







Professional Readiness for

Innovation, Employability, and Entrepreneurship

PROJECT REPORT

Title : Car Resale Value Prediction

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1.INTRODUCTION

1.1 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.

1.2 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

2.1 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.

2.2 References

Z.Z Keiel		
Project Title	Author	Abstract
Price Prediction of Used Cars Using Machine Learning		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.
of Prices for Used Car by using Regression Models	Prajak Chertchom, Thongchai Kaewkiriya, Suwat	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.
Using	Isakovic, Dino Keco, Zerina Masetic,	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
price	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.

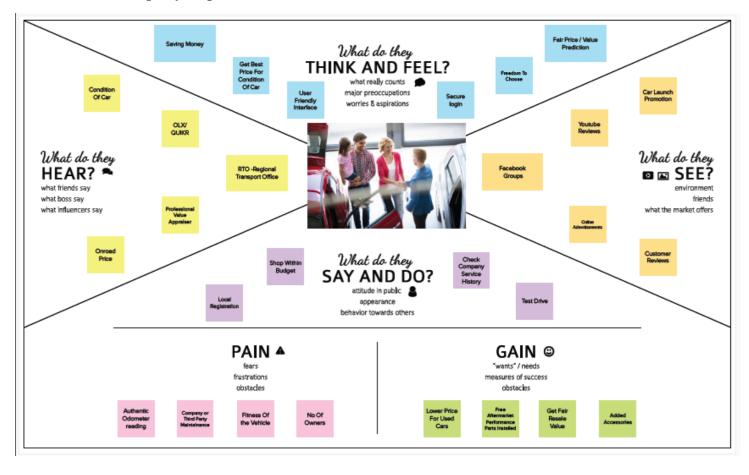
Prediction of Used Car Zhang; Qiang Wang Price Based on Supervised Learning Algorithm (2021)	In this work, Extra Trees Regressor, Random Forest Regressor was used. Finally, the algorithm was optimized by using the hyperparameter function. The results show that R2 = 0.9807 obtained from extreme random numbers is the best performance. The algorithm was obtained and validated with new data to derive the final algorithm model.
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2.3 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.

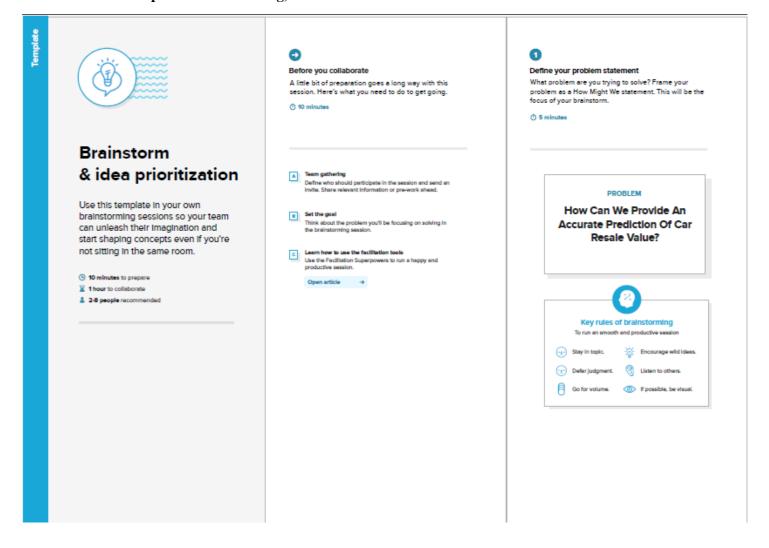
3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

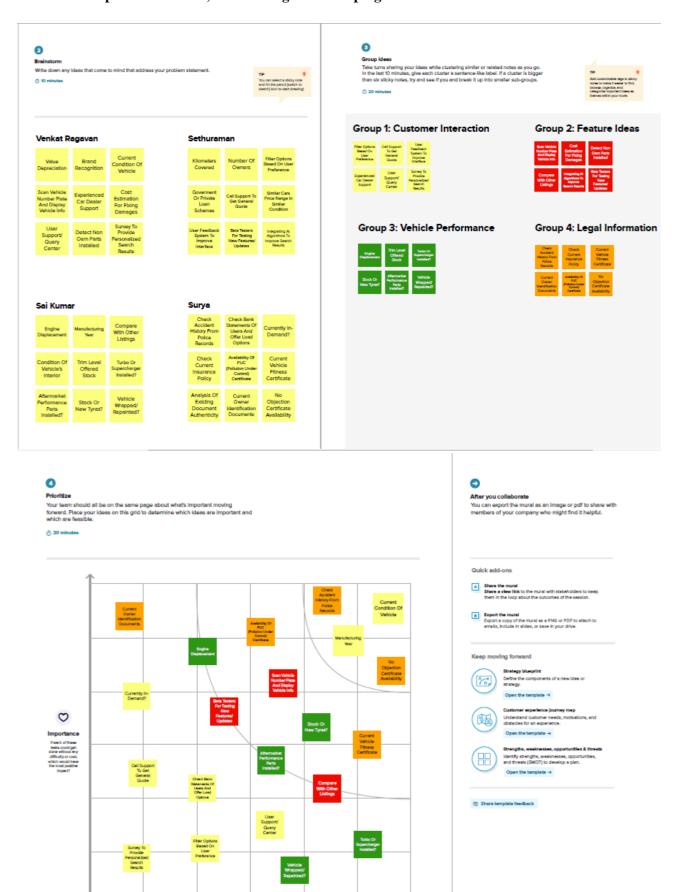


3.2 Ideation & Brainstorming

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



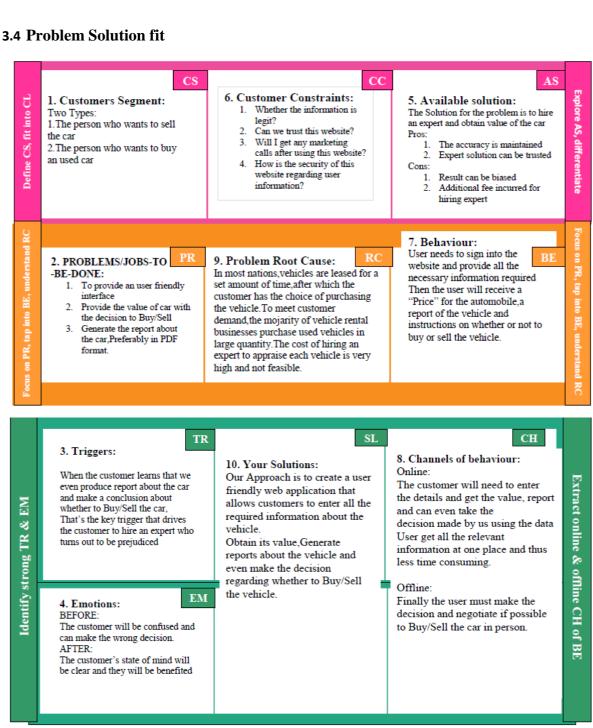
Step-2: Brainstorm, Idea Listing and Grouping



3.3 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 webbased 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	 Enhanced resale value accuracy Improved relationships with customers Leads to increased quality of products and it's related after sales service

5.	Business Model (Revenue	This business plan addresses all relevant concerns by
	Model)	presenting a comprehensive account of a month-
		bymonth 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.



4.REQUIREMENT ANALYSIS

4.1 Functional Requirements

Following are the functional requirements of the proposed solution.

FR	Functional Requirement	Sub Requirement (Story / Sub-Task)
No.	(Epic)	
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

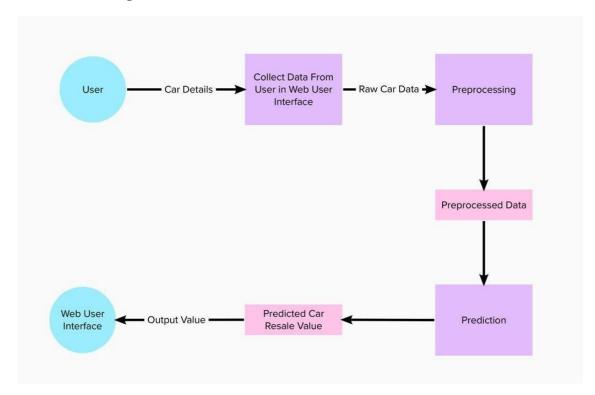
4.2 Non-Functional requirements

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

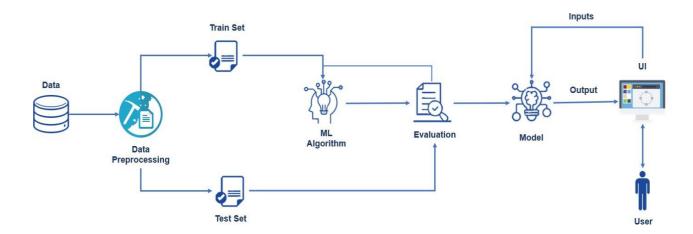
FR	Non-Functional Requirement	Description
No.		
NFR-1	Usability	Predicting the resale value
NFR-2	Security	Providing security to the website
NFR-3	Reliability	Providing high reliability by predicting values
		for different types of cars
NFR-4	Performance	Providing high performance by using some
		machine 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

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



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

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Title	Description	Date
Literature Survey and Information Gathering	Gathering Information by referring the technical papers, research publications etc.	3 September 2022
Prepare Empathy Map	To capture user pain and gains Prepare List of Problem Statement	10 September 2022
Ideation	Prioritize a top 3 ideas based on feasibility and Importance	17 September 2022
Proposed Solution	Solution include novelty, feasibility, business model, social impact and scalability of solution	
Problem Solution Fit	Solution fit document	1 October 2022
Solution Architecture	Solution Architecture	1 October 2022
Customer Journey	To Understand User Interactions and experiences with application	8 October 2022
Functional Requirement	Prepare functional Requirement	12 October 2022
Data flow Diagrams	Data flow diagram	12 October 2022
Technology Architecture	Technology Architecture diagram	12 October 2022
Milestone & sprint delivery plan	Activity what we done &further plans	22 October 2022
2	Develop and submit the developed code by testing it	24 October 2022 – 19 November 2022

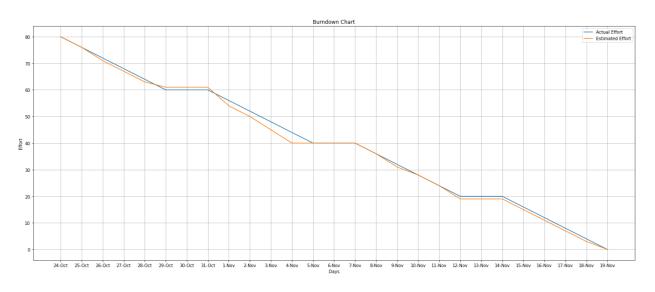
6.2 Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Point s	Priority	Team Member s
Sprint-1	Home Page	USN-1	As a user, I can view thehome page of the web application.	20	Low	VenkatRagava n A S Sethuraman P
Sprint-2	Data Entry	USN-2	As a user, I can enter my cardetails in the application.	20	Medium	VenkatRagava n A S SaiKumar L
Sprint-3	Car resale valuedisplay	USN-3	As a user, I can view theresale value of my car.	20	Medium	VenkatRaga van A S Sethuraman P
Sprint-4	Resale Value Prediction	USN-4	As a user,I expect the application to predict theresale value of car.	20	Medium	VenkatRaga van A S Surya E

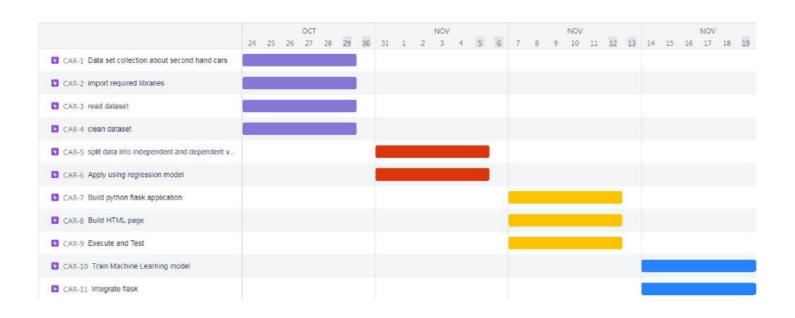
6.3 Project Tracker

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

6.4 Burndown Chart



6.5 Reports from JIRA



7. CODING & SOLUTIONING

7.1 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">
           rel="stylesheet"
  link
    href="https://cdnjs.cloudflare.com/ajax/libs/fontawesome/4.7.0/css/font-
awesome.min.css">
 </head>
 <body>
  <section class="header">
   <nav>
    <a href="/"><img src="../static/Images/sang.png" width="100"
height="100"></a>
   </nav>
    <div class="text-box">
      <h1>Car resale value Predictor</h1>
      >Best system to predict the amount of resale value based on the parameters
provided by the user .
      <a href="./predict_page" class="visit-btn ">Check price</a>
</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:



7.2 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>
kead>
ke
```

	table, th,
padding:	10px;
}	
<body></body>	
<pre><div class="container"></div></pre>	
	<div class="header"></div>
	e Accurate Resale Value of Your Car
	<pre></pre>
	tp://localhost:5000/predict" class="form">
-	padding:10px>Registration year :
<pre><input autocomplete="off" id="year" maxlength="50" na=""/></pre>	
	<i class="fas fa-check-circle"></i>
	. <i class="fas fa-exclamation-circle"></i>
	
	<div class="form-control"></div>
<label for<="" td=""><td>or="month">Registration Month : </td></label>	or="month">Registration Month :
<input id="month" maxlength=" autocomplete=" off"=""/>	50" name="regmonth" type="text"
-	<i class="fas fa-check-circle"></i>
	. <i class="fas fa-exclamation-circle"></i>
	
	<div class="form-control"></div>
<label< td=""><td>for="power">Power of car in PS: </td></label<>	for="power">Power of car in PS:
	50" name="powerps" type="text'
autocomplete="off"/>	
-	<i class="fas fa-check-circle"></i>
	. <i class="fas fa-exclamation-circle"></i>
	
	<div class="form-control"></div>
	>Kilometers that car have driven :
<input id="kilometer" maxle<="" td=""/> <td>ength="50" name="kms" type="text"</td>	ength="50" name="kms" type="text"
autocomplete="off"/>	
*	<i class="fas fa-check-circle"></i>
	. <i class="fas fa-exclamation-circle"></i>
	<pre></pre>
./1*	
class="form-control">	<div< td=""></div<>

مسلمان
Manual
\tu\name{\tu}\na
<input id="manual" name="geartype" type="radio" value="manual"/>
Add a farmatic of the
Automatic
<input id="automatic" name="geartype" type="radio" value="automatic"/>
<pre>Not mentioned</pre>
<input id="not" name="geartype" type="radio" value="not-declared"/>
<i class="fas fa-exclamation-circle"></i>

<h3>Vour car is repaired or damaged :</h3>

<ta< th=""><th>ı</th></ta<>	ı
ble style="width:50%">	
Yes	
<input id="yes" name="damage" type="radio" value="yes"/>	
\u\lambda	
No	
<input id="no" name="damage" type="radio" value="no"/>	
tuz input type- radio name- damage value- no lu- no /z tuz	
Not Declared	
41. 2 44 11.11 11.11 11.11 11.11	
<input <="" name="damage" td="" type="radio" value="not-declared"/> <td></td>	
id="notdec"/>	
/i class="fas fa_check_circle"\/i\	
21 CINCO—"TRO TR_CHACK_CITCIA"\\/\lambda\/\la	

si class="fas fa-exclamation-circle">

Model Type :
<pre></pre> <pre> <pre> select name="model" id="model"> </pre></pre>
<option disabled="" hidden="" selected="" value="">Choose Model Name</option>
<pre><option value="golf">Golf </option></pre>
<option value="grand">Grand </option>
<pre>coption value="fabia">Fabia </pre>
<pre>coption value="2_reihe">2 Reihe </pre>
<pre>coption value="andere">Andere </pre>
<pre>coption value="c_max">C Max </pre>
<pre>coption value="3_reihe">3 Reihe </pre>
<pre>coption value="passat">Passat </pre>
<pre>coption value="navara">Navara </pre>
<pre></pre>
<pre></pre> <pre>coption value="polo">Polo </pre>
<pre>coption value="twingo">Twingo </pre>
<pre>coption value="a_klasse">A klasse </pre>
<pre>coption value="scirocco">Scirocco </pre>
<pre>coption value="5er">5er </pre>
<pre>coption value="meriva">Meriva </pre>
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<pre>coption value="kadett">Kadett </pre>
<pre>coption value="signum">Signum </pre> coption value="astra">Astra
<pre></pre> <pre>coption value="jetta">Jetta </pre> <pre>coption value="fiesta">Fiesta </pre>
<pre>coption value= micra >wircra </pre> <pre>coption value="vito">Vito </pre>
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<pre>coption value="sprinter">Sprinter </pre>

<pre>coption value="156">156 </pre>
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<option value="scenic">Scenic </option>
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<option value="insignia">Insignia </option>
<option value="combo">Combo </option>
<pre><pre><pre><option value="focus">Focus </option></pre></pre></pre>
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<option value="a6">A6 </option>
option value="omega">Omega
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value="matiz">Matiz <option <="" option=""> value="rio">Rio </option> value="touareg">Touar <option <="" option=""></option>	<pre> value="beetle"> otion> reg value="logan"> </pre>	Beetle <option logan="" option="" td="" value<=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" td=""><td></td></option> value="beetle"> ption> reg value="logan">		Beetle <option coption="" logan="" td="" value<=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" td=""><td><pre></pre></td></option> value="beetle"> value="beetle"> otion> reg value="logan">	<pre></pre>	Beetle <option coption="" logan="" td="" value<=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" option=""></option>	<pre> value="beetle"> value="beetle"> otion> reg value="logan"> </pre>	Beetle <option coption="" logan="" td="" value<=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" td=""><td> <pre></pre></td></option> value="beetle"> otion> reg value="logan"> me="s_max">S	<pre></pre>	Beetle <option <option<="" coption="" logan="" max="" td="" value=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" option=""> value="rio">Rio </option> value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore</option></option></option>	<pre> value="beetle"> value="beetle"> otion> reg value="logan"> </pre> <pre> </pre> <pre></pre> <pre><td>Beetle <option <option<="" coption="" logan="" max="" td="" value=""><td><pre></pre> <pre></pre> <pre><</pre></td></option></td></pre>	Beetle <option <option<="" coption="" logan="" max="" td="" value=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" option=""></option>	value="beetle"> otion> reg value="logan"> =="s_max">S	Beetle <option <option="" coption="" logan="" matiz"="" max="" value="x_reihe <option value</td><td><pre></pre> <pre></pre> <pre><</td></tr><tr><td>value=">Matiz <option <="" td=""><td> <pre></pre></td></option> value="beetle"> otion> reg </option>	<pre></pre>	Beetle <option <option="" coption="" galaxy<="" logan="" max="" td="" value="x_reihe <option value on value="><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>		
value="matiz">Matiz <option <="" option=""> value="rio">Rio </option> Touar <option <="" option=""> value="cuore">Cuore <option <="" option="" value=""> </option></option>	<pre> value="beetle"> otion> reg value="logan"> <option <option<="" pre=""> <pre><option< pre=""> <pre><option< pre=""> <pre><option< pre=""> <pre><option< pre=""></option<></pre></option<></pre></option<></pre></option<></pre></option></pre>	Beetle <option <option="" coption="" galaxy="" logan="" max="" td="" value="x_reihe <option value on value=" value<=""><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" td=""><td> </td></option> value="beetle"> otion> reg value="logan"> <option> <option <="" <option="" pre=""></option></option>		Beetle <option <option="" c1"="" coption="" galaxy="" logan="" max="" otion="" value="via</td><td><pre>//option> value=">C1<option<option< pre=""> <pre>//option> e="spider">Spider</pre></option<option<></option>					
value="matiz">Matiz <option <="" option=""> value="rio">Rio </option> value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore</option></option></option>	value="beetle"> otion> reg value="logan"> <option <option="" <option<="" td=""><td>Beetle <option <option="" coption="" galaxy="" logan="" max="" otion="" s_klasse'<="" td="" value="viau value="><td><pre></pre> <pre></pre> <pre><</pre></td></option></td></option>	Beetle <option <option="" coption="" galaxy="" logan="" max="" otion="" s_klasse'<="" td="" value="viau value="><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>				
value="matiz">Matiz <option <="" td=""><td> </td></option> value="beetle"> otion> reg value="logan"> <option <option="" <option<="" td=""><td>Beetle <option <option="" coption="" galaxy="" logan="" matiz"="" max="" n="" otion="" s_klasse'="" value="1_reihe</td><td><pre></pre> <pre></pre> <pre><</td></tr><tr><td>value=">Matiz <option <="" option=""> value="rio">Rio </option> value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore</option></option></option></option></td><td> </td></option> value="beetle"> otion> reg value="logan"> <option <option="" <option<="" td=""><td>Beetle <option 1_reihe="" <option="" coption="" galaxy="" logan="" matiz"="" max="" n="" value="avensis</td><td><pre></pre> <pre></pre> <pre><</td></tr><tr><td>value=">Matiz <option <="" td=""><td> </td></option> value="beetle"> otion> reg </option> value="logan"> </td></option> <option <option="" <option<="" td=""><td>Beetle <option 1_reihe="" <option="" avensis="" coption="" galaxy="" logan="" max="" td="" val<="" value="avensis value="><td><pre></pre> <pre></pre> <pre><</pre></td></option></td></option>		Beetle <option <option="" coption="" galaxy="" logan="" matiz"="" max="" n="" otion="" s_klasse'="" value="1_reihe</td><td><pre></pre> <pre></pre> <pre><</td></tr><tr><td>value=">Matiz <option <="" option=""> value="rio">Rio </option> value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore <option value="cuore">Cuore</option></option></option></option>		Beetle <option 1_reihe="" <option="" coption="" galaxy="" logan="" matiz"="" max="" n="" value="avensis</td><td><pre></pre> <pre></pre> <pre><</td></tr><tr><td>value=">Matiz <option <="" td=""><td> </td></option> value="beetle"> otion> reg </option> value="logan">		Beetle <option 1_reihe="" <option="" avensis="" coption="" galaxy="" logan="" max="" td="" val<="" value="avensis value="><td><pre></pre> <pre></pre> <pre><</pre></td></option>	<pre></pre> <pre><</pre>

(anti-nambra n5 05 danti-na
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>
<pre>coption value="kaefer">Kaefer </pre>
<pre>coption value="santa">Santa </pre>
<option value="cooper">Cooper </option>
<pre>coption value="leon">Leon </pre>
<option value="4_reihe">4 Reihe </option>
<option value="laguna">Laguna </option>
<option value="ptcruiser">Ptcruiser </option>
<option value="clk">Clk </option>
<pre>coption value="primera">Primera </pre>
<pre><pre></pre><pre><pre><pre><pre><pre><pre><pre><</pre></pre></pre></pre></pre></pre></pre></pre>
<pre><pre></pre></pre> <pre></pre>
<pre></pre>
<option value="qashqai">Qashqai </option>
<option value="carisma">Carisma </option>
<option value="accord">Accord </option>
<pre>coption value="corolla">Corolla </pre>
<option value="lanos">Lanos </option>
<option value="phaeton">Phaeton </option>
<option value="boxster">Boxster </option>
<pre>coption value="verso">Verso </pre>
<pre>coption value="swift">Swift </pre>
<pre>coption value="rav">Rav </pre>
value="picanto">Picanto
<pre><option< td=""></option<></pre>
value="stilo">Stilo <option< td=""></option<>
value="alhambra">Alhambra
<pre>coption value="911">911</pre>
<pre></pre> option value="mx_reihe">Mx
Reihe <option< td=""></option<>
value="m_reihe">M Reihe
<pre><option< td=""></option<></pre>
<option value="ypsilon">Ypsilon</option>
<option value="cayenne">Cayenne </option>
<option value="galant">Galant </option>
<pre>coption value="justy">Justy </pre>
<pre>coption value="90">90 </pre>

<pre>coption value="agila">Agila </pre>
<option value="duster">Duster </option>
<option value="cr_reihe">Cr Reihe </option>
<pre></pre>
<option value="discovery">Discovery </option>
<pre><pre><coption value="c_reihe">C Reihe </coption></pre></pre>
<pre>coption value="v_klasse">V Klasse </pre>
<pre></pre>
<pre></pre>
<option value="aygo">Aygo </option>
<option value="cc">Cc </option>
<pre>coption value="carnival">Carnival </pre>
<pre></pre> <pre>coption value="fusion">Fusion </pre>
option value void > Bora < option >
<pre></pre>
<pre></pre>
<pre></pre>
<pre></pre>
<pre></pre>
<pre>coption value="100">100 </pre>
<pre>coption value="147">147 </pre>
<pre>coption value="q3">Q3 </pre>
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>
<pre></pre>
<option value="x_type">X Type </option>
<option value="5_reihe">5 Reihe </option>
<option value="ducato">Ducato </option>
<pre>coption value="s_type">S Type</pre>
<pre></pre> <pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre></pre></pre>
Trail <pre></pre>
value="toledo">Toledo
<option value="altea">Altea</option>
<option value="voyager">Voyager </option>
<pre><option< td=""></option<></pre>
<pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre></pre></pre>
<pre></pre> option > <pre><pre><pre>coption value="range_rover">Range</pre></pre></pre>
Rover <option< td=""></option<>
value="antara">Antara
<option value="tucson">Tucson</option>
<pre>coption value="q7">Q7 </pre>
<pre>coption value="citigo">Citigo </pre>
<option value="jimny">Jimny </option>

contion value-"ay maiha"> Cy Daiha clantion
<pre>coption value="cx_reihe">Cx Reihe </pre>
<pre></pre>
<pre>coption value="lybra">Lybra </pre>
<option value="range_rover_sport">Range Rover Sport </option>
<pre></pre>
<pre>coption value="159">159 </pre>
<option value="freelander">Freelander </option>
<pre>coption value="captiva">Captiva </pre>
<option value="c2">C2 </option>
<pre>coption value="500">500 </pre>
<pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre></pre></pre>
<pre>coption value="147">147 </pre>
<pre>coption value="cherokee">Cherokee </pre>
<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>
<pre>coption value="601">601 </pre>
<option value="3_reihe">3 Reihe </option>
<pre>coption value="4_reihe">4 Reihe </pre>
<pre></pre>
<pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre></pre></pre>
<pre>coption value="niva">Niva </pre>
<option value="5_reihe">5 Reihe </option>
<pre></pre>
<option value="nubira">Nubira </option>
<option value="vivaro">Vivaro</option>
<pre></pre> option value="g_klasse">G
Klasse <
value="lodgy">Lodgy
<pre><option value="850">850 </option></pre>
<pre><option value="serie_2">Serie 2 </option></pre> <pre><option value="6er">6er</option></pre>
value="charade">Charade
<pre><option value="croma">Croma </option></pre>
<pre><option value="outlander">Outlander </option></pre>
<pre>coption value="doblo">Doblo </pre>
Sprint raise— dollo > Dollo \ option

<pre>coption value="musa">Musa </pre>
<pre>coption value="amarok">Amarok </pre>
<pre></pre>
<pre>coption value="move">Move </pre>
<pre>coption value="9000">9000 </pre>
<pre>coption value="145">145 </pre>
<pre>coption value="aveo">Aveo </pre>
<pre></pre>
<option value="300c">300c </option>
<option value="b_max">B Max </option>
<pre>coption value="delta">Delta </pre>
<pre>coption value="terios">Terios </pre>
<pre>coption value="rangerover">RangeRover </pre>
coption value="90">90
<pre>coption value="materia">Materia </pre>
<pre><pre></pre></pre> <pre><pre><pre><pre><pre><pre><pre><</pre></pre></pre></pre></pre></pre></pre>
<pre></pre>
<pre>coption value="serie_3">Serie 3 </pre>
<pre>coption value="48429">48429 </pre>
<pre>coption value="serie_1">Serie 1 </pre>
<option value="discovery_sport">Discovery Sport </option>
<i class="fas fa-check-circle"></i>

<pre><pre><label for="brand">Brand :</label></pre></pre>
<pre><select id="brand" name="brand"></select></pre>
<option disabled="" hidden="" selected="" value="">Choose Brand Name</option>
<pre>coption value="volkswagen">Volkswagen </pre>
<pre>coption value="audi">Audi </pre>
<pre>coption value="jeep">Jeep </pre>
<pre>coption value="skoda">Skoda </pre>
<pre>coption value="bmw">Bmw </pre>
<pre>coption value="peugeot">Peugeot </pre>
<pre>coption value="ford">Ford </pre>
<pre>coption value="mazda">Mazda </pre>

contion value—"handa" \ Uanda
<pre>coption value="honda">Honda </pre>
<pre></pre>
<pre>coption value="mini">Mini </pre>
<pre>coption value="smart">Smart </pre>
<pre>coption value="hyundai">Hyundai </pre>
<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>
<pre></pre>
<option value="suzuki">Suzuki </option>
<pre>coption value="lancia">Lancia </pre>
<pre>coption value="toyota">Toyota </pre>
conting value—"above lot"> Chave lot / option>
<pre>coption value="chevrolet">Chevrolet </pre>
<pre> <pre> <pre> </pre> <pre> <pre> <pre> <pre> </pre> <pre> <pre< td=""></pre<></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre></pre>
<pre>coption value="daihatsu">Daihatsu </pre>
<pre>coption value="trabant">Trabant </pre>
<pre>coption value="saab">Saab </pre>
<pre>coption value="chrysler">Chrysler </pre>
<option value="jaguar">Jaguar </option>
<pre>coption value="daewoo">Daewoo </pre>
<pre></pre>
<option value="land_rover">Land Rover </option>
<option value="lada">Lada </option>
<pre></pre>
<pre><i class="fas fa-check-circle"></i></pre>
<pre><i class="fas fa-exclamation-circle"></i></pre>

<label for="fuelType">Fuel Type</label>
: <select< td=""></select<>
name="fuelType" id="fuel"> <option disabled="" selected<="" td="" value=""></option>
hidden>Choose Fuel Type
<pre><option value="petrol"></option></pre> Petrol
<pre></pre> option value="diesel">
Diesel <option value="not-declared"></option>
Not Declared <option< td=""></option<>
value="lpg">LPG
<option value="cng">CNG</option>
<pre></pre>
value="hybrid">Hybrid
<pre><option value="others">Others </option></pre>
<pre>coption value="electric">Electric </pre>
<pre></pre>

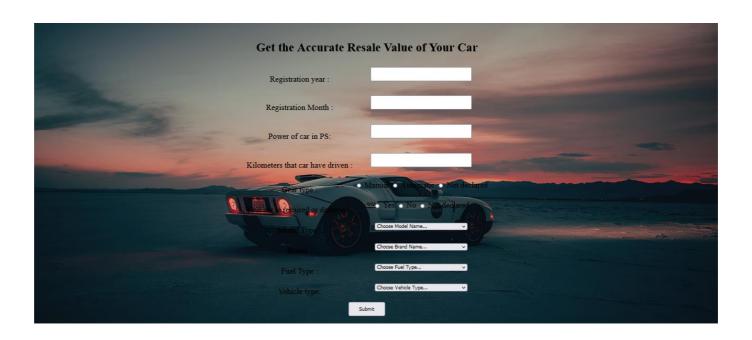
```
 <i class="fas fa-check-circle"></i>
 ______</div>
 ......<label for="vehicletype">Vehicle type: </label>
 .....<select name="vehicletype" id="vehicle" >
 .. <option value="" disabled selected hidden>Choose Vehicle Type...</option>
 ......coption value="coupe">Coupe </option>
  <option value="suv">SUV </option>
  <option value="kleinwagen">Kleinwagen </option>
  <option value="limousine">Limousine </option>
 .....<option value="cabrio">Cabrio </option>
 ......coption value="bus">Bus </option>
 .....<option value="andere">Andere </option>
 ......coption value="volkswagen">Volkswagen </option>
 ......</select>
  <i class="fas fa-check-circle"></i>
 .....
 ______</div>
 ......<input type="submit" id="submit"></input>
 </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{	
cold	or:Black:
text-alig	
padding:10px 0px 10px	X
100px; }	
#model{	
·	1 500
widt	
colo	r: black;
}	
,	
U1 16	
#brand{	
widt	h:500px;
colo	r: black:
}	_,,
J	
#fuel{	
widt	h:500px:
colo	-
	1. Diack,
}	
<pre>#vehicle{</pre>	
widtl	h·500nx·
colo	r: black;
}	
.form{	
padding:30 ₁	ρx
40px; }	
.form-control{	
•	m·10nv·
margin-botto	-
padding-botto	_
position:	relative;
margin-left	i :
100px; }	
100рх, 3	
.form-control label{	
displa	av:block:
_	.,
margin-	
bottom:5px; }	

.form-control input{	
	•
	· ·
}	dispiay.iiiiie-table,
.form-control i{	
	nosition:absolute:
	-
}	visiomty.maden,
forms control area (
.form-control span{	
	-
	•
	•
	_
}	font-size:1rem;
J	
.form-control.success input{	1 1
color:#2ecc71; }	border-
. ,	
.form-control.error input{	
color:#e743c3; }	border-
colore7+3c3, j	
.form-control.error span{	
	color:red;
	•••••
visibility:visible; }	
.form-control.success i.fa-check-circle {	
	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;
cursor:pointer;
transition:all .5s;
...... font-size:1rem;
..... margin-left: 100px;
}
.form #submit:hover{
......background-
color:#6441a5; }
.form-control #manual{
20%; }
```

Output



7.3 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>
  k rel="icon" type="image/x-icon" href="../static/Images/favicon.ico">
</head>
<body>
......<section class="header">
<nav>
    <a href="/"><img src="../static/Images/sang.png" width="100"
height="100"></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{
}
nav{
display:flex;
padding: 2%
6%;
justify-content: space-between; align-
items: center;
}
```

Output



7.4 Model Selection & Hyperparameter Tuning Code

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='b75e0564aba32dce859c600444 18df71ce7389a8')

data = pd.read_csv('../input/naalaiyathiran/Preprocessed/autos_preprocessed.csv', header=0, sep=',', encoding='Latin1')

labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']

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]
     }
  }
}
                   wandb.sweep(sweep=bagging_regressor_configs,
sweep_id =
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
```

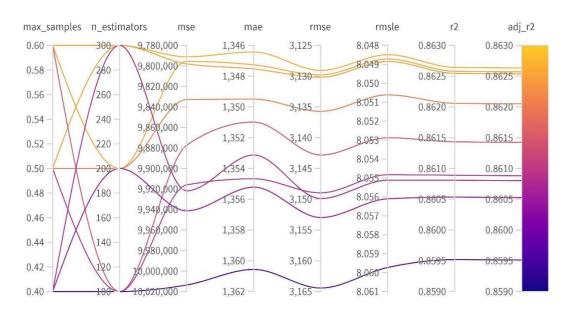
```
}
  wandb.init(config=config_defaults)
config = wandb.config
X = labeled.iloc[:,1:].values
Y = labeled.iloc[:,0].values.reshape(-1,1)
  X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.4,
random_state=42)
  model = XGBRegressor(
learning_rate=config.learning_rate,
n_estimators = 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": {
```

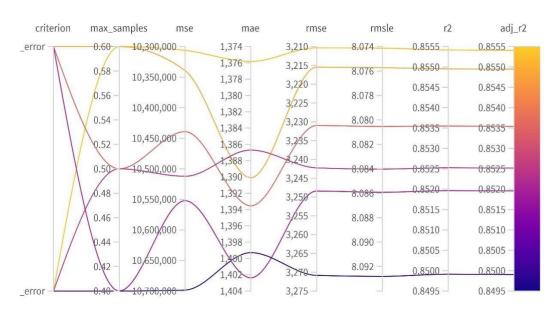
```
"values": [True]
},
"metric": {
    "values": ['rmse']
},
"n_estimators": {
    "values": [100,200,300]
},
"random_state": {
    "values": [42]
}
}
sweep_id = wandb.sweep(sweep=lgbm_configs, project="car_resale_value")
wandb.agent(sweep_id=sweep_id, function=LGBM_regressor)
```

Output:

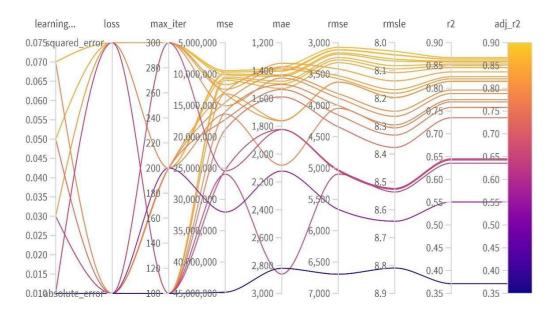
1) Bagging Regressor



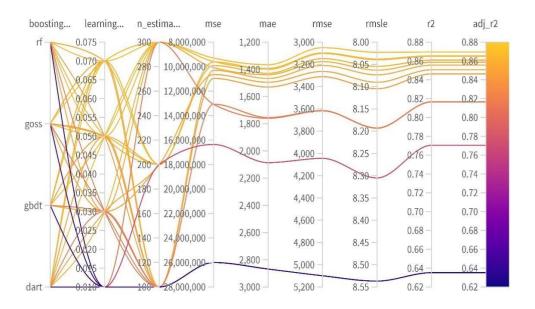
2) Extra Tree Regressor



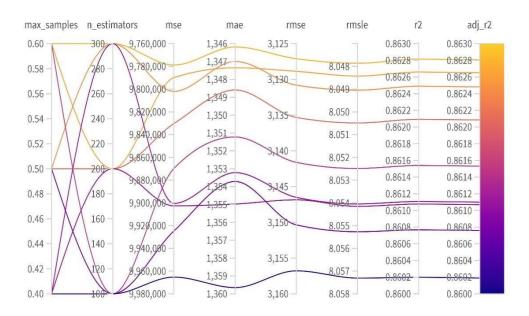
3) HOG Boosting Regressor



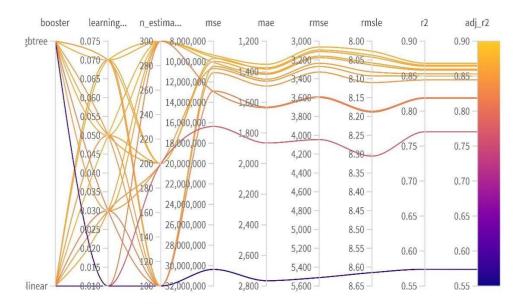
4) LGBM Regressor



5) Random Forest Regressor



6) XGB Regressor



7.5 Flask Integration # 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 = "Dca hJaB69BWMyWbReqM35KhVIdAKbOl0U5FlHacMgsW" requests.post('https://iam.cloud.ibm.com/identity/token', token response = 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 pagereturn 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')



headers={'Authorization':	'Bearer	•	+	mltoken})
	pre	dictions = 1	response_sc	oring.json()
		print(re	esponse_sco	oring.json())
	predict = prediction	ons['predict	ions'][0]['va	alues'][0][0]
		. print("Fin	al prediction	n :",predict)
r	eturn render_temp	olate('predic	et.html',pred	lict=predict)
ifname_=='_main_':				
	reg_model = lo	oad_model(()#load the s	saved model
ap	p.run(host='localh	ost', debug	=True, threa	aded=False)

8.TESTING

8.1 Test Cases Scenarios

1	Verify user is able to see home page?
2	Verify user is able to navigate to data entry page?
3	Verify user is able to see data entry page?
4	Verify user is able to enter values in the fields?
5	Verify user is able to navigate to output display page?
6	Verify user is able to view the output display page?
7	Verify user is able to view the car resale value output in the output display page?

8.2 User Acceptance Testing

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status Comments	TC for Automation(Y/N)	BUG
HomePage_TC_001	Ü	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	E	All the UI elements rendered properly	Working as expected	Pass	N	
HomePage_TC_002	Functional	Home Page	Verify the Data Entry page can be reachable.		Enter URL and click go Werify all the UI elements displayed or not. Press the Check Price button.	8	User should navigate to Data Entry Page	Working as expected	Pass	N	
DataEntryPage_TC_001	Ül	Data Entry Page	Verify all the UI elements in Data Entry page rendered properly		1. Enter URL and click go 2. Verify all the UL elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the UL elements displayed or not.	8	All the UI elements rendered properly	Working as expected	Pass	N	
DataEntryPage_TC_002	Functional	Data Entry Page	Verify user is able to enter all values		1. Inter 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	12 12 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	
DataEntryPage_TC_003	Functional	Data Entry Page	Verifiy the Output Display page can be reachable.		1.Enter URL and click go 2.Verify all the U 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	8	User should navigate to Output Display Page	Working as expected	Pass	N	
utputDisplayPage_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 Ut elements displayed or not. 3. Press the Check Price button in the home page 4. Verify all the Ut elements displayed or not 5. Verify f all values can be entered 6. Press the submit Bauton 7. Verify all the Ut elements displayed or not.	20	All the UI elements rendered properly	Working as expected	Pass	N	
utputDisplayPage_TC_002	Functional	Output Display Page	Verify user is able to get predicted result		1. Fintor URL and click go 2. Verly all the U elements displayed or not. 3. Press the Check Price button in the home page 4. Verify, all the U elements displayed or not 5. Verify, if all busines on be entered 6. Press the submit Button 7. Verify all the U elements displayed or not 8. Verify if the predicted value is displayed or not 8. Verify if the predicted value is displayed or not	3	Predited Car Resale Value is displayed on the page	Working as expected	Pass	N	

8.3 UAT Report

8.3.1 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

8.3.2 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

9.1 Performance Metrics

S No.	Name	Description
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
2.	Tune the Model	Hyperparameter 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]
		Validation Method: Grid Search Cross Validation
		Best Parameters:
		1) Learning Rate – 0.07
		2) Boosting Type – 'gbdt'
		3) Number of Estimators - 300

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>
  k rel="icon" type="image/x-icon" href="../static/Images/favicon.ico">
  <link rel="stylesheet" href="../static/css/style.css">
  k 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="/"><img src="../static/Images/sang.png" width="100" height="100"></a>
   </nav>
    <div class="text-box">
     <h1>Car resale value Predictor</h1>
     >Best system to predict the amount of resale value based on the parameters provided
by the user .
     <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>
k rel="icon" type="image/x-icon" href="../static/Images/favicon.ico">
<script src="https://kit.fontawesome.com/b9b6bac803.js"</pre>
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>
      <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"</pre>
      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>
      Manual
```

```
<input type="radio" name="geartype" value="manual" id="manual"
/>
           Automatic
  <input type="radio" name="geartype" value="automatic" id="automatic" />
           Not mentioned
                <input type="radio" name="geartype" value="not-declared" id="not"
/>
           <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>
           Yes
  ="radio" name="damage" value="yes" id="yes"/>
                 No 
                      <input type="radio" name="damage" value="no"
id="no"/>
                Not Declared
                   <input type="radio" name="damage" value="not-declared"
id="notdec"/>
                <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 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="ypsilon">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</pre>
<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="sandero">Sandero </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 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 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 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
            width:80%;
#f0f0f0;
       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-
                   font-style:italic;
weight:bolder;
       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;
}
                          background-
.form #submit:hover{
color:#6441a5;
.form-control #manual{
       padding-bottom: 20%;
}
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>
  k rel="icon" type="image/x-icon" href="../static/Images/favicon.ico">
</head>
<body>
       <section class="header">
   <nav>
    <a href="/"><img src="../static/Images/sang.png" width="100" height="100"></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(' \setminus n \setminus 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])
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='8DImq73hywb09uzAo_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])
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 ison
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:
                   wml_client.repository.ModelMetaNames.TYPE: 'scikit-learn_1.0',
MODEL_NAME,
  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 & Project Demo Link:

- https://github.com/IBM-EPBL/IBM-Project-37380-1660306542
- https://www.youtube.com/watch?v=ONdZ91UiDb0