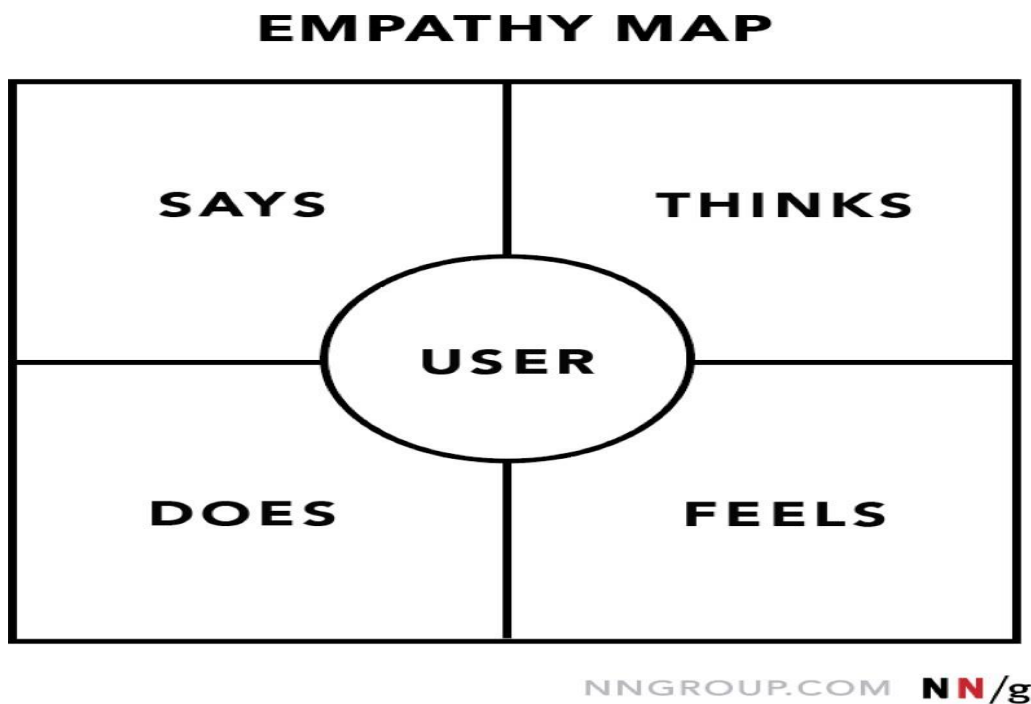
Figure 12: Bar plot of variable importance

Empathy map Canvas

Car Resale Value Prediction Using Random Forest Regressor

Which algorithm is best for used car price prediction?

At the last stage, predictive models were applied to predict price of cars in an order: **random forest**, linear regression, ridge regression, lasso, KNN, XGBoost. By considering all four metrics from table 15, it can be concluded that random forest the best model for the prediction for used.



Used car sellers (dealers):

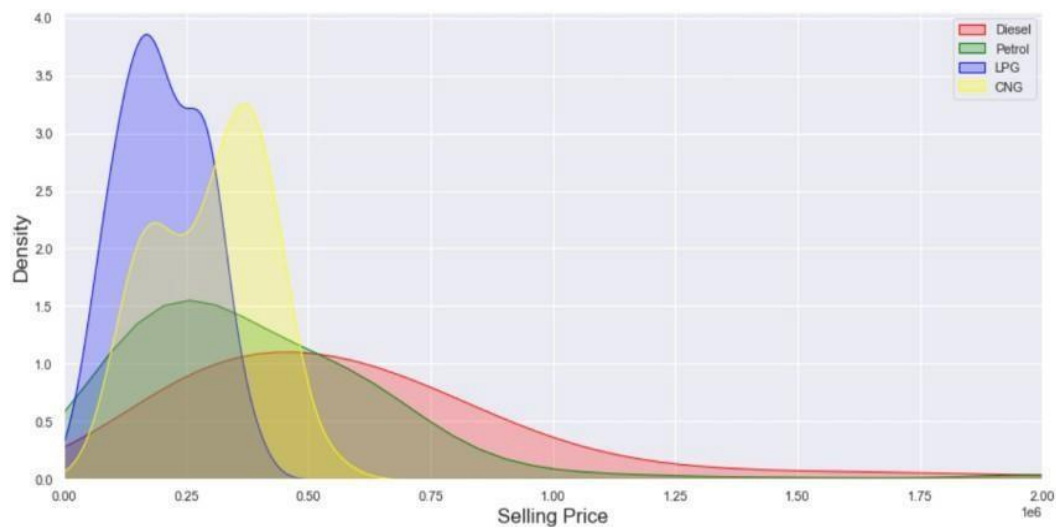
They are one of the biggest target group that can be interested in results of this study. If used car sellers better understand what makes a car desirable, what the important features are for a used car, then they may consider this knowledge and offer a better service.

Online pricing services:

There are websites that offers an estimate value of a car. They may have a good prediction model. However, having a second model may help them to give a better prediction to their users. Therefore, the model developed in this study may help online web services that tells a used car's market value.

Individuals:


There are lots of individuals who are interested in the used car market at some points in their life because they wanted to sell their car or buy a used car. In this process, it's a big corner to pay too much or sell less than it's market value.



Ideation & Brainstorming




Step-1: Team Gathering, Collaboration and Select the Problem Statement

Template




Brainstorm & idea prioritization


Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.


 10 minutes to prepare
 1 hour to collaborate
 3-8 people recommended

[Share template feedback](#)


 **Before you collaborate**

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.


 10 minutes

**Team gathering**

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.


**Set the goal**

Think about the problem you'll be focusing on solving in the brainstorming session.


**Learn how to use the facilitation tools**


Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#)


 **Define your problem statement**

The problem statement is to consider the main factors which would affect the resale value of a vehicle and to build a regression model that would give the nearest resale value of the vehicle.







 5 minutes



How might we predict the resale value of a car?



Key rules of brainstorming

 Stay in focus	 Encourage wild ideas
 Defer judgment	 Listen to others
 Go for volume	 If possible, be visual

IDEAS Listing & Brainstorm:



Grouping:



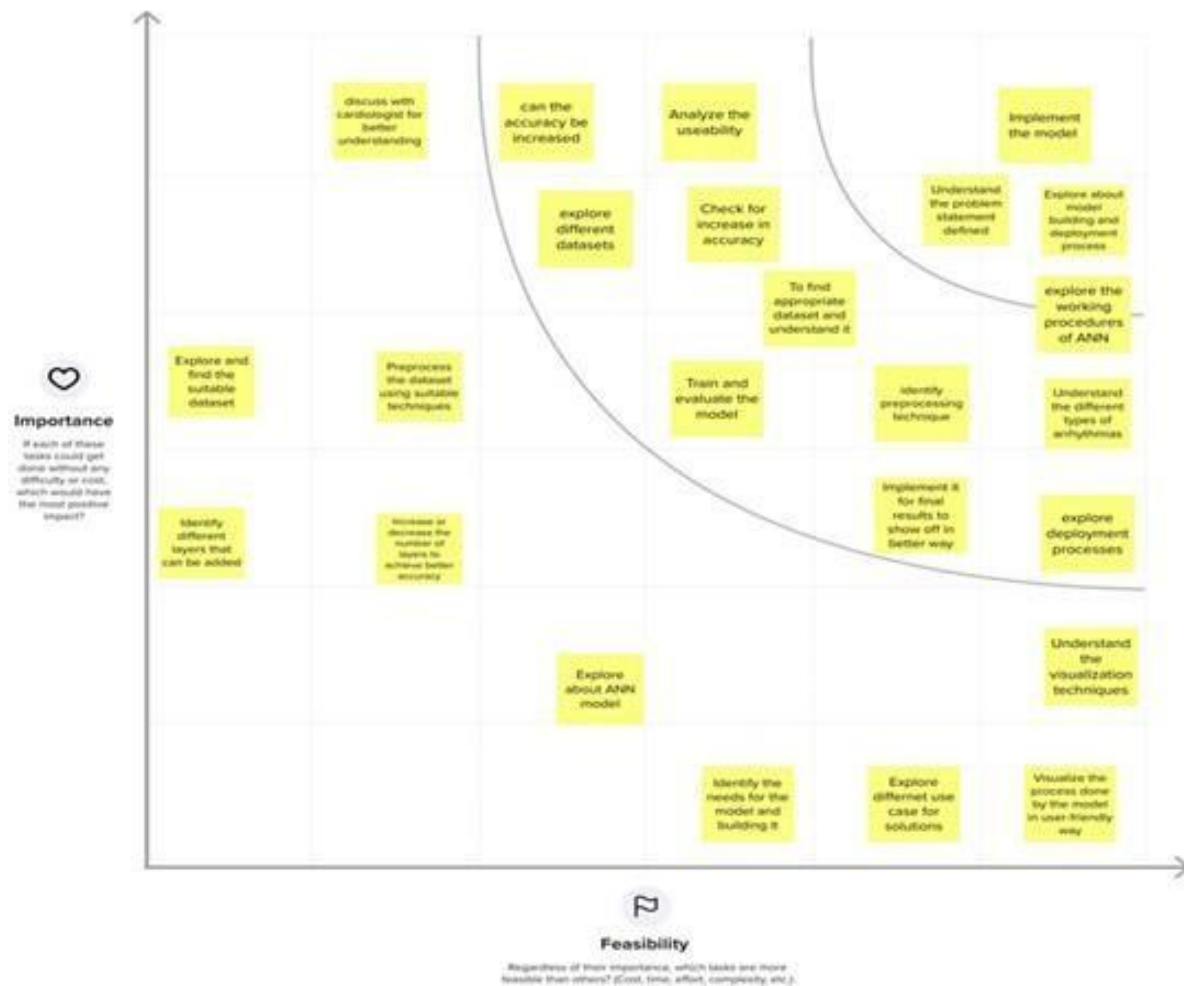
Step-3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes



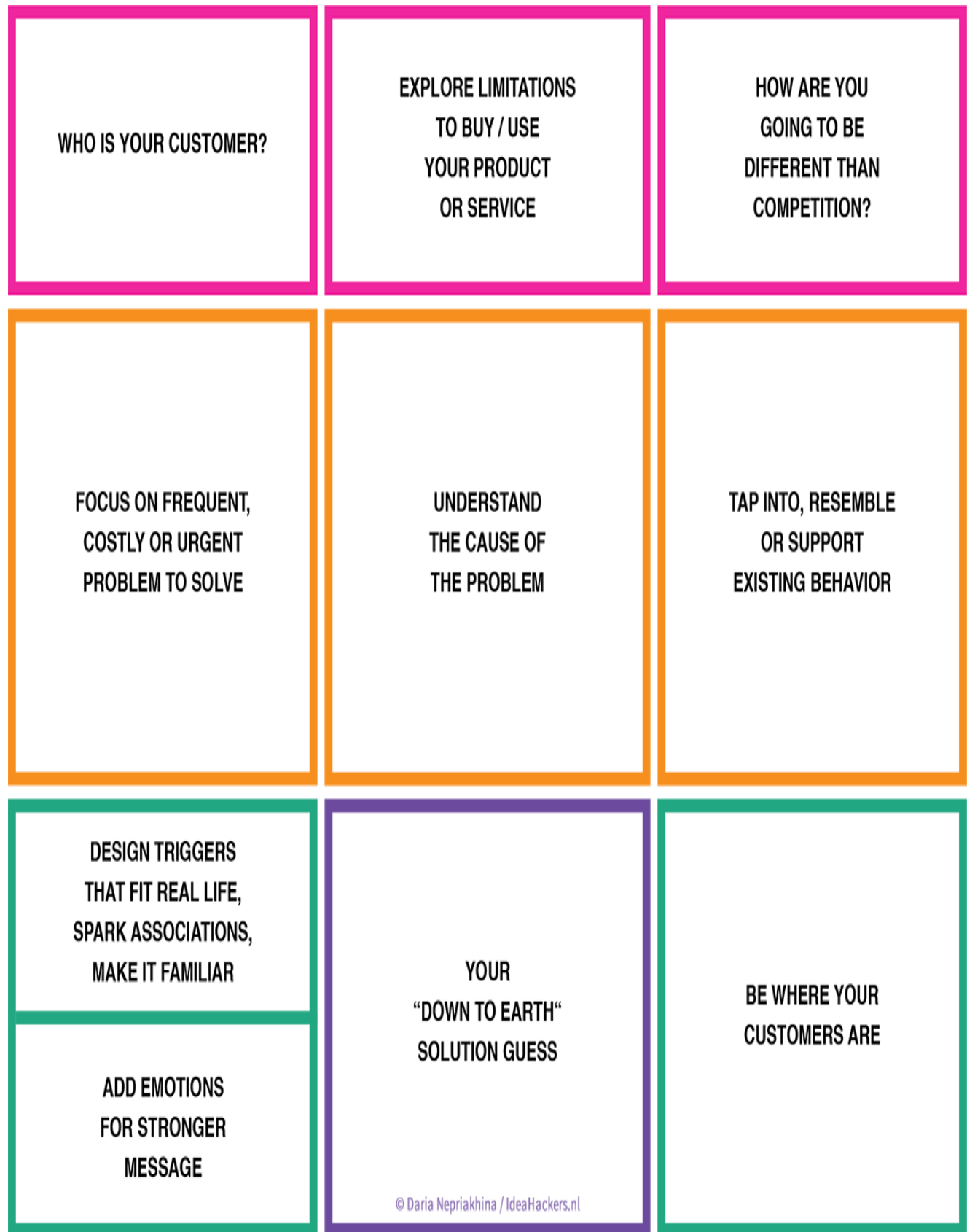
Proposed Solution

S. No:	Parameter	Description
1.	Problem Statement (Problem to be solved)	With difficult economic conditions, it is likely that sales of second-hand imported (reconditioned) cars and used cars will increase. In many developed countries, it is common to lease a car rather than buying it outright. After the lease period is over, the buyer has the possibility to buy the car at its residual value, i.e., its expected resale value. Thus, it is of commercial interest to sellers/financers to be able to predict the salvage value (residual value) of cars with accuracy.
2.	Idea / Solution description	In order to predict the resale value of the car, we proposed an intelligent, flexible, and effective system that is based on using regression algorithms. Considering the main factors which would affect the resale value of a vehicle a regression model is to be built that would give the nearest resale value of the vehicle. We will be using various regression algorithms and algorithm with the best accuracy will be taken as a solution, then it will be integrated to the web-based application where the user is notified with the status of his product.
3.	Novelty / Uniqueness	Car resale value price data frequently resides in several locations from various sources, such as industries or private persons, to various source systems. The organization as a whole contributes to the data. This data becomes accessible and usable when it is combined into a single, central system, such as an enterprise data warehouse (EDW).

4.	Social Impact / Customer Satisfaction	<ol style="list-style-type: none"> 1. Enhanced resale value accuracy 2. Improved relationships with customers 3. Leads to increased quality of products and it's related after sales service
5.	Business Model (Revenue Model)	This business plan addresses all relevant concerns by presenting a comprehensive account of a month-by-month marketing strategy coupled with an extensive report on all aspects of the needs of a successful used car center.
6.	Scalability of the Solution	A variety of institutions must store, evaluate, and take action on the massive amounts of data being produced by the car resale industries as it expands quickly. India is a vast, culturally varied nation with a sizable population that is increasingly able to access centralized resale services.

Problem Solution fit

<u>1. Customer Segments</u> + Car mechanic + Customer	<u>1. Customer Limitation</u> Proper information about the car is to be known by the customer to find the resale value.	<u>5. Available Solution</u> To predict the resale value of the car, we use an intelligent, flexible, and effective system with web application.
<u>1. Problems</u> Customer should know the details of their car in web application.	<u>2. Problem root cause</u> <ul style="list-style-type: none"> • No Proper platform for car resale value prediction. 	<u>2. Behavior</u> Customers are supposed to enter the car details in the web application to find the resale price of the car.



4. REQUIREMENT ANALYSIS

Functional Requirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Website
FR-2	User Confirmation	Confirmation via website
FR-3	Car Registration	Registering the car details
FR-4	Value Prediction	Predicting the car resale value

Non-Functional requirements

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Predicting the resale value
NFR-2	Security	Providing security to the website
NFR-3	Reliability	Providing high reliability by predicting values for different types of cars
NFR-4	Performance	Providing high performance by using some machine learning techniques
NFR-5	Availability	It is used for all types of cars
NFR-6	Scalability	Predicting values for different types of cars

5. PROJECT DESIGN

Data Flow Diagrams

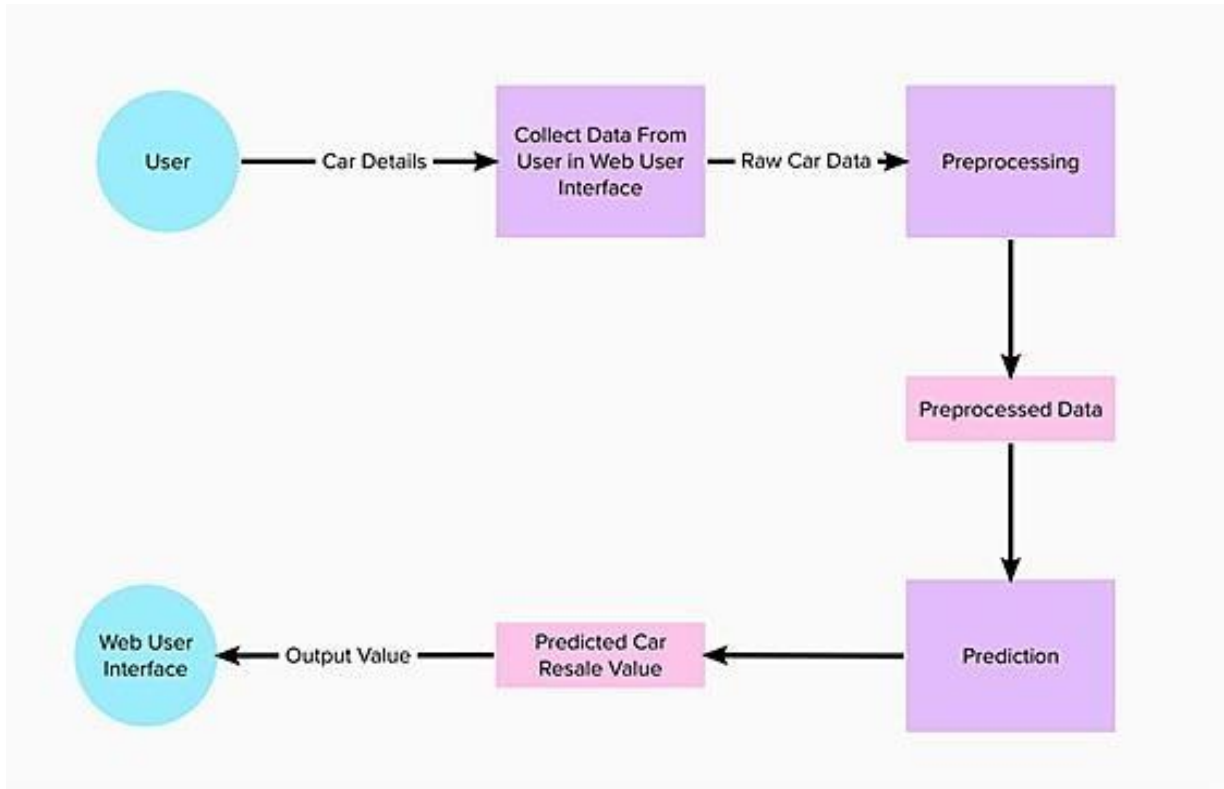
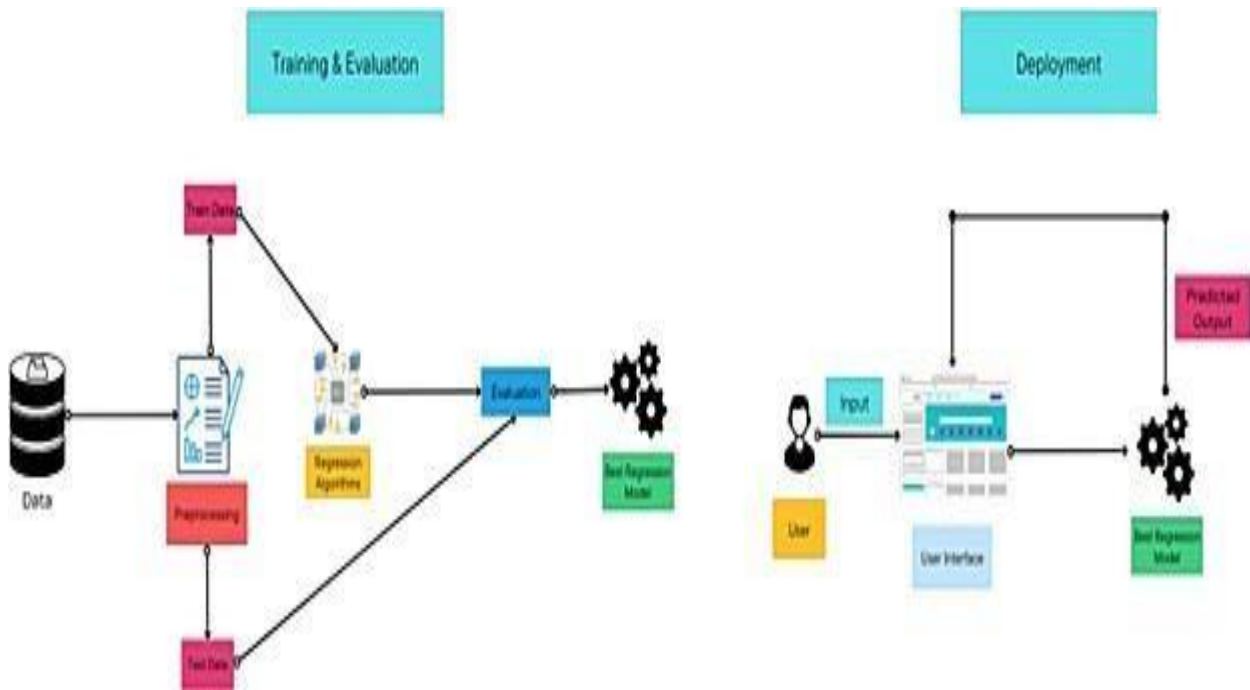


Table 6
The effect of condition on price

Condition	Price					
	N	Mean	SD	SE	95% Conf.	Interval
excellent	153863	14492.84	10079.87	25.70	14442.47	14543.20
fair	21728	6448.94	6204.25	42.09	6366.44	6531.44
good	95136	10988.28	8818.59	28.59	10932.24	11044.32
like new	67102	22397.07	12569.97	48.53	22301.96	22492.18
new	3448	30019.38	14791.83	251.91	29525.57	30513.19
salvage	34055	10913.53	8114.61	43.97	10827.34	10999.71

Solution & Technical Architecture



User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Desktop user)	Home Page	USN-1	As a user, I can view the home page of the web application.	I can view the homepage	Low	Sprint-1
Customer (Desktop user)	Data Entry	USN-2	As a user, I can enter my car details in the application.	I can enter the car details	Medium	Sprint-2

Customer (Desktop user)	View car Resalevalue	USN-3	As a user, I can view theresale value of my car.	I can view mycar's resale value	Medium	Sprint-3
Customer (Desktop user)	Resale Value Prediction	USN-4	As a user, I expect the application to predict theresale value of my car.	I expect the application to predict my car resale price	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

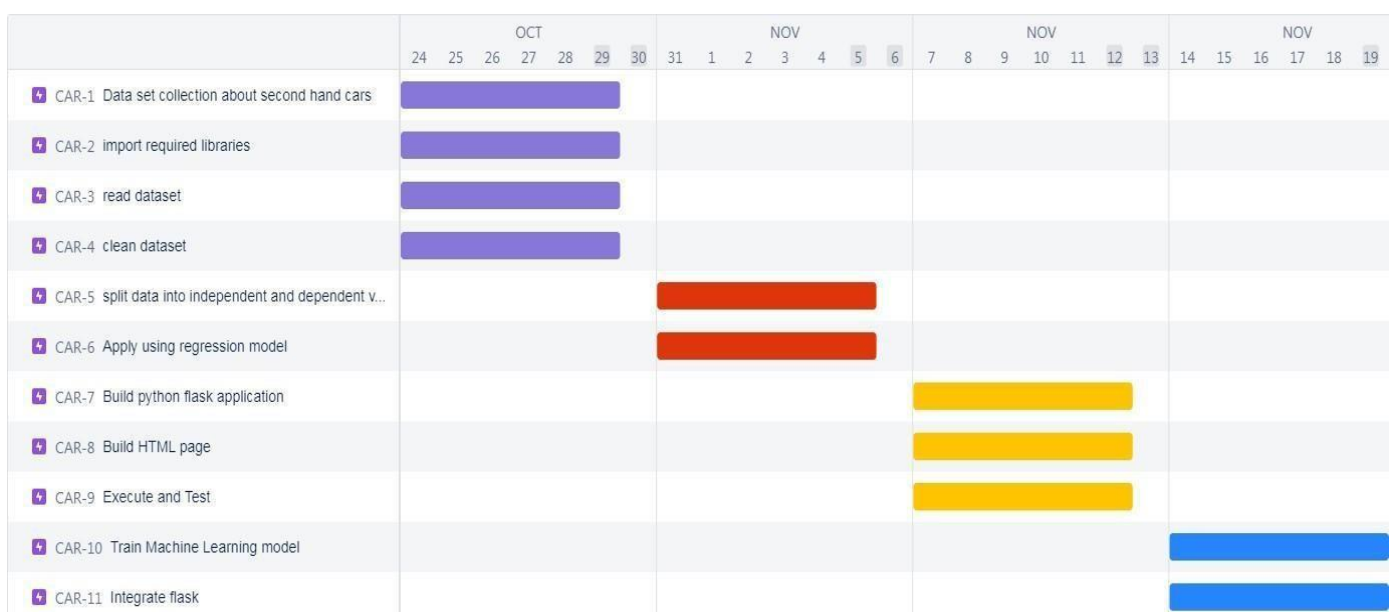
Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Pre-process data	USN-1	Collect Dataset	1	Low	Jayaram
Sprint-1		USN-2	Import required libraries	1	Low	Jayaram
Sprint-1		USN-3	Read and clean data sets	2	Low	Jayaram & Rahul
Sprint-2	Model building	USN-1	Split data into independent and dependent variables	3	Medium	Anandhakrishnan
Sprint-2		USN-2	Apply using regression model	3	Medium	Anandhakrishnan ,Nalan & Jayaram,
Sprint-3	Application building	USN-1	Build python flask application and HTML page	5	High	Anandhakrishnan
Sprint-3		USN-2	Execute and test	5	High	Anandhakrishnan
Sprint-4	Training the model	USN-1	Train machine learning model	5	High	Nalan
Sprint-4		USN-2	Integrate flask	5	High	Nalan

Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Reports from JIRA



7. CODING AND SOLUTIONING

Feature-1

Home Page

Displays the home page of the application.

Code:

1) car.html <!DOCTYPE html> <html lang="en" dir="ltr">

<head>

<meta charset="utf-8">

<title>Car Resale Value Predicting Application</title>

<link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> <link rel="stylesheet" href="../static/css/style.css">

<linkrel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/fontawesome/4.7.0/css/font-awesome.min.css">

</head>

<body>

<section class="header"> <nav>

</nav>

<div class="text-box">

<h1>Car resale value Predictor</h1>

<p>Best system to predict the amount of resale value based on the parameters provided by the user .</p>

Check price </div>

</section>

</body>

</html>

2) style.css

{

margin:

0;

padding:

0;

}

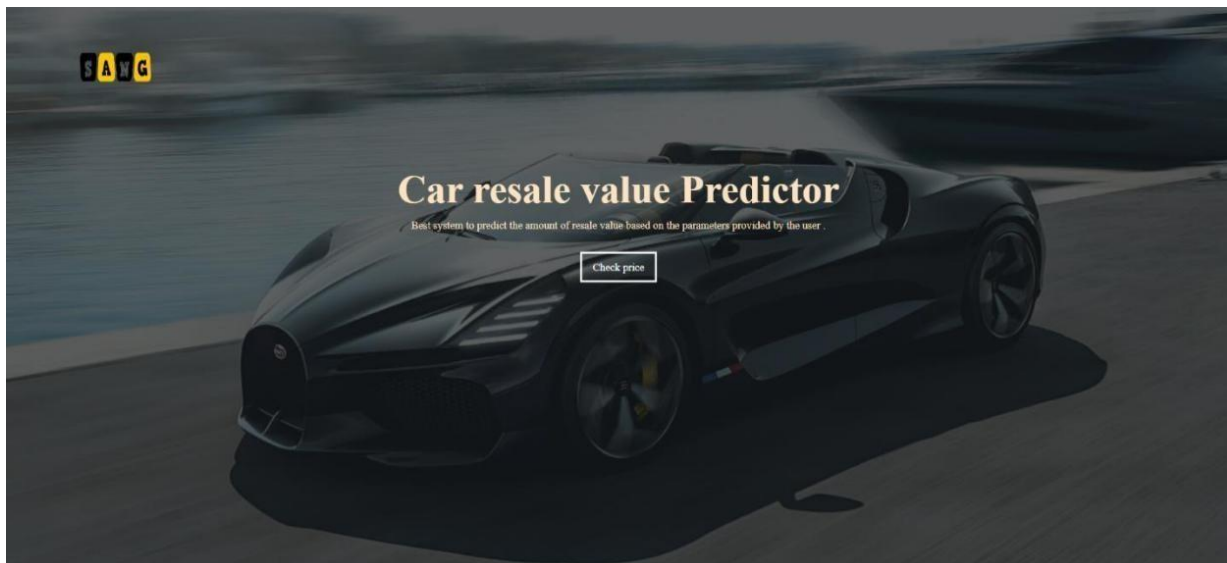

```
.header{      min-
height: 100vh;
width: 100%;
background-
image:
    linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car1.p
ng); background-position: center; background-size: cover;
position: relative;
}
nav{
display:flex; padding: 2%
6%; justify-content: space-
between; align-items:
center;
}
.nav-links{
flex: 1; text-
align: right;
}
.nav-links ul li{ list-
style: none; display:
inline-block;
padding: 8px 12px;
position: relative;
}
.nav-links ul li a{
color:white; text-
decoration: none; font-
size: 13px;
}.text-box{ text-align: center;
position: relative; color: #FFE4C4;
top:50%;
}
```

```

.text-box h1{ margin-top: 50px; font-size:
55px;
}
.text-box p{ margin: 10px 0 40px;
font-size: 15px;
} .visit-btn{ display: inline; border: 3px solid
#fff;
padding:10px
14px; font-size:
15px;
background:
transparent; color:
white; text-
decoration:none;
}

```

Output:



Data Entry Page

Allows user to enter the details about the car for which the resale value is to be predicted.

Code:

```
1) value.html <!DOCTYPE html> <html lang="en"
dir="ltr"> <head>
<link rel="stylesheet" href="../static/css/value.css"> <title>Car Resale Value
Predicting Application</title>

<link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> <script
src="https://kit.fontawesome.com/b9b6bac803.js" crossorigin="anonymous"></script>

<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/fontawesome/4.7.0/css/font-
awesome.min.css">

<style>
..... table, th,
td
{ .....
padding: ..... 10px;
.....
... }
..... </style>

</head>

<body>

<div class="container">

..... <div class="header">

..... <h1>Get the Accurate Resale Value of Your Car</h1>

..... </div>

.....<form action="http://localhost:5000/predict" class="form">

..... <div class="form-control">

..... <label for="year" padding:10px>Registration year : </label>

<input id="year" maxlength="50" name="regyear" type="text"

autocomplete="off"/>

..... <i class="fas fa-check-circle"></i>
```

```
..... <i class="fas fa-exclamation-circle"></i>

..... <span></span>

..... </div>

..... <div class="form-control">

..... <label for="month">Registration Month : </label>

<input          id="month"    maxlength="50"    name="regmonth"    type="text"

autocomplete="off"/>

..... <i class="fas fa-check-circle"></i>

..... <i class="fas fa-exclamation-circle"></i>

..... <span></span>

..... </div>

..... <div class="form-control">

.....<label for="power">Power of car in PS: </label>

<input          id="power"    maxlength="50"    name="powerps"    type="text"

autocomplete="off"/>

..... <i class="fas fa-check-circle"></i>

..... <i class="fas fa-exclamation-circle"></i>

..... <span></span>

..... </div>

..... <div class="form-control">

..... <label for="kilometer">Kilometers that car have driven : </label>

<input          id="kilometer"    maxlength="50"    name="kms" type="text"

autocomplete="off"/>

..... <i class="fas fa-check-circle"></i>
```

..... <i class="fas fa-exclamation-circle"></i>

.....

</div> <div
class="form-control">

..... <h3>Gear Type</h3>

..... <table style="width:50% ">

<tr>

<th></th>

<th></th>

</tr>

<tr>

..... <td>Manual</td>

<td><input type="radio" name="geartype" value="manual" id="manual" /></td>

</tr>

<tr>

..... <td>Automatic</td>

.....

```
<td><input type="radio" name="geartype" value="automatic" id="automatic" /></td>
```

.....

```
</tr>
```

.....

```
<tr>
```

.....

```
<td>Not mentioned</td>
```

.....

.....

```
<td><input type="radio" name="geartype" value="not-declared" id="not" /></td>
```

.....

```
</tr>
```

.....

```
</table>
```

..... <i class="fas fa-check-circle"></i>..... <i
class="fas fa-exclamation-circle"></i>
..... </div>
..... <div

```
class="form-control">
```

.....

.....

.....

```
<h3>Your car is repaired or damaged :</h3>
```

.....<ta

```
ble style="width:50% ">
```

.....

.....

```
<tr>
```

.....

.....

```
<th></th>
```

.....

.....

```
<th></th>
```

.....
.....
.....
.....
.....

</tr>

.....
.....
.....

<tr>

.....
..... <td>Yes</td>

.....
..... <td><input type="radio" name="damage" value="yes" id="yes"/></td>

.....
..... </tr>

.....
..... <tr>

.....
..... <td>No</td>

.....
..... <td><input type="radio" name="damage" value="no" id="no"/></td>

.....
.....
.....

</tr>

.....
.....

```
.....
<tr>
.....
..... <td>Not Declared</td>
.....
.....
<td><input type="radio" name="damage" value="not-declared"
id="notdec"/></td>
.....
..... </tr>
.....
</table>
```

```
..... <i class="fas fa-check-circle"></i>
..... <i class="fas fa-exclamation-circle"></i>
..... <span></span>
..... </div>
..... <div class="form-control">
..... <label for="model">Model Type : </label>
..... <select name="model" id="model">
```

```
... <option value="" disabled selected hidden>Choose Model Name...</option> <option value="golf">Golf
</option>
..... <option value="grand">Grand </option>
..... <option value="fabia">Fabia </option>
..... <option value="3er">3er </option>
..... <option value="2_reihe">2 Reihe </option>
..... <option value="andere">Andere </option>
```


..... <option value="c_max">C Max </option>

..... <option value="3_reihe">3 Reihe </option>

..... <option value="passat">Passat </option>

..... <option value="navara">Navara </option>

..... <option value="ka">Ka </option>

..... <option value="polo">Polo </option>

..... <option value="twingo">Twingo </option>

.....<option value="a_klasse">A klasse </option>

..... <option value="scirocco">Scirocco </option>

..... <option value="5er">5er </option>

..... <option value="meriva">Meriva </option>

..... <option value="arosa">Arosa </option>

..... <option value="c4">C4 </option>

..... <option value="civic">Civic </option>

..... <option value="transporter">Transporter </option>

..... <option value="punto">Punto </option>

..... <option value="e_klasse">E Klasse </option>

..... <option value="clio">Clio </option>

..... <option value="kadett">Kadett </option>

..... <option value="kangoo">Kangoo </option>

..... <option value="corsa">Corsa </option>

..... <option value="one">One </option>

.....<option value="fortwo">Fortwo </option>

..... <option value="1er">1er </option>

..... <option value="b_klasse">B Klasse </option>

.....<option value="signum">Signum </option>

.....<option value="astra">Astra </option>

..... <option value="a8">A8 </option>

..... <option value="jetta">Jetta </option>

..... <option value="fiesta">Fiesta </option>

..... <option value="c_klasse">C Klasse </option>

..... <option value="micra">Micra </option>

..... <option value="vito">Vito </option>

..... <option value="sprinter">Sprinter </option>

..... <option value="156">156 </option>

..... <option value="escort">Escort </option>

..... <option value="forester">Forester </option>

..... <option value="xc_reihe">Xc Reihe </option>

..... <option value="scenic">Scenic </option>

..... <option value="a4">A4 </option>

..... <option value="a1">A1 </option>

..... <option value="insignia">Insignia </option>

..... <option value="combo">Combo </option>

..... <option value="focus">Focus </option>

..... <option value="tt">Tt </option>

..... <option value="a6">A6 </option>

..... <option value="jazz">Jazz </option>

.....<option value="omega">Omega </option>

..... <option value="slk">Slk </option>

..... <option value="7er">7er </option>

..... <option value="80">80 </option>

..... <option value="147">147 </option>

..... <option value="glk">Glk </option>

..... <option value="100">100

</option> <option value="z_reihe">Z

Reihe </option>..... <option

value="sportage">Sportage </option>

..... <option value="sorento">Sorento

</option>

..... <option value="v40">V40

</option> <option

value="5er">5er </option> <option

value="ibiza">Ibiza </option>

<option value="3er">3er </option>

<option value="mustang">Mustang </option>

..... <option value="eos">Eos

</option> <option

value="touran">Touran </option>

.....<option value="getz">Getz </option>

..... <option value="a3">A3 </option>

..... <option value="almera">Almera </option>

..... <option value="megane">Megane </option>

..... <option value="7er">7er </option>

..... <option value="1er">1er </option>

..... <option value="lupo">Lupo </option>

..... <option value="r19">R19 </option>

..... <option value="zafira">Zafira </option>

..... <option value="caddy">Caddy </option>

..... <option value="2_reihe">2 Reihe </option>

.....<option value="mondeo">Mondeo </option>

..... <option value="cordoba">Cordoba </option>

..... <option value="colt">Colt </option>

..... <option value="impreza">Impreza </option>

..... <option value="vectra">Vectra </option>

..... <option value="berlingo">Berlingo </option>

..... <option value="80">80 </option>

..... <option value="m_klasse">M Klasse </option>

..... <option value="tiguan">Tiguan </option>

..... <option value="i_reihe">I Reihe </option>

..... <option value="espace">Espace </option>

..... <option value="sharan">Sharan </option>

..... <option value="6_reihe">6 Reihe </option>

..... <option value="panda">Panda </option>

..... <option value="up">Up </option>

..... <option value="seicento">Seicento </option>

..... <option value="ceed">Ceed </option>

..... <option value="5_reihe">5 Reihe </option>

..... <option value="yeti">Yeti </option>

..... <option value="octavia">Octavia </option>

..... <option value="mii">Mii </option>

..... <option value="rx_reihe">Rx Reihe </option>

..... <option value="6er">6er </option>

..... <option value="modus">Modus </option>

..... <option value="fox">Fox
</option> <option
value="matiz">Matiz </option>
<option value="beetle">Beetle </option>
..... <option value="c1">C1
</option> <option
value="rio">Rio </option> <option
value="touareg">Touareg </option>
<option value="logan">Logan </option>
..... <option value="spider">Spider
</option> <option
value="cuore">Cuore </option>
<option value="s_max">S Max </option>
..... <option value="a2">A2
</option>

..... <option value="x_reihe">X Reihe </option>

..... <option value="a5">A5 </option>

.....<option value="galaxy">Galaxy </option>

..... <option value="c3">C3 </option>

..... <option value="viano">Viano </option>

.....<option value="s_klasse">S Klasse </option>

..... <option value="1_reihe">1 Reihe </option>

..... <option value="avensis">Avensis </option>

..... <option value="sl">Sl </option>

..... <option value="roomster">Roomster </option>

..... <option value="q5">Q5 </option>

..... <option value="kaefer">Kaefer </option>

..... <option value="santa">Santa </option>

..... <option value="cooper">Cooper </option>

..... <option value="leon">Leon </option>

..... <option value="4_reihe">4 Reihe </option>

..... <option value="500">500 </option>

..... <option value="laguna">Laguna </option>

.....<option value="ptcruiser">Ptcruiser </option>

..... <option value="clk">Clk </option>

..... <option value="primera">Primera </option>

..... <option value="exeo">Exeo </option>

..... <option value="159">159 </option>

..... <option value="transit">Transit </option>

.....<option value="juke">Juke </option>

..... <option value="qashqai">Qashqai </option>

..... <option value="carisma">Carisma </option>

..... <option value="accord">Accord </option>

..... <option value="corolla">Corolla </option>

..... <option value="lanos">Lanos </option>

..... <option value="phaeton">Phaeton </option>

.....<option value="boxster">Boxster </option>

.....<option value="verso">Verso </option>

..... <option value="swift">Swift </option>

..... <option value="rav">Rav </option>

..... <option value="kuga">Kuga
</option> <option

value="picanto">Picanto </option>

<option value="kalos">Kalos </option>

..... <option value="superb">Superb

</option> <option

value="stilo">Stilo </option> <option

value="alhambra">Alhambra </option>

..... <option value="911">911

<option> <option value="mx_reihe">Mx

Reihe </option>..... <option

value="m_reihe">M Reihe </option>

<option value="roadster">Roadster </option>

..... <option value="epsilon">Ypsilon

</option>

..... <option value="cayenne">Cayenne </option>

..... <option value="galant">Galant </option>

..... <option value="justy">Justy </option>

..... <option value="90">90 </option>

..... <option value="sirion">Sirion </option>

..... <option value="crossfire">Crossfire </option>

..... <option value="6_reihe">6 Reihe </option>

..... <option value="agila">Agila </option>

..... <option value="duster">Duster </option>

..... <option value="cr_reihe">Cr Reihe </option>

..... <option value="v50">V50 </option>

..... <option value="discovery">Discovery </option>

..... <option value="c_reihe">C Reihe </option>

..... <option value="v_klasse">V Klasse </option>

..... <option value="yaris">Yaris </option>

..... <option value="c5">C5 </option>

..... <option value="aygo">Aygo </option>

..... <option value="cc">Cc </option>

..... <option value="carnival">Carnival </option>

..... <option value="fusion">Fusion </option>

..... <option value="bora">Bora </option>

..... <option value="forfour">Forfour </option>

..... <option value="100">100 </option>

..... <option value="cl">Cl </option>

..... <option value="tigra">Tigra </option>

..... <option value="156">156 </option>

..... <option value="300c">300c </option>

..... <option value="100">100 </option>

..... <option value="147">147 </option>

..... <option value="q3">Q3 </option>

..... <option value="spark">Spark </option>

..... <option value="v70">V70 </option>

..... <option value="x_type">X Type </option>

..... <option value="5_reihe">5 Reihe </option>

.....<option value="ducato">Ducato </option>

..... <option value="s_type">S Type


```

</option> ..... <option value="x_trail">X
Trail          </option> ..... <option
value="toledo">Toledo          </option>
.....<option          value="altea">Altea
</option>
.....          <option value="7er">7er
</option> ..... <option
value="voyager">Voyager          </option> .....
<option          value="calibra">Calibra          </option>
.....          <option value="bravo">Bravo
</option> ..... <option value="range_rover">Range
Rover          </option> ..... <option
value="antara">Antara          </option>
.....<option          value="tucson">Tucson
</option>
..... <option value="q7">Q7 </option>
..... <option value="citigo">Citigo </option>
..... <option value="jimny">Jimny </option>
.....          <option value="cx_reihe">Cx Reihe </option>
.....          <option value="wrangler">Wrangler </option>
.....          <option value="lybra">Lybra </option>
.....          <option value="range_rover_sport">Range Rover Sport </option>
.....          <option value="lancer">Lancer </option>
.....          <option value="159">159 </option>
.....          <option value="freelander">Freelander </option>
.....          <option value="captiva">Captiva </option>
.....          <option value="c2">C2 </option>
.....          <option value="500">500 </option>
.....          <option value="range_rover_evoque">Range Rover Evoque </option>
.....          <option value="sander0">Sander0 </option>
.....          <option value="note">Note </option>
.....          <option value="900">900 </option>

```

```

..... <option value="147">147 </option>
..... <option value="defender">Defender </option>
..... <option value="cherokee">Cherokee </option>
..... <option value="clubman">Clubman </option>
..... <option value="samara">Samara </option>
..... <option value="2_reihe">2 Reihe </option>
..... <option value="1er">1er </option>
..... <option value="3er">3er </option>
..... <option value="601">601 </option>
..... <option value="3_reihe">3 Reihe </option>
..... <option value="4_reihe">4 Reihe </option>
..... <option value="5er">5er </option>
..... <option value="6_reihe">6 Reihe </option>
..... <option value="legacy">Legacy </option>
..... <option value="pajero">Pajero </option>
..... <option value="auris">Auris </option>
..... <option value="niva">Niva </option>
..... <option value="5_reihe">5 Reihe </option>
..... <option value="s60">S60 </option>
..... <option value="nubira">Nubira </option>
..... <option value="vivaro">Vivaro
..... <option value="g_klasse">G
..... </option>..... <option
>Lodgy </option> .....
..... ">850 </option> .....
..... value="serie_2">Serie 2 </option>
..... <option value="6er">6er
..... <option
rade">Charade </option> .....
..... value="croma">Croma </option> .....
lue="outlander">Outlander </option>
..... <option value="gl">Gl </option>
..... <option value="doblo">Doblo </option>

```

```

..... <i class="fas fa-check-circle"></i>
..... <i class="fas fa-exclamation-circle"></i>
..... <span></span>
..... </div>
..... <div class="form-control">
..... <label for="vehicletype">Vehicle type: </label>
..... <select name="vehicletype" id="vehicle" >
.. <option value="" disabled selected hidden>Choose Vehicle Type...</option>
..... <option value="coupe">Coupe </option>
<option value="suv">SUV </option>
<option value="kleinwagen">Kleinwagen </option> <option
value="limousine">Limousine </option>
..... <option value="cabrio">Cabrio </option>
..... <option value="bus">Bus </option>
..... <option value="kombi">Kombi </option>
..... <option value="andere">Andere </option>
..... <option value="volkswagen">Volkswagen </option>
..... </select>
..... <i class="fas fa-check-circle"></i>
..... <i class="fas fa-exclamation-circle"></i>
..... <span></span>
..... </div>
..... <input type="submit" id="submit"></input>
..... </form>

</div>
</body>
</html>

```

2. Value.css

```

*{ padding:0px;
margin:0; box-
sizing:border-box;
font-family:
cursive; font-
weight: bold;

```

```

color: #E74C3C;
}

body{
background-image: linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car2.png);
..... min-
height:100vh;
.....display:f
lex;.....justify-
content:center;
.....align-
items:center;
}
.header{
..... color:Black;
..... text-align:center;
..... padding:10px 0px 10px
100px; }
#model{
..... width:500px;
..... color: black;
}
#brand{
..... width:500px;
..... color: black;
}
#fuel{
..... width:500px;
..... color: black;
}
#vehicle{
..... width:500px;
..... color: black;
}

```

```

}
.form{
..... padding:30px
40px; }
.form-control{
..... margin-bottom:10px;
..... padding-bottom: 20px;
..... position:relative;
..... margin-left:
100px; }
.form-control label{
..... display:block;
..... margin-
bottom:5px; }
.form-control input{
..... border: 2px solid #f0f0f0;
..... width:80%;
..... font-size :.8rem;
..... padding:5px;
.....display:inline-table;
}
.form-control i{
..... position:absolute;
..... right:20px;
..... top:35px;
..... visibility:hidden;
}
.form-control span{
..... position:absolute;
..... left:0;
..... bottom:0;
..... visibility:hidden;
..... font-weight:bolder;
..... font-style:italic;

```

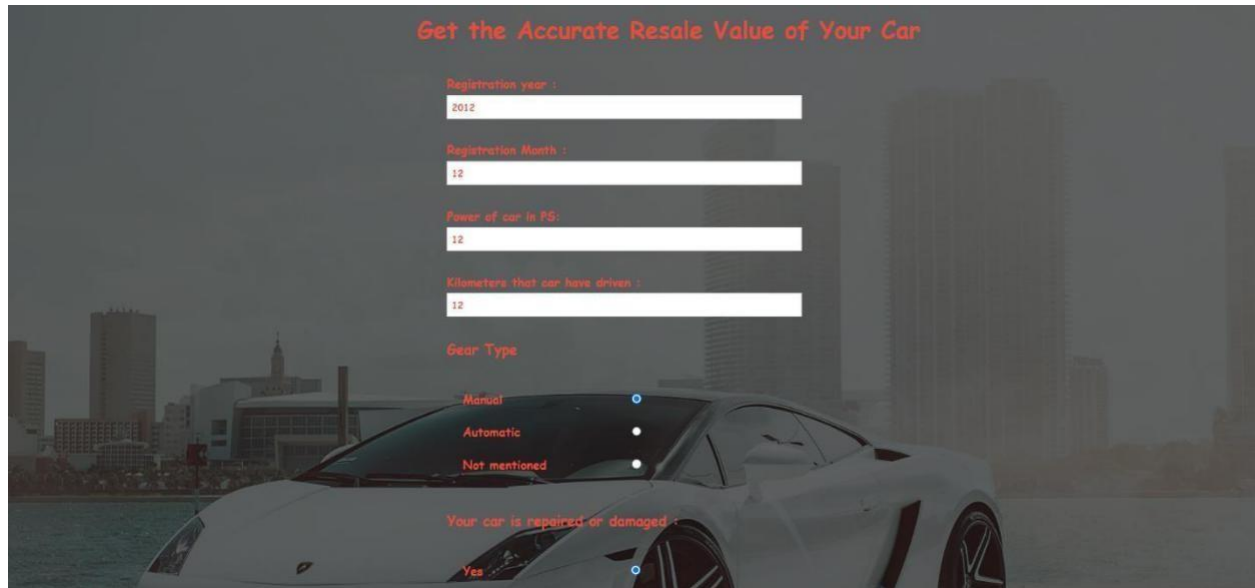
```

..... font-size:1rem;
}
.form-control.success input{
..... border-
color:#2ecc71; }
.form-control.error input{
..... border-
color:#e743c3; }
.form-control.error span{
..... color:red;
.....
visibility:visible; }
.form-control.success i.fa-check-circle {
..... border-color:#2ecc71;
..... visibility:visible;
}
.form-control.error i.fa-exclamation-circle {
..... border-color:#e73c3c;
..... visibility:visible;
}
.form #submit{
..... background-color:#E74C3C;
..... border:none;
..... outline:none;
..... color:white;
..... width:500px;
..... border-radius:4px;
..... padding:10px;
..... cursor:pointer;
..... transition:all .5s;
..... font-size:1rem;
..... margin-left: 100px;
}
.form #submit:hover{

```

```
..... background-color:#6441a5; }  
.form-control #manual{  
..... padding-bottom:  
20%; }
```

Output:



Get the Accurate Resale Value of Your Car

Registration year :
2012

Registration Month :
12

Power of car in PS:
12

Kilometers that car have driven :
12

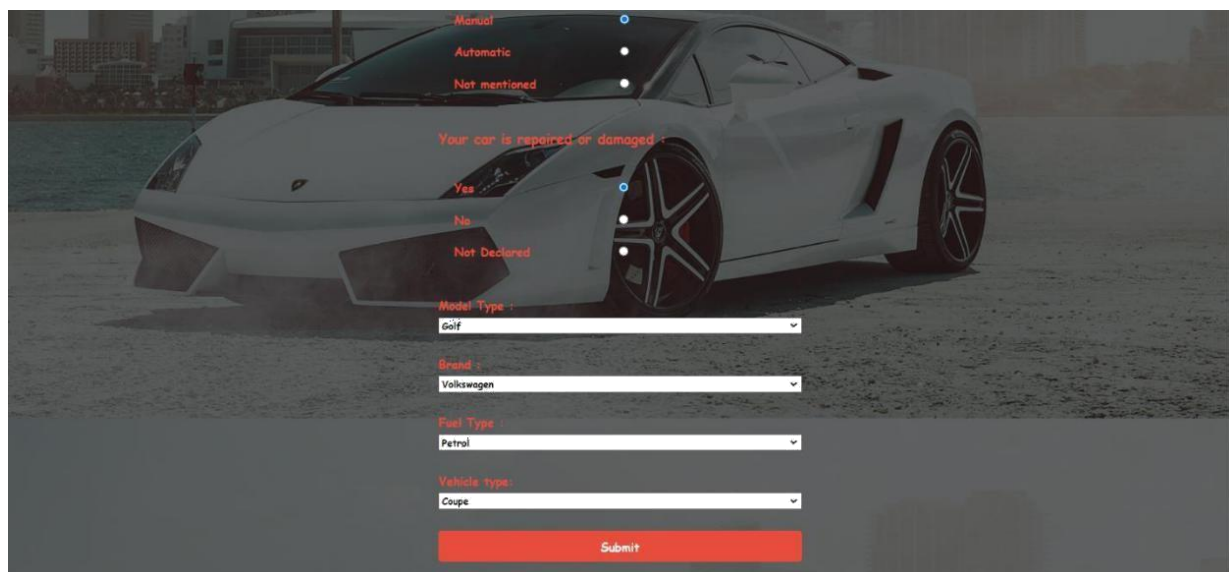
Gear Type

Manual ☒

Automatic ☐

Not mentioned ☐

Your car is repaired or damaged :
Yes ☒



Manual ☒

Automatic ☐

Not mentioned ☐

Your car is repaired or damaged :
Yes ☒

No ☐

Not Declared ☐

Model Type :
Golf

Brand :
Volkswagen

Fuel Type :
Petrol

Vehicle type:
Coupe

Submit

Output Display Page:

The predicted resale car value is displayed in this page.

Code:

1) predict.html

```
<!DOCTYPE html> <html
lang="en"> <head>

<meta charset="UTF-8">

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<meta name="viewport" content="width=device-width, initial-scale=1.0"> <link rel="stylesheet"
href="../static/css/predict.css">

<title>Car Resale Value Predicting Application</title>

<link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> </head>

<body>

..... <section class="header">

<nav>

<a href="/"></a>

</nav>

<div class="text-box">

<h1>The Predicted Car Resale Value is </h1>

.....

<h1>{{ predict }}</h1>

</div>

</section>

.....

.....

</body>
```

2) predict.css

```
.header{ min-height: 100vh; width:
100%;

background-image: linear-gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(..Images/car3.j
pg); background-position: center; background-size: cover;

position: relative;

}

.text-box{

text-align:
```



```
center;

position:
relative; color:
#FFE4C4;
top:50%;
}

.text-box h1{
margin-top: 50px;
font-size: 55px;
}

.text-box p{
margin: 10px 0
40px; font-size:
15px;
}

body{
..... margin: 0;
}

nav{
display:flex;
padding: 2%
6%;
justify-content: space-between; align-
items: center;
}
```

Output:



8. TESTING

Test cases:

Screenshots:

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q			
1					Date	15-Nov-22														
2					Team ID	PNT2022TMD47297														
3					Project Name	Project - Car Resale Value Prediction														
4					Maximum Marks	4 marks														
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requirement	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By						
6	HomePage_TC_001	UI	Home Page	Verify all the UI elements in Home page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not	-	All the UI elements rendered properly	Working as expected	Pass		N		Nalan S						
7	HomePage_TC_002	Functional	Home Page	Verify the Data Entry page can be reachable.		1.Enter URL and click go 2.Verify all the UI elements displayed or not 3.Press the Check Price button.	-	User should navigate to Data Entry Page	Working as expected	Pass		N		Anandhakrishnan A						
8	DataEntryPage_TC_001	UI	Data Entry Page	Verify all the UI elements in Data Entry page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not	-	All the UI elements rendered properly	Working as expected	Pass		N		Jayaram M						
9	DataEntryPage_TC_002	Functional	Data Entry Page	Verify user is able to enter all values		1.Enter URL and click go 2.Verify all the UI elements displayed or not 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered	2012 12 12 Manual Yes Golf Volkswagen Petrol Coupe	User should be able to enter all values in data entry page	Working as expected	Pass		N		Nalan S						
10	DataEntryPage_TC_003	Functional	Data Entry Page	Verify the Output Display page can be reachable.		1.Enter URL and click go 2.Verify all the UI elements displayed or not 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button	-	User should navigate to Output Display Page	Working as expected	Pass		N		Ragul N						

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q			
1						Date	15-Nov-22													
2						Team ID	PNT2022TMD47297													
3						Project Name	Project - Car Resale Value Prediction													
4						Maximum Marks	4 marks													
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requirement	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By						
10	DataEntryPage_TC_003	Functional	Data Entry Page	Verify the Output Display page can be reachable.		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6.Press the submit Button	-	User should navigate to Output Display Page	Working as expected	Pass		N		Ragul N						
11	OutputDisplayPage_TC_001	UI	Output Display Page	Verify all the UI elements in Output Display page rendered properly		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not	-	All the UI elements rendered properly	Working as expected	Pass		N		Jayaram M						
12	OutputDisplayPage_TC_002	Functional	Output Display Page	Verify user is able to get predicted result		1.Enter URL and click go 2.Verify all the UI elements displayed or not. 3.Press the Check Price button in the home page 4. Verify all the UI elements displayed or not 5. Verify if all values can be entered 6. Press the submit Button 7. Verify all the UI elements displayed or not 8. Verify if the predicted value is displayed or not	-	Predicted Car Resale Value is displayed on the page	Working as expected	Pass		N		Anandhakrishnan A						
13																				

User Acceptance Testing:

Defect Analysis:

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	2	3	1	1	7
Duplicate	1	0	3	0	4
External	2	0	0	1	3
Fixed	2	2	1	2	7
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	2	2	1	5
Totals	7	7	9	6	29

Test Case Analysis:

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Home Page	5	0	0	5
Data Entry Page	15	0	0	15
Output Page	4	0	0	4

Hyper Parameter Tuning	3	0	0	3
Final Model Building	2	0	0	2
Flask Application	10	0	0	10
Train Model on IBM	3	0	0	3
Final Report Output	4	0	0	4

9. RESULTS

Performance Metrics

1. Metrics:

Regression Model: LGBM Regressor

MAE: 1327.55

MSE: 9492244.28

RMSE: 3080.95

RMSLE: 8.03

R2 Score: 0.8668

Adjusted R2 Score: 0.8668

Screenshot:

```
model = LGBMRegressor(boosting_type="gbdt",learning_rate=0.07,metric="rmse",n_estimators=300,objective="root_mean_squared_error",random_state=42,reg_sqrt=True)
model.fit(X_train, Y_train)

Y_pred = model.predict(X_test)

find_scores(Y_test, Y_pred, X_train)

/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/sklearn/utils/validation.py:993: DataConversionWarning: A column-vector y was passed when a 1d array was expected
the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)

{'mae': 1327.549477341283,
'mse': 9492244.283543464,
'rmse': 3080.948601249859,
'rmsle': 8.032992815968017,
'r2': 0.8668348937732229,
'adj_r2_score': 0.8668269262555739}
```

2. Tune the Model:

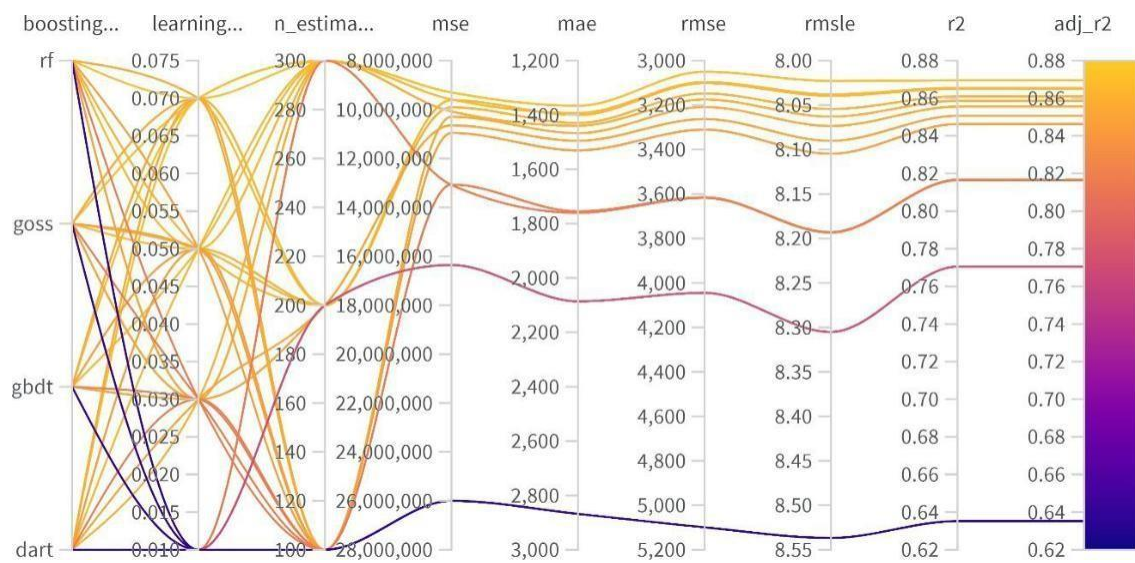
Hyper parameter Tuning:

1. Learning Rate: [0.01, 0.03, 0.05, 0.07]
2. Boosting Type: ['gbdt', 'dart', 'goss', 'rf']
3. Number of Estimators: [100, 200, 300]
4. Validation Method: Grid Search Cross Validation
5. Best Parameters:
Learning Rate – 0.07
Boosting Type – 'gbdt'
Number of Estimators – 300

Screenshot:

```
lgbm_configs = {  
    "name": 'LGBMRegressor',  
    "method": "grid",  
    "metric": {  
        "name": "adj_r2",  
        "goal": "maximize"  
    },  
    "parameters": {  
        "learning_rate": {  
            "values": [0.01, 0.03, 0.05, 0.07]  
        },  
        "objective": [  
            "values": ['root_mean_squared_error']  
        ],  
        "boosting_type": {  
            "values": ['gbdt', 'dart', 'goss', 'rf']  
        },  
        "reg_sqrt": {  
            "values": [True]  
        },  
        "metric": {  
            "values": ['rmse']  
        },  
        "n_estimators": {  
            "values": [100, 200, 300]  
        },  
        "random_state": {  
            "values": [42]  
        }  
    }  
}
```

3. Wandb sweep:



10. ADVANTAGES & DISADVANTAGES

Advantages:

- Application is easy to use
- User Friendly
- No Cost
- No need to commission any agent to get car resale value estimate

Disadvantages:

- User needs to fill every asked detail of the car
- Doesn't work for cars from different distributions
- Not always accurate

11. CONCLUSION

The increased prices of new cars and the financial incapability of the customers to buy them, used Car sales are on a global increase. Therefore, there is an urgent need for a Car Resale Value Prediction system which effectively determines the worthiness of the car in terms of cost. The proposed system is a web application that will help users to determine the accurate price of used cars.

12. FUTURE SCOPE

In future, large historical data of car price can be used to train the model, and which can help improve the estimation of the machine learning model. Moreover, we can build an application for mobile phone platforms like android, iOS for interacting with users. For better performance, we plan to judiciously design deep learning neural networks.

13. APPENDIX

Source Code:

User Interface

car.html

```
<!DOCTYPE html>
<html lang="en" dir="ltr">
  <head>
    <meta charset="utf-8">
    <title>Car Resale Value Predicting Application</title>
    <link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> <link
      rel="stylesheet" href="../static/css/style.css"> <link rel="stylesheet"
      href="https://cdnjs.cloudflare.com/ajax/libs/fontawesome/4.7.0/css/font-awesome.min.css">
    </head>
    <body>
      <section class="header">
        <nav>
          <a href="/"></a>

          </nav>
          <div class="text-box">
            <h1>Car resale value Predictor</h1>
            <p>Best system to predict the amount of resale value based on the parameters provided by the user
            .</p>
            <a href="/predict_page" class="visit-btn ">Check price</a> </div>
          </section>

        </body>
      </html>
```

style.css

```
*{
margin:
0;
padding:
0;
}

.header{ min-height:
100vh; width: 100%;
background-image:
linear-
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car1.png); background-position: center;

background-size:
cover; position:
relative; } nav{
```

```

display:flex; padding: 2%
6%; justify-content: space-
between; align-items:
center; } .nav-links{ flex: 1;
text-align: right; } .nav-links
ul li{ list-style: none;
display: inline-block;
padding: 8px 12px;
position: relative; } .nav-
links ul li a{ color:white;
text-decoration: none; font-
size: 13px; } .text-box{ text-
align: center; position:
relative; color: #FFE4C4;
top:50%; } .text-box h1{
margin-top: 50px; font-size:
55px; } .text-box p{ margin:
10px 0 40px; font-size:
15px; } .visit-btn{ display:
inline; border: 3px solid
#fff; padding:10px 14px;
font-size: 15px;
background: transparent;
color: white; text-
decoration:none;
}

```

value.html

```

<!DOCTYPE html>
<html lang="en" dir="ltr">
<head>
<link rel="stylesheet" href="../static/css/value.css"> <title>Car
Resale Value Predicting Application</title>
<link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> <script
src="https://kit.fontawesome.com/b9b6bac803.js" crossorigin="anonymous"></script> <link
rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/fontawesome.min.css"> <style>

```

table, th, td

```

{
padding: 10px;
}
</style>
</head>
<body>
<div class="container">
    <div class="header">
        <h1>Get the Accurate Resale Value of Your Car</h1> </div>
        <form action="http://localhost:5000/predict" class="form"> <div
class="form-control">

```

```

<label for="year" padding:10px>Registration year : </label>
<input id="year" maxlength="50" name="regyear" type="text" autocomplete="off"/> <i
class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="month">Registration Month : </label>
<input id="month" maxlength="50" name="regmonth" type="text" autocomplete="off"/> <i
class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="power">Power of car in PS: </label>
<input id="power" maxlength="50" name="powerps" type="text" autocomplete="off"/> <i
class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="kilometer">Kilometers that car have driven : </label> <input
id="kilometer"      maxlength="50"      name="kms"      type="text"
autocomplete="off"/>
<i class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
    <h3>Gear Type</h3>
    <table style="width:50%">
        <tr>
            <th></th>
            <th></th>
        </tr>
        <tr>
            <td>Manual</td>
            <td><input type="radio" name="geartype" value="manual" id="manual"
/></td>
        </tr>
        <tr>
            <td>Automatic</td>
            <td><input type="radio" name="geartype" value="automatic" id="automatic" /></td>
        </tr>
        <tr>
            <td>Not mentioned</td>
            <td><input type="radio" name="geartype" value="not-declared" id="not"
/></td>

```

```

        </tr>
    </table>
    <i class="fas fa-check-circle"></i>
    <i class="fas fa-exclamation-circle"></i>
    <span></span>
</div>
<div class="form-control">
    <h3>Your car is repaired or damaged :</h3>
    <table style="width:50%">
        <tr>
            <th></th>
            <th></th>
        </tr>
        <tr>
            <td><input type="radio" name="damage" value="yes" id="yes"/></td> </tr>
            <td>No</td>
            <td><input type="radio" name="damage" value="no"
id="no"/></td>
        </tr>
        <tr>
            <td>Not Declared</td>
            <td><input type="radio" name="damage" value="not-declared"
id="notdec"/></td>
        </tr>
    </table>
    <i class="fas fa-check-circle"></i>
    <i class="fas fa-exclamation-circle"></i>
    <span></span>
</div>
<div class="form-control">
    <label for="model">Model Type : </label>
    <select name="model" id="model">
        <option value="" disabled selected hidden>Choose Model Name...</option>
        <option value="golf">Golf </option>
        <option value="grand">Grand </option>
        <option value="fabia">Fabia </option>
        <option value="3er">3er </option>
        <option value="2_reihe">2 Reihe </option>
        <option value="andere">Andere </option>
        <option value="c_max">C Max </option>
        <option value="3_reihe">3 Reihe </option>
        <option value="passat">Passat </option>
        <option value="navara">Navara </option>
        <option value="ka">Ka </option>
        <option value="polo">Polo </option>
    </select>

```

<option value="twingo">Twingo </option>
<option value="a_klasse">A klasse </option>
<option value="scirocco">Scirocco </option>
<option value="5er">5er </option>
<option value="meriva">Meriva </option>
<option value="arosa">Arosa </option>
<option value="c4">C4 </option>
<option value="civic">Civic </option>
<option value="transporter">Transporter </option> <option
value="punto">Punto </option> <option value="e_klasse">E
Klasse </option> <option value="clio">Clio </option> <option
value="kadett">Kadett </option>
<option value="kangoo">Kangoo </option>
<option value="corsa">Corsa </option>
<option value="one">One </option>
<option value="fortwo">Fortwo </option>
<option value="1er">1er </option>
<option value="b_klasse">B Klasse </option>
<option value="signum">Signum </option>
<option value="astra">Astra </option>
<option value="a8">A8 </option> <option value="jetta">Jetta </option> <option value="fiesta">Fiesta
</option> <option value="c_klasse">C Klasse </option> <option value="micra">Micra </option> <option
value="vito">Vito </option> <option value="sprinter">Sprinter </option> <option value="156">156
</option> <option value="escort">Escort </option> <option value="forester">Forester </option> <option
value="xc_reihe">Xc Reihe </option>
<option value="scenic">Scenic </option>
<option value="a4">A4 </option>
<option value="a1">A1 </option>
<option value="insignia">Insignia </option>
<option value="combo">Combo </option>
<option value="focus">Focus </option>
<option value="tt">Tt </option>
<option value="a6">A6 </option>
<option value="jazz">Jazz </option>
<option value="omega">Omega </option>
<option value="slk">Slk </option>
<option value="7er">7er </option>
<option value="80">80 </option>
<option value="147">147 </option>
<option value="glk">Glk </option>
<option value="100">100 </option>
<option value="z_reihe">Z Reihe </option>
<option value="sportage">Sportage </option>
<option value="sorento">Sorento </option>
<option value="v40">V40 </option>
<option value="5er">5er </option>
<option value="ibiza">Ibiza </option>
<option value="3er">3er </option>

<option value="mustang">Mustang </option>
<option value="eos">Eos </option>
<option value="touran">Touran </option>
<option value="getz">Getz </option>
<option value="a3">A3 </option>
<option value="almera">Almera </option>
<option value="megane">Megane </option>
<option value="7er">7er </option>
<option value="1er">1er </option>
<option value="lupo">Lupo </option>
<option value="r19">R19 </option>
<option value="zafira">Zafira </option>
<option value="caddy">Caddy </option>
<option value="2_reihe">2 Reihe </option>
<option value="mondeo">Mondeo </option>
<option value="cordoba">Cordoba </option>
<option value="colt">Colt </option>
<option value="impreza">Impreza </option>
<option value="vectra">Vectra </option>
<option value="berlingo">Berlingo </option>
<option value="80">80 </option>
<option value="m_klasse">M Klasse </option> <option
value="tiguan">Tiguan </option>
<option value="i_reihe">I Reihe </option>
<option value="espace">Espace </option>
<option value="sharan">Sharan </option>
<option value="6_reihe">6 Reihe </option>
<option value="panda">Panda </option>
<option value="up">Up </option>
<option value="seicento">Seicento </option>
<option value="ceed">Ceed </option>
<option value="5_reihe">5 Reihe </option>
<option value="yeti">Yeti </option>
<option value="octavia">Octavia </option>
<option value="mii">Mii </option>
<option value="rx_reihe">Rx Reihe </option>
<option value="6er">6er </option>
<option value="modus">Modus </option>
<option value="fox">Fox </option>
<option value="matiz">Matiz </option>
<option value="beetle">Beetle </option>
<option value="c1">C1 </option>
<option value="rio">Rio </option>
<option value="touareg">Touareg </option>
<option value="logan">Logan </option>
<option value="spider">Spider </option>
<option value="cuore">Cuore </option>
<option value="s_max">S Max </option>

<option value="a2">A2 </option>
<option value="x_reihe">X Reihe </option>
<option value="a5">A5 </option>
<option value="galaxy">Galaxy </option>
<option value="c3">C3 </option>
<option value="viano">Viano </option>
<option value="s_klasse">S Klasse </option>
<option value="1_reihe">1 Reihe </option>
<option value="avensis">Avensis </option>
<option value="sl">Sl </option>
<option value="roomster">Roomster </option> <option
value="q5">Q5 </option> <option value="kaefer">Kaefer
</option>
<option value="santa">Santa </option>
<option value="cooper">Cooper </option>
<option value="leon">Leon </option>
<option value="4_reihe">4 Reihe </option>
<option value="500">500 </option>
<option value="laguna">Laguna </option>
<option value="ptcruiser">Ptcruiser </option>
<option value="clk">Clk </option>

<option value="primera">Primera </option>
<option value="exeo">Exeo </option>
<option value="159">159 </option>
<option value="transit">Transit </option>
<option value="juke">Juke </option>
<option value="qashqai">Qashqai </option>
<option value="carisma">Carisma </option>
<option value="accord">Accord </option>
<option value="corolla">Corolla </option>
<option value="lanos">Lanos </option>
<option value="phaeton">Phaeton </option>
<option value="boxster">Boxster </option>
<option value="verso">Verso </option>
<option value="swift">Swift </option>
<option value="rav">Rav </option>
<option value="kuga">Kuga </option>
<option value="picanto">Picanto </option>
<option value="kalos">Kalos </option>
<option value="superb">Superb </option>
<option value="stilo">Stilo </option>
<option value="alhambra">Alhambra </option>
<option value="911">911 </option>
<option value="mx_reihe">Mx Reihe </option> <option
value="m_reihe">M Reihe </option> <option
value="roadster">Roadster </option> <option
value="epsilon">Epsilon </option> <option

value="cayenne">Cayenne </option> <option
value="galant">Galant </option> <option value="justy">Justy
</option> <option value="90">90 </option> <option
value="sirion">Sirion </option>
<option value="crossfire">Crossfire </option>
<option value="6_reihe">6 Reihe </option>
<option value="agila">Agila </option>
<option value="duster">Duster </option>
<option value="cr_reihe">Cr Reihe </option>
<option value="v50">V50 </option>
<option value="discovery">Discovery </option> <option
value="c_reihe">C Reihe </option> <option
value="v_klasse">V Klasse </option> <option
value="yaris">Yaris </option> <option <option
value="aygo">Aygo </option> <option value="cc">Cc
</option>
<option value="carnival">Carnival </option>
<option value="fusion">Fusion </option>
<option value="bora">Bora </option>
<option value="forfour">Forfour </option>
<option value="100">100 </option>
<option value="cl">Cl </option>
<option value="tigra">Tigra </option>
<option value="156">156 </option>
<option value="300c">300c </option>
<option value="100">100 </option>
<option value="147">147 </option>
<option value="q3">Q3 </option>
<option value="spark">Spark </option>
<option value="v70">V70 </option>
<option value="x_type">X Type </option>
<option value="5_reihe">5 Reihe </option>
<option value="ducato">Ducato </option>
<option value="s_type">S Type </option>
<option value="x_trail">X Trail </option>
<option value="toledo">Toledo </option>
<option value="altea">Altea </option>
<option value="7er">7er </option>
<option value="voyager">Voyager </option>
<option value="calibra">Calibra </option>
<option value="bravo">Bravo </option>
<option value="range_rover">Range Rover </option> <option
value="antara">Antara </option>
<option value="tucson">Tucson </option> <option
value="q7">Q7 </option> <option value="citigo">Citigo
</option> <option value="jimny">Jimny </option> <option
value="cx_reihe">Cx Reihe </option> <option
value="wrangler">Wrangler </option> <option
value="lybra">Lybra </option>

<option value="range_rover_sport">Range Rover Sport </option> <option value="lancer">Lancer </option> <option value="159">159 </option>
<option value="freelander">Freelander </option> <option value="captiva">Captiva </option> <option value="c2">C2
</option> <option value="500">500 </option>
<option value="range_rover_evoque">Range Rover Evoque </option> <option value="sander" >Sander </option> <option value="note">Note </option>
<option value="900">900 </option>
<option value="147">147 </option>
<option value="defender">Defender </option>
<option value="cherokee">Cherokee </option>
<option value="clubman">Clubman </option>
<option value="samara">Samara </option>
<option value="2_reihe">2 Reihe </option>
<option value="1er">1er </option>
<option value="3er">3er </option>
<option value="601">601 </option>
<option value="3_reihe">3 Reihe </option>
<option value="4_reihe">4 Reihe </option>
<option value="5er">5er </option>
<option value="6_reihe">6 Reihe </option>
<option value="legacy">Legacy </option>
<option value="pajero">Pajero </option>
<option value="auris">Auris </option>
<option value="niva">Niva </option>
<option value="5_reihe">5 Reihe </option>
<option value="s60">S60 </option>
<option value="nubira">Nubira </option>
<option value="vivaro">Vivaro </option>
<option value="g_klasse">G Klasse </option>
<option value="lodgy">Lodgy </option>
<option value="850">850 </option>
<option value="serie_2">Serie 2 </option>
<option value="6er">6er </option>
<option value="charade">Charade </option> <option value="croma">Croma </option> <option value="outlander">Outlander </option> <option value="gl">Gl </option> <option value="doblo">Doblo
</option>
<option value="musa">Musa </option>
<option value="amarok">Amarok </option>
<option value="156">156 </option>
<option value="move">Move </option>
<option value="9000">9000 </option>
<option value="v60">V60 </option>
<option value="145">145 </option>
<option value="aveo">Aveo </option>
<option value="200">200 </option>
<option value="300c">300c </option>

```
<option value="b_max">B Max </option>
<option value="delta">Delta </option>
<option value="terios">Terios </option>
<option value="rangerover">RangeRover </option> <option
value="90">90 </option>
<option value="materia">Materia </option> <option
value="kalina">Kalina </option> <option
value="elefantino">Elefantino </option> <option value="i3">I3
</option>
<option value="kappa">Kappa </option>
<option value="serie_3">Serie 3 </option>
<option value="48429">48429 </option>
<option value="serie_1">Serie 1 </option>
<option value="discovery_sport">Discovery Sport </option> </select>
<i class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="brand">Brand :</label>
<select name="brand" id="brand">
<option value="" disabled selected hidden>Choose Brand Name...</option> <option
value="volkswagen">Volkswagen </option> <option value="audi">Audi </option>
<option value="jeep">Jeep </option>
<option value="skoda">Skoda </option>
<option value="bmw">Bmw </option>
<option value="peugeot">Peugeot </option>
<option value="ford">Ford </option>
<option value="mazda">Mazda </option>
<option value="nissan">Nissan </option>
<option value="renault">Renault </option>
<option value="mercedes_benz">Mercedes Benz </option> <option
value="opel">Opel </option> <option value="seat">Seat </option>
<option value="citroen">Citroen </option>
<option value="honda">Honda </option>
<option value="fiat">Fiat </option>
<option value="mini">Mini </option>
<option value="smart">Smart </option>
<option value="hyundai">Hyundai </option>
<option value="sonstige_autos">Sonstige Autos </option> <option
value="alfa_romeo">Alfa Romeo </option> <option
value="subaru">Subaru </option> <option value="volvo">Volvo
</option>
<option value="mitsubishi">Mitsubishi </option> <option
value="kia">Kia </option>
<option value="suzuki">Suzuki </option> <option
value="lancia">Lancia </option> <option
value="porsche">Porsche </option> <option
value="toyota">Toyota </option> <option
```

```

value="chevrolet">Chevrolet </option> <option
value="dacia">Dacia </option> <option
value="daihatsu">Daihatsu </option>
<option value="trabant">Trabant </option>
<option value="saab">Saab </option>
<option value="chrysler">Chrysler </option>
<option value="jaguar">Jaguar </option>
<option value="daewoo">Daewoo </option>
<option value="rover">Rover </option>
<option value="land_rover">Land Rover </option> <option
value="lada">Lada </option> </select>
<i class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="fuelType">Fuel Type :</label>
<select name="fuelType" id="fuel">
<option value="" disabled selected hidden>Choose Fuel Type...</option> <option
value="petrol"> Petrol </option> <option value="diesel"> Diesel </option>
<option value="not-declared"> Not Declared </option> <option
value="lpg">LPG </option> <option value="cng">CNG </option>
<option value="hybrid">Hybrid </option>
<option value="others">Others </option>
<option value="electric">Electric </option>
</select>
<i class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<div class="form-control">
<label for="vehicletype">Vehicle type: </label> <select
name="vehicletype" id="vehicle" >
<option value="" disabled selected hidden>Choose Vehicle Type...</option> <option
value="coupe">Coupe </option> <option value="suv">SUV </option>
<option value="kleinwagen">Kleinwagen </option> <option
value="limousine">Limousine </option> <option
value="cabrio">Cabrio </option> <option value="bus">Bus
</option> <option value="kombi">Kombi </option>
<option value="andere">Andere </option>
<option value="volkswagen">Volkswagen </option>
</select>
<i class="fas fa-check-circle"></i>
<i class="fas fa-exclamation-circle"></i>
<span></span>
</div>
<input type="submit" id="submit"></input>
</form>

```

```

</div>

```

```
</body>
```

```
</html>
```

```
value.css *{  
padding:0px;  
margin:0; box-  
sizing:border-box;  
font-family:  
cursive; font-  
weight: bold;  
color: #E74C3C;  
}
```

```
body{  
    background-image: linear-  
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(..Images/car2.png);  
    min-height:100vh;  
    display:flex; justify-  
content:center;  
    align-items:center;  
}
```

```
.header{  
    color:Black; text-  
align:center;  
    padding:10px 0px 10px 100px;  
}
```

```
#model{  
    width:500px;  
    color: black;  
}
```

```
#brand{  
    width:500px;  
    color: black;  
}
```

```
#fuel{  
    width:500px;  
    color: black;  
}
```

```
#vehicle{  
    width:500px;  
    color: black;  
}
```

```
.form{  
    padding:30px 40px;  
}
```

```
.form-control{
    margin-bottom:10px;
    padding-bottom: 20px;
    position:relative;
    margin-left: 100px;
}

.form-control label{
    display:block;        margin-
bottom:5px;
}

.form-control input{
    border: 2px solid
#f0f0f0;    width:80%;
    font-size :.8rem;
    padding:5px;
    display:inline-table;
}

.form-control i{
    position:absolute;
    right:20px;
    top:35px;
    visibility:hidden;
}

.form-control span{

    position:absolute
;    left:0;
    bottom:0;
    visibility:hidden;    font-
weight:bolder;    font-style:italic;
    font-size:1rem;
}
.form-control.success input{
    border-color:#2ecc71;
}

.form-control.error input{
    border-color:#e743c3;
}

.form-control.error span{
    color:red;
    visibility:visible;
```

```
}
```

```
.form-control.success i.fa-check-circle { border-color:#2ecc71;
```

```
visibility:visible;
```

```
}
```

```
predict.html
```

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
<meta charset="UTF-8">
```

```
<meta http-equiv="X-UA-Compatible" content="IE=edge">
```

```
<meta name="viewport" content="width=device-width, initial-scale=1.0"> <link  
rel="stylesheet" href="../static/css/predict.css"> <title>Car Resale Value Predicting  
Application</title>
```

```
<link rel="icon" type="image/x-icon" href="../static/Images/favicon.ico"> </head>
```

```
<body>
```

```
<section class="header">
```

```
<nav>
```

```
<a href="/"></a> </nav>
```

```
<div class="text-box">
```

```
<h1>The Predicted Car Resale Value is </h1>
```

```
<h1>{{predict}}</h1>
```

```
</div>
```

```
</section>
```

```
</body>
```

```
</html>
```

```
predict.css .header{
```

```
min-height: 100vh;
```

```
width: 100%;
```

```
background-image:
```

```
linear-
```

```
gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(..Images/car3.j  
pg); background-position: center; background-size: cover;
```

```
position: relative;
```

```
}
```

```
.text-box{
```

```
text-align:
```

```
center;
```

```
position:
```

```
relative; color:
```

```
#FFE4C4;
```

```
top:50%; }
```

```
.text-box h1{
margin-top:
50px; font-
size: 55px;
}
.text-box p{
margin: 10px 0
40px; font-size:
15px;
}
```

```
body{
margin: 0;
}
```

```
nav{
display: flex; padding: 2%
6%; justify-content: space-
between; align-items:
center;
}
```

```
app.py # Import
Libraries import
pandas as pd
import numpy
as np
from flask import Flask, render_template, Response, request import pickle
from sklearn.preprocessing import LabelEncoder import
requests
```

NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.

```
API_KEY = "04ZW6LlrLwAfofEU2VHPt69RKCWVc9U1o5LXkAU_66qA" token_response =
requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":API_KEY, "grant_type":
'urn:ibm:params:oauth:grant-type:apikey'}) mltoken = token_response.json()["access_token"]
header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}
```

```
app = Flask(__name__)#initiate flask app
```

```
def load_model(file='../Result/resale_model.sav'):#load the saved model return
pickle.load(open(file, 'rb'))
```

```
@app.route('/') def
index():#main page
return render_template('car.html')
```

```
@app.route('/predict_page') def
predict_page():#predicting page
```

```

    return render_template('value.html')

@app.route('/predict', methods=['GET','POST'])
def predict():
    reg_year = int(request.args.get('regyear'))
    powerps = float(request.args.get('powerps'))
    kms= float(request.args.get('kms'))
    reg_month = int(request.args.get('regmonth'))

    gearbox = request.args.get('geartype')
    damage = request.args.get('damage')
    model = request.args.get('model')
    brand = request.args.get('brand')
    fuel_type =
request.args.get('fuelType')
    veh_type = request.args.get('vehicletype')

    new_row = {'yearOfReg':reg_year, 'powerPS':powerps, 'kilometer':kms,
               'monthOfRegistration':reg_month, 'gearbox':gearbox,
               'notRepairedDamage':damage,
               'model':model, 'brand':brand, 'fuelType':fuel_type,
               'vehicletype':veh_type}

    print(new_row)

    new_df      =      pd.DataFrame(columns=['vehicletype','yearOfReg','gearbox',
        'powerPS','model','kilometer','monthOfRegistration','fuelType',
        'brand','notRepairedDamage'])
    new_df = new_df.append(new_row, ignore_index=True)
labels = ['gearbox','notRepairedDamage','model','brand','fuelType','vehicletype'] mapper =
{}

    for i in labels:
        mapper[i] = LabelEncoder()
        mapper[i].classes = np.load('../Result/'+str('classes'+i+'.npy'), allow_pickle=True)
        transform = mapper[i].fit_transform(new_df[i])
        new_df.loc[:,i+'_labels'] = pd.Series(transform, index=new_df.index)

    labeled = new_df[['yearOfReg','powerPS','kilometer','monthOfRegistration'] + [x+'_labels'
for x in labels]]

    X = labeled.values.tolist()
    print('\n\n', X)
    #predict = reg_model.predict(X)

    # NOTE: manually define and pass the array(s) of values to be scored in the next line
    payload_scoring = {"input_data": [{"fields": [['yearOfReg', 'powerPS', 'kilometer',
#           'monthOfRegistration','gearbox_labels', 'notRepairedDamage_labels',
#           'model_labels','brand_labels', 'fuelType_labels', 'vehicletype_labels']], "values": X}]}
    #

```



```

# response_scoring =
# requests.post('https://ussouth.ml.cloud.ibm.com/ml/v4/deployments/c0f74260-1f5f-43ad-
# 8d71eb12ef099507/predictions?version=2022-11-13', json=payload_scoring,
# headers={'Authorization': 'Bearer ' + mltoken})
# predictions = response_scoring.json()
# print(response_scoring.json())
#
# predict = predictions['predictions'][0]['values'][0][0]
print("Final prediction :",predict)
#
# return render_template('predict.html',predict=predict)
#
# if __name__ == '__main__':
#
#     reg_model = load_model()#load the saved model
app.run(host='localhost', debug=True, threaded=False)
#
# car_resale_value_prediction_modellin
# g.py import pandas as pd import
# numpy as np
# from sklearn.preprocessing import LabelEncoder
# from sklearn.model_selection import train_test_split, GridSearchCV
#
# from sklearn.metrics import mean_absolute_error, mean_squared_error,
r2_score import pickle
# import wandb
#
# #regression models
#
# from sklearn.ensemble import BaggingRegressor,
RandomForestRegressor, HistGradientBoostingRegressor, ExtraTreesRegressor
#
# from xgboost.sklearn import XGBRegressor
# from lightgbm import LGBMRegressor
#
# wandb.login(key='b75e0564aba32dce859c60044418df71ce7389a8')
#
# data = pd.read_csv('../input/naalaiya-thiran/Preprocessed/autos_preprocessed.csv',
header=0, sep=',', encoding='Latin1')
#
# labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']
#
# mapper = {}
# for i in
# labels:
#
#     mapper[i] = LabelEncoder() mapper[i].fit(data[i])
tr = mapper[i].transform(data[i])
np.save(str('classes'+i+'.npy'), mapper[i].classes_)
data.loc[:, i+'_labels'] = pd.Series(tr,
index=data.index)

labeled = data[['price', 'yearOfRegistration','powerPS','kilometer','monthOfRegistration'] +[x+"_labels" for
x in labels]]

print(labeled.columns)

```

```

def find_scores(Y_actual, Y_pred, X_train):
    mae = mean_absolute_error(Y_actual, Y_pred)
    mse = mean_squared_error(Y_actual, Y_pred)
    rmse = np.sqrt(mse)    rmsle
    = np.log(rmse)    r2 =
    r2_score(Y_actual, Y_pred)
    n, k = X_train.shape
    adj_r2_score = 1 - ((1-r2)*(n-1)/(n-k-1))

    wandb.log({"mae": mae, "mse": mse, 'rmse':rmse, 'rmsle':rmsle, 'r2':r2,
'adj_r2':adj_r2_score})

def bagging_regressor():
    config_defaults = {
        'n_estimators':100,
        'max_samples':0.4,
        'bootstrap':True,
        'random_state':42
    }

    wandb.init(config=config_defaults)
    config = wandb.config

X = labeled.iloc[:,1:].values
Y = labeled.iloc[:,0].values.reshape(-1,1)

    X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

    model = BaggingRegressor(
n_estimators=config.n_estimators,
bootstrap=config.bootstrap,
max_samples=config.max_samples,
    random_state = config.random_state)

    model.fit(X_train, Y_train)

    Y_pred = model.predict(X_test)

    find_scores(Y_test, Y_pred, X_train)
bagging_regressor_configs = {
    "name":'BaggingRegressor',
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {
        "n_estimators": {
            "values": [100, 200, 300]

```

```

    },
    "max_samples": {
        "values": [0.4, 0.5, 0.6]
    }
}
}

```

```

sweep_id = wandb.sweep(sweep=bagging_regressor_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=bagging_regressor)

```

```

def random_forest_regressor():

```

```

    config_defaults = {
        'n_estimators': 100,
        'max_samples': 0.4,
        'criterion': 'squared_error',
        'bootstrap': True,
        'random_state': 42
    }

```

```

    wandb.init(config=config_defaults)
    config = wandb.config

```

```

X = labeled.iloc[:, 1:].values
Y = labeled.iloc[:, 0].values.reshape(-1, 1)

```

```

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

```

```

    model = RandomForestRegressor(
        n_estimators=config.n_estimators,
        criterion=config.criterion,
        bootstrap=config.bootstrap,
        max_samples=config.max_samples,
        random_state=config.random_state)

```

```

    model.fit(X_train, Y_train)

```

```

    Y_pred = model.predict(X_test)
    find_scores(Y_test, Y_pred, X_train)

```

```

random_forest_configs = {
    "name": "RandomForestRegressor",
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {
        "n_estimators": {
            "values": [100, 200, 300]
        },

```

```

    "max_samples": {
        "values": [0.4,0.5, 0.6]
    }
}

```

```

sweep_id = wandb.sweep(sweep=random_forest_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=random_forest_regressor)

```

```

def hist_gradient_boost_regressor():

```

```

    config_defaults = {
        'loss':'squared_error',
        'learning_rate': 0.1,
        'max_iter':100,
        'random_state':42
    }

```

```

    wandb.init(config=config_defaults)
    config = wandb.config

```

```

X = labeled.iloc[:,1:].values
Y = labeled.iloc[:,0].values.reshape(-1,1)

```

```

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

```

```

    model = HistGradientBoostingRegressor(
        loss=config.loss,
        learning_rate = config.learning_rate,
        max_iter=config.max_iter,
        random_state = config.random_state)

```

```

    model.fit(X_train, Y_train)
    Y_pred = model.predict(X_test)

```

```

    find_scores(Y_test, Y_pred, X_train)

```

```

hist_gradient_boost_configs = {
    "name": 'HistGradientBoostingRegressor',
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {
        "loss": {
            "values": ['squared_error', 'absolute_error']
        },
        "learning_rate": {
            "values": [0.01, 0.03, 0.05, 0.07]
        }
    }
}

```

```

    },
    "max_iter": {
        "values": [100,200,300]
    },
    "random_state": {
        "values": [42]
    }
}
}

```

```

sweep_id = wandb.sweep(sweep=hist_gradient_boost_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=hist_gradient_boost_regressor)

```

```

def extra_tree_regressor():
    config_defaults = {
        'criterion':'squared_error',
        'max_samples':0.4,
        'bootstrap': True,
        'random_state':42
    }
    wandb.init(config=config_defaults)
    config = wandb.config

```

```

X = labeled.iloc[:,1:].values
Y = labeled.iloc[:,0].values.reshape(-1,1)

```

```

        X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)
        model = ExtraTreesRegressor(
criterion=config.criterion,
bootstrap = config.bootstrap,
max_samples=config.max_samples,
        random_state = config.random_state)

        model.fit(X_train, Y_train)

        Y_pred = model.predict(X_test)

        find_scores(Y_test, Y_pred, X_train)

```

```

extra_tree_configs = {
    "name":'ExtraTreesRegressor',
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {
        "criterion": {

```

```

        "values": ['squared_error', 'absolute_error']
    },
    "max_samples": {
        "values": [0.4, 0.5, 0.6]
    }
}
}

```

```

sweep_id = wandb.sweep(sweep=extra_tree_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=extra_tree_regressor)

```

```

def XGB_regressor():
    config_defaults = {
        'learning_rate': 0.1,
        'n_estimators': 500,
        'booster': 'gbtree',
        'eta': 0.01,
        'random_state': 42
    }
    wandb.init(config=config_defaults)
    config = wandb.config

```

```

X = labeled.iloc[:, 1:].values
Y = labeled.iloc[:, 0].values.reshape(-1, 1)
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

```

```

model = XGBRegressor(
    learning_rate=config.learning_rate,
    n_estimators=config.n_estimators,
    random_state=config.random_state)

```

```

model.fit(X_train, Y_train)

```

```

Y_pred = model.predict(X_test)

```

```

find_scores(Y_test, Y_pred, X_train)

```

```

extra_tree_configs = {
    "name": 'XGBRegressor',
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {
        "learning_rate": {
            "values": [0.01, 0.03, 0.05, 0.07]
        },
    },
}

```

```

    "n_estimators": {
        "values": [100,200,300]
    },
    "booster": {
        "values": ['gbtree','gblinear']
    },
    "eta": {
        "values": [0.01, 0.03, 0.05, 0.07]
    }
}
}

```

```

sweep_id = wandb.sweep(sweep=extra_tree_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=XGB_regressor)

```

```

def LGBM_regressor():
    config_defaults = {
        'objective':'root_mean_squared_error',
        'reg_sqrt': True,
        'metric':'rmse',
        'random_state':42
    }

```

```

    wandb.init(config=config_defaults)
    config = wandb.config

```

```

X = labeled.iloc[:,1:].values
Y = labeled.iloc[:,0].values.reshape(-1,1)

```

```

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

```

```

    model = LGBMRegressor(
        learning_rate=config.learning_rate,
        n_estimators = config.n_estimators,
        random_state = config.random_state)

```

```

    model.fit(X_train, Y_train)

```

```

    Y_pred = model.predict(X_test)

```

```

    find_scores(Y_test, Y_pred, X_train)

```

```

lgbm_configs = {
    "name":'LGBMRegressor',
    "method": "grid",
    "metric": {
        "name": "adj_r2",
        "goal": "maximize"
    },
    "parameters": {

```

```

"learning_rate": {
    "values": [0.01, 0.03, 0.05, 0.07]
},
"objective": {
    "values": ['root_mean_squared_error']
},
"boosting_type": {
    "values": ['gbdt','dart','goss','rf']
},
"reg_sqrt": {
    "values": [True]
},
"metric": {
    "values": ['rmse']
},
"n_estimators": {
    "values": [100,200,300]
},
"random_state": {
    "values": [42]
}
}
}

```

```

sweep_id = wandb.sweep(sweep=lgbm_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=LGBM_regressor)

```

```

car_resale_value_prediction_LGBM.py
import pandas as pd import numpy as np from
sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import
train_test_split
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score import pickle

```

```

#regression model
from lightgbm import LGBMRegressor

```

```

import os, types import pandas
as pd from botocore.client
import Config
import ibm_boto3

```

```

def __iter__(self): return 0

```

```

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',

```



```
ibm_api_key_id='8DIImq73hywb09uzAo_T_TsAZI_ocZgFLuhQdwmfUJZTX',
ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
config=Config(signature_version='oauth'),
endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')
```

```
bucket = 'carresalevalueprediction-donotdelete-pr-whcxr42j79mqcv' object_key =
'autos_preprocessed.csv'
```

```
body =
cos_client.get_object(Bucket=bucket,Key=object_key)['Body'] # add missing __iter__
method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(__iter__, body )
```

```
data = pd.read_csv(body)
data.head()
labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']
```

```
mapper = {}
for i in
labels:
    mapper[i] = LabelEncoder() mapper[i].fit(data[i]) tr =
mapper[i].transform(data[i]) np.save(str('classes'+i+'.npy'),
mapper[i].classes_) data.loc[:, i+'_'+labels] = pd.Series(tr,
index=data.index)
```

```
labeled = data[['price', 'yearOfRegistration','powerPS','kilometer','monthOfRegistration'] +[x+"_"+labels" for
x in labels]]
```

```
print(labeled.columns)
```

```
def find_scores(Y_actual, Y_pred, X_train):
    scores = dict()
    mae = mean_absolute_error(Y_actual, Y_pred)
    mse = mean_squared_error(Y_actual, Y_pred)
    rmse = np.sqrt(mse)    rmsle
= np.log(rmse)    r2 =
r2_score(Y_actual, Y_pred)
n, k = X_train.shape
adj_r2_score = 1 - ((1-r2)*(n-1)/(n-k-1))

    scores['mae']=mae
scores['mse']=mse
scores['rmse']=rmse
scores['rmsle']=rmsle
scores['r2']=r2
    scores['adj_r2_score']=adj_r2_score

    return scores
```

```
X = labeled.iloc[:,1:].values
```

```

Y = labeled.iloc[:,0].values.reshape(-1,1)

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4, random_state=42)

model =
LGBMRegressor(boosting_type="gbdt",learning_rate=0.07,metric="rmse",n_estimators=300, obj
ective="root_mean_squared_error",random_state=42,reg_sqrt=True)

model.fit(X_train, Y_train)

Y_pred = model.predict(X_test)

find_scores(Y_test, Y_pred, X_train)

pickle.dump(model, open('resale_model.sav', 'wb'))

get_ipython().system('pip install -U ibm-watson-machine-learning')

from ibm_watson_machine_learning import APIClient import json

wml_credentials = {
    "apikey":"Qo9j8ni7qMJ8j1C8VFDRFHbuGRAhYWcTlkVqnYg1AGkE",
    "url":"https://us-south.ml.cloud.ibm.com"
}

wml_client = APIClient(wml_credentials)
wml_client.spaces.list()

SPACE_ID= "bf7bc386-40bf-4d85-91e6-eedd2c53f245"

wml_client.set.default_space(SPACE_ID)

wml_client.software_specifications.list(100)

import sklearn
sklearn.__version__

MODEL_NAME = 'CRVP'
DEPLOYMENT_NAME = 'CRVP'
DEMO_MODEL = model

software_spec_uid = wml_client.software_specifications.get_id_by_name('runtime-22.1-
py3.9') model_props = {    wml_client.repository.ModelMetaNames.NAME:
MODEL_NAME,    wml_client.repository.ModelMetaNames.TYPE: 'scikit-learn_1.0',
    wml_client.repository.ModelMetaNames.SOFTWARE_SPEC_UID: software_spec_uid
}

model_details = wml_client.repository.store_model(
    model=DEMO_MODEL,

```

```
    meta_props=model_props,  
    training_data=X_train,  
    training_target=Y_train  
)  
model_details  
model_id =  
wml_client.repository.get_model_id(model_details)  
model_id deployment_props = {  
    wml_client.deployments.ConfigurationMetaNames.NAME:DEPLOYMENT_NAME,  
    wml_client.deployments.ConfigurationMetaNames.ONLINE: {}  
}  
deployment = wml_client.deployments.create(  
    artifact_uid=model_id,  
    meta_props=deployment_props  
)
```

- **GitHub link:** <https://github.com/IBM-EPBL/IBM-Project-52481-1661006811>
- **Project Demo link:**

