

Professional Readiness for **Innovation,Employability, and Entrepreneurship**

PROJECT REPORT

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **:** | Car Resale Value Prediction | |
| **Team ID** | **:** | PNT2022TMID49030 | |
| **Team Lead** | **:** | S.NAGAJOTHI |  |
| **Members** | **:** | T.AROCKIASOWMIYA |  |
|  |  | S.SANGEETHA POOVITHA MARY |  |
|  |  | D.SARANYA |  |



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# INTRODUCTION

### Project Overview

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

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

### Purpose

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

# LITERATURE SURVEY

### Existing problem

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

### References

|  |  |  |
| --- | --- | --- |
| **Project Title** | **Author** | **Abstract** |
| Price Prediction of Used Cars Using Machine Learning | Chuyang Jin | This work aims to build a model to predict used cars' reasonable prices based on multiple aspects. Various regression methods, including linear regression, polynomial regression, support vector regression, decision tree regression, and random forest regression, were applied in the work to obtain highest accuracy. Compared to previous research, the resulting model includes more aspects of used cars while also having a higher prediction accuracy. |
| Prediction of Prices for Used Car  by using Regression Models (2018) | Nitis Monburinon, Prajak Chertchom, Thongchai Kaewkiriya, Suwat Rungpheung, Sabir Buya, Pitchayakit Boonpou. | In this work, a model to evaluate price based on big data analysis is proposed. It takes advantage of vehicle data and vehicle transaction data to analyze the price data for each type of vehicles. The work uses optimized Back Propagation neural network algorithm. |
| Car Price Prediction Using Machine Learning (2019) | Enis gegic, Becir Isakovic, Dino Keco, Zerina Masetic, Jasmin Kevric. | In this work, several distinct attributes are analyzed for the reliable and accurate prediction. The work is to build a model to predict the resale price of cars in Bosnia and  Herzegovina |
| Used Car price prediction (2021) | Praful Rane, Deep Pandya, Dhawal Kotak. | In this work, machine learning models that can accurately predict the price of a used car based on its features was built. They have implemented and evaluated various learning methods on dataset consisting of the sale prices of different models. |

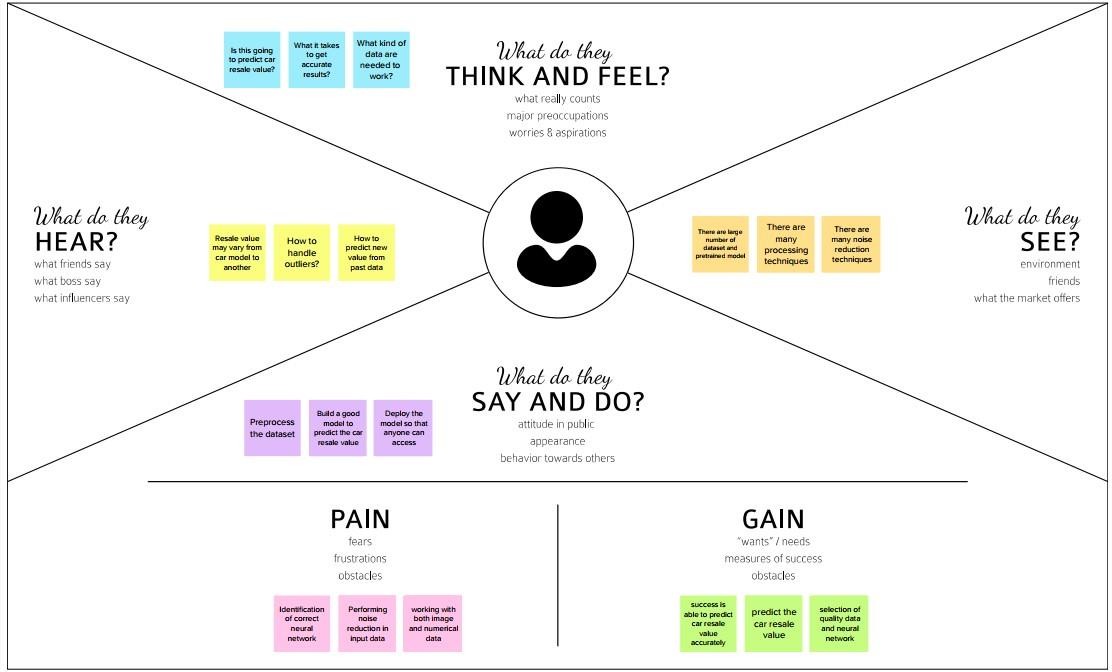
|  |  |  |
| --- | --- | --- |
| Prediction of Used Car Price Based on Supervised Learning Algorithm (2021) | Feng Wang, Xusong Zhang; Qiang Wang | In this work, Extra Trees Regressor, Random Forest Regressor was used. Finally, the algorithm was optimized by using the hyperparameter function. The results show that 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. |

* 1. **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.

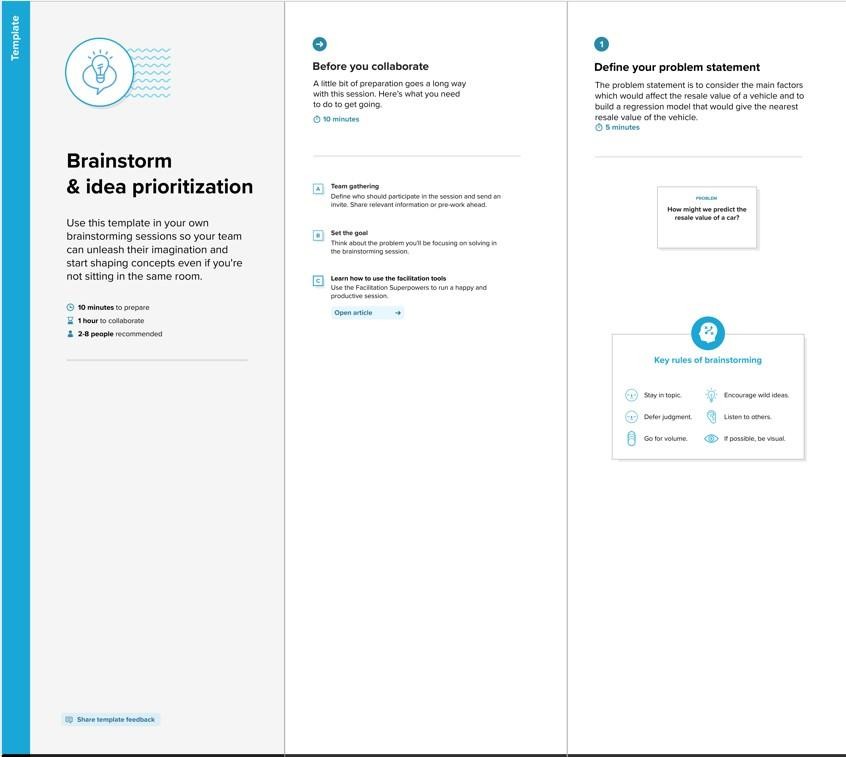
# IDEATION & PROPOSED SOLUTION

* 1. **Empathy Map Canvas**

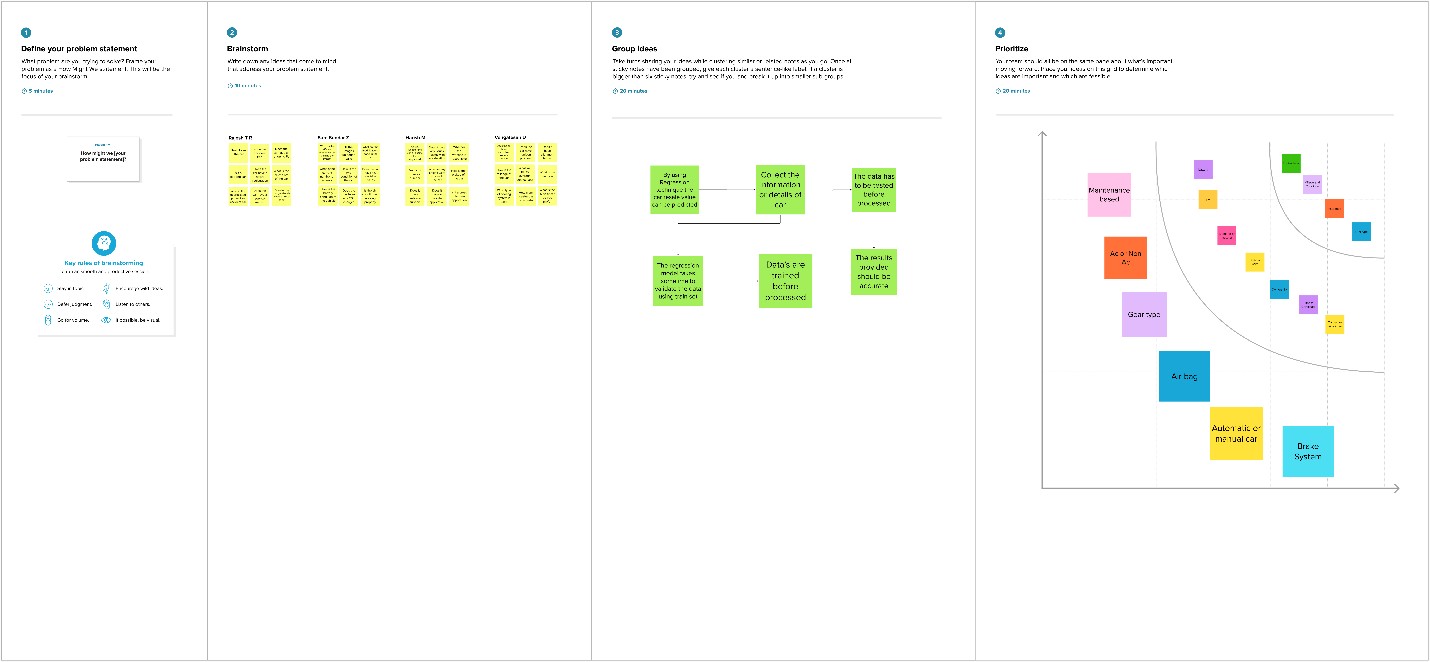


### Ideation & Brainstorming

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



**Step-2: Brainstorm, Idea Listing and Grouping**



### 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 | 1. Enhanced resale value accuracy 2. Improved relationships with customers 3. Leads to increased quality of products and it’s related after sales service |

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

### Problem Solution fit

|  |  |  |
| --- | --- | --- |
| **1.Customer Segments**  + Car mechanic + Customer | **6.Customer Limitation** Proper information about the car is to be known by the customer to find the resale value. | **5. Available Solution** To predict the resale value of the car, we use an intelligent, flexible, and effective system with web application. |
| **2. Problems**  Customer should know the details of their car in web application. | **9. Problem root cause**   * No Proper platform for car resale value prediction. * No awareness of resale price of a used car. | **7. Behavior**  Customers are supposed to enter the car details in the web application to find the resale price of the car. |
| **3. Triggers to Act**   1. When customers decided to sell their car. 2. When car mechanic decides to buy a used car. | **10. Your Solution**  Using predictive modelling to predict the resale value of car. | **8. Channels of Behaviour**  **1. Online:** car details to be entered in web application. |
| **4. Emotions**  Customers get an awareness of the resale price of their own car. | **2. Offline:** customers are supposed to collect the details of their car with the help of a car mechanic. |

# REQUIREMENT ANALYSIS

* 1. **Functional Requirements**

Following are the functional requirements of the proposed solution.

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

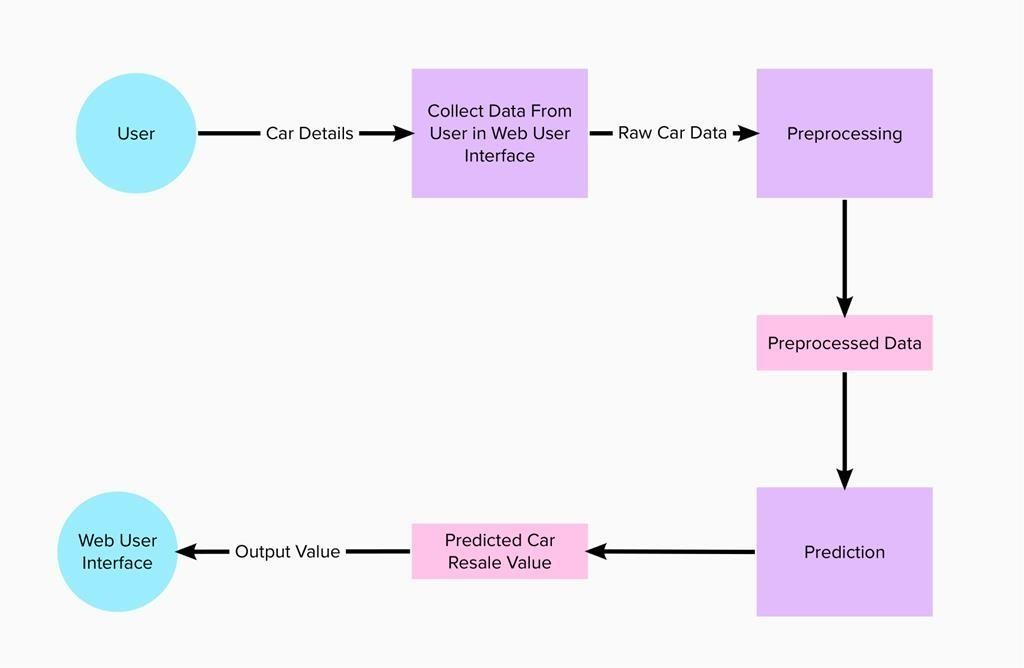
### Non-Functional requirements

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

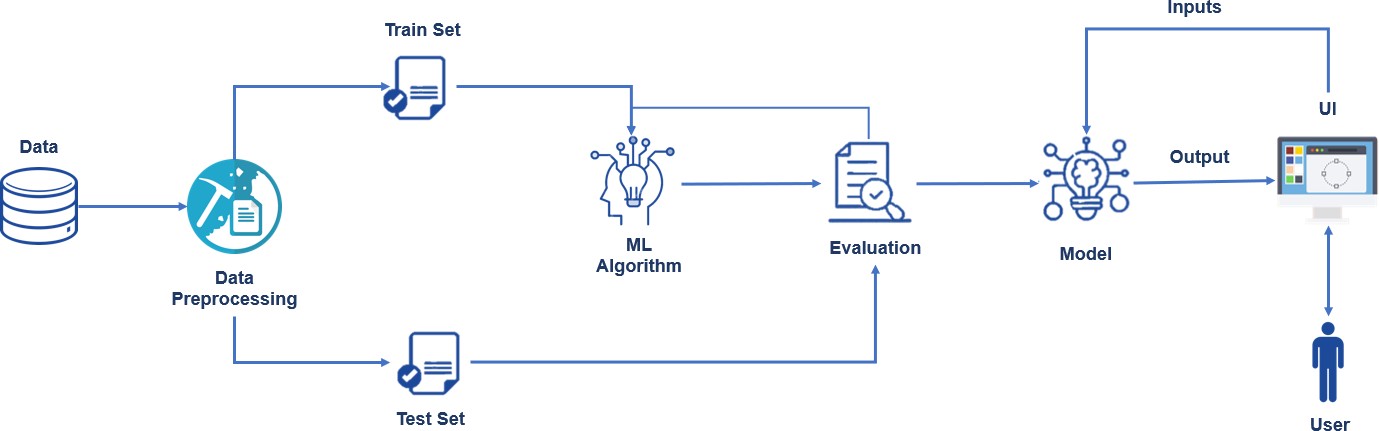
|  |  |  |
| --- | --- | --- |
| **FR**  **No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | Predicting the resale value |
| NFR-2 | **Security** | Providing security to the website |
| NFR-3 | **Reliability** | Providing high reliability by predicting values  for different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

# PROJECT DESIGN

* 1. **Data Flow Diagrams**



### Solution & Technical Architecture



### User Stories

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

# PROJECT PLANNING & SCHEDULING

### Sprint Planning & Estimation

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | | **Description** | **Date** |
| Literature Survey Information Gathering | and | 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 | 24 September 2022 |
| 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 |
| Project Development- Delivery of sprint 1,2,3 &4 | | Develop and submit the developed code by testing it | 24 October 2022 –  19 November 2022 |

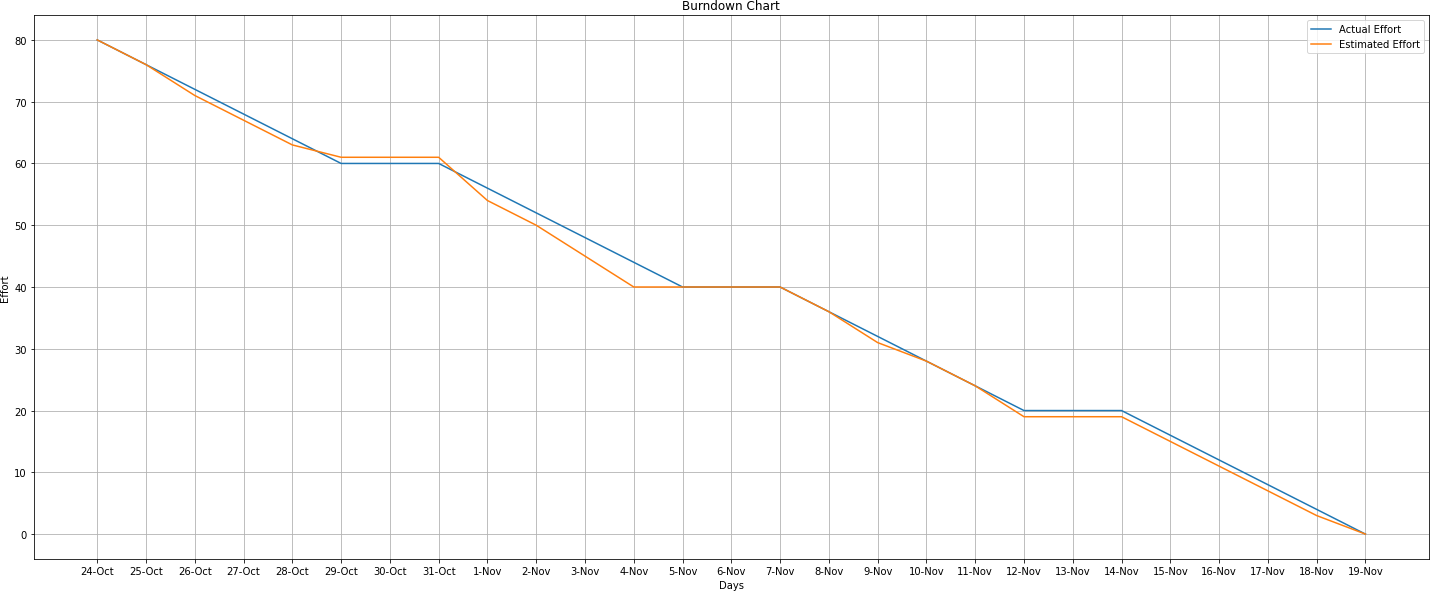
* 1. **Sprint Delivery Schedule**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
| Sprint-1 | Home Page | USN-1 | As a user, I can view the home page of the web application. | 20 | Low | Rajesh T R |
| Sprint-2 | Data Entry | USN-2 | As a user, I can enter my car details in the application. | 20 | Medium | Harish M |
| Sprint-3 | Car resale value display | USN-3 | As a user, I can view the resale value of my car. | 20 | Medium | Sam Sundar Z |
| Sprint-4 | Resale Value Prediction | USN-4 | As a user, I expect the application to predict the resale value of my car. | 20 | Medium | Vengatesan D |

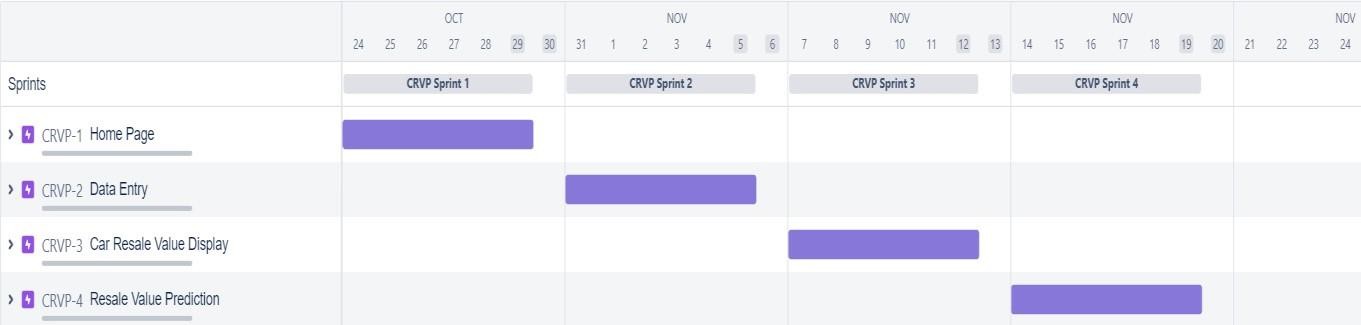
### Project Tracker

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 |

* 1. **Burndown Chart**



* 1. **Reports from JIRA**



# CODING & SOLUTIONING

### 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">

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

awesome.min.css">

</head>

<body>

<section class="header">

<nav>

<a href="/"><img src="../static/Images/sang.png" width="100" height="100"></a>

</nav>

<div class="text-box">

<h1>Car resale value Predictor</h1>

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

<a href="./predict\_page" class="visit-btn ">Check price</a>

</div>

</section>

</body>

</html>

* + 1. **style.css**

\*{ margin:

0;

padding:

0;

}

.header{ min- height: 100vh;

width: 100%; background- image:

linear- gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car1.p ng); background-position: center; background-size: cover; position: relative;

}

nav{

display:flex; padding: 2%

6%; justify-content: space- between; align-items: center;

}

.nav-links{ flex: 1; text- align: right;

}

.nav-links ul li{ list- style: none; display: inline-block; padding: 8px 12px; position: relative;

}

.nav-links ul li a{ color:white; text- decoration: none; font- size: 13px;

} .text-box{ text-align: center; position: relative;

color: #FFE4C4;

top:50%;

}

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

}

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

} .visit-btn{ display: inline; border: 3px solid

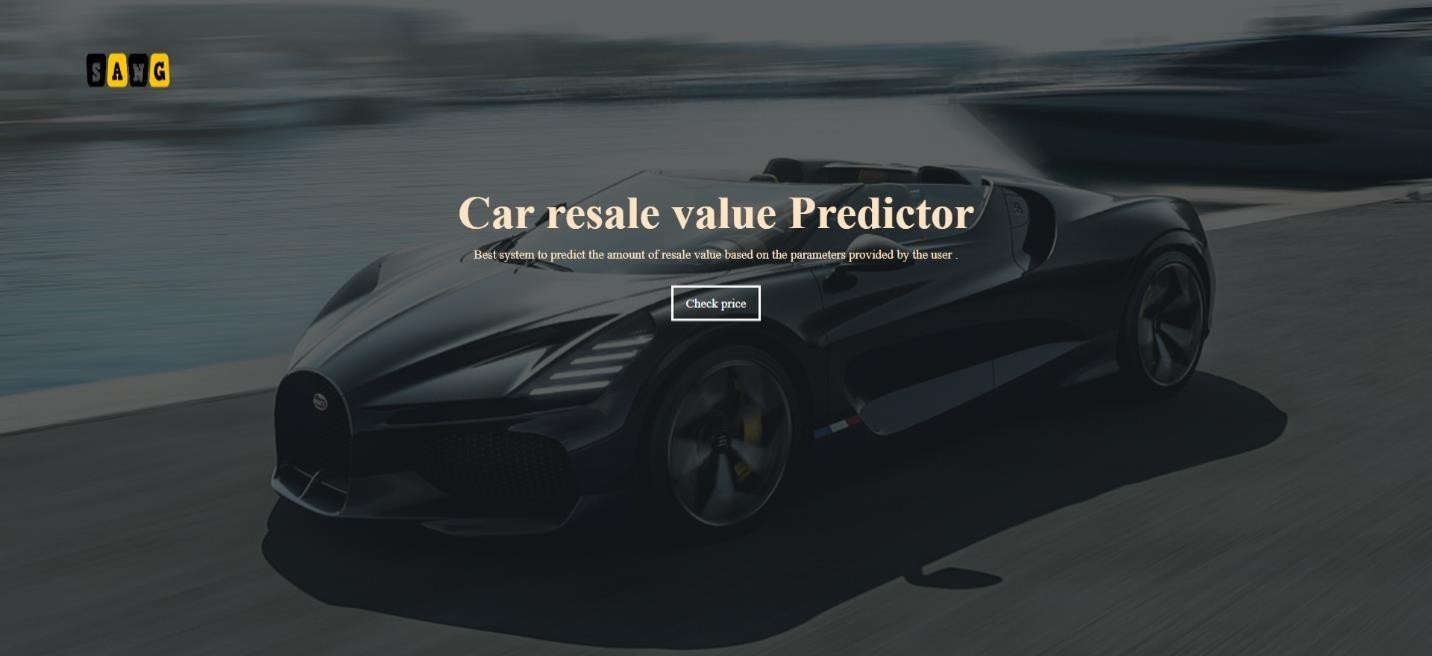
#fff; padding:10px 14px; font-size:

15px; background:

transparent; color:

white; text- decoration:none;

}

**Output:**

### Data Entry Page

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

**Code:**

* + 1. **value.html**

<!DOCTYPE html>

<html lang="en" dir="ltr">

<head>

<link rel="stylesheet" href="../static/css/value.css">

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

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

<script src="https://kit.fontawesome.com/b9b6bac803.js" crossorigin="anonymous"></script>

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

<style>

......................................................................................................... table, th,

td { ...................................................................................................

padding: 10px;

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.... }

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</head>

<body>

<div class="container">

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

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

................................................................................................................... </div>

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

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

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

<input id="year" maxlength="50" name="regyear" type="text" autocomplete="off"/>

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

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

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

................................................................................................................... </div>

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

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

<input id="month" maxlength="50" name="regmonth" type="text" autocomplete="off"/>

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

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

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................................................................................................................... </div>

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

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

<input id="power" maxlength="50" name="powerps" type="text" autocomplete="off"/>

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

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

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

................................................................................................................... </div>

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

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

<input id="kilometer" maxlength="50" name="kms" type="text" autocomplete="off"/>

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</div> ................................................................................. <div

class="form-control">

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

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<tr>

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<tr>

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

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

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<tr>

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

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

/></td>

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<tr>

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..................................................................................... <td>Not mentioned</td>

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

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</tr>

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</div> ................................................................................. <div

class="form-control">

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

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ble style="width:50%">

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<tr>

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

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

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

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

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<tr>

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........................................................................................ <td>Not Declared</td>

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<td><input type="radio" name="damage" value="not-declared" id="notdec"/></td>

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</table>

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

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

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

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

........................................................ <label for="model">Model Type : </label>

................................................................... <select name="model" id="model">

... <option value="" disabled selected hidden>Choose Model Name...</option>

<option value="golf">Golf </option>

............................................................ <option value="grand">Grand </option>

.............................................................. <option value="fabia">Fabia </option>

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

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

........................................................ <option value="andere">Andere </option>

......................................................... <option value="c\_max">C Max </option>

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

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

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

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

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

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

....................................................<option value="a\_klasse">A klasse </option>

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

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

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

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

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

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

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

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

................................................... <option value="e\_klasse">E Klasse </option>

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

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

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

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

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

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

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

................................................... <option value="b\_klasse">B Klasse </option>

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

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

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

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

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

................................................... <option value="c\_klasse">C Klasse </option>

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

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

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

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

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

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

.................................................. <option value="xc\_reihe">Xc Reihe </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

</option> ...................................................... <option value="z\_reihe">Z

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

value="sportage">Sportage </option>

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

</option>

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

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

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

value="ibiza">Ibiza </option> .....................................................................

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

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

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

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

value="touran">Touran </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

................................................. <option value="m\_klasse">M Klasse </option>

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

........................................................ <option value="i\_reihe">I Reihe </option>

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

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

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

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

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

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

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

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

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

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

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

.................................................. <option value="rx\_reihe">Rx Reihe </option>

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

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

................................................................... <option value="fox">Fox

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

value="matiz">Matiz </option> ...........................................................

<option value="beetle">Beetle </option>

...................................................................... <option value="c1">C1

</option> <option

value="rio">Rio </option> <option

value="touareg">Touareg </option> ............................................................

<option value="logan">Logan </option>

........................................................... <option value="spider">Spider

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

value="cuore">Cuore </option> ..........................................................

<option value="s\_max">S Max </option>

...................................................................... <option value="a2">A2

</option>

...................................................... <option value="x\_reihe">X Reihe </option>

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

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

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

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

....................................................<option value="s\_klasse">S Klasse </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

value="picanto">Picanto </option> .............................................................

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

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

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

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

value="alhambra">Alhambra </option>

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

</option> ................................................ <option value="mx\_reihe">Mx

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

value="m\_reihe">M Reihe </option> ....................................................

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

........................................................ <option value="x\_type">X Type </option>

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

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

......................................................... <option value="s\_type">S Type

</option> ......................................................... <option value="x\_trail">X

Trail </option> ......................................................... <option

value="toledo">Toledo </option>

...............................................................<option value="altea">Altea

</option>

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

</option> <option

value="voyager">Voyager </option> ........................................................

<option value="calibra">Calibra </option>

............................................................ <option value="bravo">Bravo

</option> ...................................... <option value="range\_rover">Range Rover </option> .......................................................... <option

value="antara">Antara </option>

.........................................................<option value="tucson">Tucson

</option>

...................................................................... <option value="q7">Q7 </option>

............................................................ <option value="citigo">Citigo </option>

............................................................ <option value="jimny">Jimny </option>

.................................................. <option value="cx\_reihe">Cx Reihe </option>

................................................. <option value="wrangler">Wrangler </option>

............................................................. <option value="lybra">Lybra </option>

................... <option value="range\_rover\_sport">Range Rover Sport </option>

.......................................................... <option value="lancer">Lancer </option>

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

............................................. <option value="freelander">Freelander </option>

....................................................... <option value="captiva">Captiva </option>

...................................................................... <option value="c2">C2 </option>

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

............ <option value="range\_rover\_evoque">Range Rover Evoque </option>

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

........................................ <option value="volkswagen">Volkswagen </option>

................................................................ <option value="audi">Audi </option>

................................................................. <option value="jeep">Jeep </option>

........................................................... <option value="skoda">Skoda </option>

.............................................................. <option value="bmw">Bmw </option>

.....................................................<option value="peugeot">Peugeot </option>

................................................................. <option value="ford">Ford </option>

......................................................... <option value="mazda">Mazda </option>

.......................................................... <option value="nissan">Nissan </option>

....................................................... <option value="renault">Renault </option>

............................. <option value="mercedes\_benz">Mercedes Benz </option>

................................................................ <option value="opel">Opel </option>

.................................................................. <option value="seat">Seat </option>

........................................................ <option value="citroen">Citroen </option>

.......................................................... <option value="honda">Honda </option>

................................................................... <option value="fiat">Fiat </option>

................................................................ <option value="mini">Mini </option>

............................................................ <option value="smart">Smart </option>

.................................................... <option value="hyundai">Hyundai </option>

............................... <option value="sonstige\_autos">Sonstige Autos </option>

......................................... <option value="alfa\_romeo">Alfa Romeo </option>

......................................................... <option value="subaru">Subaru </option>

............................................................ <option value="volvo">Volvo </option>

............................................. <option value="mitsubishi">Mitsubishi </option>

.................................................................... <option value="kia">Kia </option>

......................................................... <option value="suzuki">Suzuki </option>

.......................................................... <option value="lancia">Lancia </option>

...................................................... <option value="porsche">Porsche </option>

......................................................... <option value="toyota">Toyota </option>

................................................ <option value="chevrolet">Chevrolet </option>

............................................................. <option value="dacia">Dacia </option>

................................................... <option value="daihatsu">Daihatsu </option>

....................................................... <option value="trabant">Trabant </option>

................................................................ <option value="saab">Saab </option>

.................................................... <option value="chrysler">Chrysler </option>

.......................................................... <option value="jaguar">Jaguar </option>

..................................................... <option value="daewoo">Daewoo </option>

.............................................................<option value="rover">Rover </option>

.......................................... <option value="land\_rover">Land Rover </option>

................................................................ <option value="lada">Lada </option>

............................................................................................................... </select>

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

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

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

................................................................................................................... </div>

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

........................................................ <label for="fuelType">Fuel Type

:</label> .................................................................. <select

name="fuelType" id="fuel"> ....... <option value="" disabled selected hidden>Choose Fuel Type...</option>

........................................................... <option value="petrol"> Petrol

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

Diesel </option> .................................... <option value="not-declared"> Not Declared </option> <option

value="lpg">LPG </option>

.................................................................<option value="cng">CNG

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

value="hybrid">Hybrid </option> ..........................................................

<option value="others">Others </option>

....................................................... <option value="electric">Electric </option>

............................................................................................................... </select>

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

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

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

................................................................................................................... </div>

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

................................................ <label for="vehicletype">Vehicle type: </label>

........................................................ <select name="vehicletype" id="vehicle" >

.. <option value="" disabled selected hidden>Choose Vehicle Type...</option>

........................................................... <option value="coupe">Coupe </option>

<option value="suv">SUV </option>

<option value="kleinwagen">Kleinwagen </option>

<option value="limousine">Limousine </option>

.......................................................... <option value="cabrio">Cabrio </option>

................................................................... <option value="bus">Bus </option>

......................................................... <option value="kombi">Kombi </option>

........................................................ <option value="andere">Andere </option>

........................................ <option value="volkswagen">Volkswagen </option>

............................................................................................................... </select>

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

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

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

................................................................................................................... </div>

...................................................... <input type="submit" id="submit"></input>

................................................................................................................ </form>

</div>

</body>

</html>

* + 1. **value.css**

\*{ padding:0px; margin:0; box- sizing:border-box; font-family:

cursive; font- weight: bold; color: #E74C3C;

}

body{

background-image: linear-

gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car2.png);

................................................................................................ min-

height:100vh;

..........................................................................................................display:f

lex; justify-

content:center;

................................................................................................align-

items:center;

}

.header{

.......................................................................................................... color:Black;

.................................................................................................. text-align:center;

........................................................................... padding:10px 0px 10px 100px; }

#model{

........................................................................................................ width:500px;

......................................................................................................... color: black;

}

#brand{

........................................................................................................ width:500px;

......................................................................................................... color: black;

}

#fuel{

........................................................................................................ width:500px;

......................................................................................................... color: black;

}

#vehicle{

........................................................................................................ width:500px;

......................................................................................................... color: black;

}

.form{

............................................................................................. padding:30px

40px; }

.form-control{

........................................................................................... margin-bottom:10px;

......................................................................................... padding-bottom: 20px;

.................................................................................................. position:relative;

.............................................................................................. margin-left: 100px; }

.form-control label{

....................................................................................................... display:block;

............................................................................................. margin-

bottom:5px; }

.form-control input{

.................................................................................... border: 2px solid #f0f0f0;

........................................................................................................... width:80%;

................................................................................................... font-size :.8rem;

........................................................................................................ padding:5px;

..............................................................................................display:inline-table;

}

.form-control i{

................................................................................................. position:absolute;

............................................................................................................ right:20px;

.............................................................................................................. top:35px;

.................................................................................................. visibility:hidden;

}

.form-control span{

................................................................................................. position:absolute;

.................................................................................................................... left:0;

.............................................................................................................. bottom:0;

.................................................................................................. visibility:hidden;

.............................................................................................. font-weight:bolder;

.................................................................................................... font-style:italic;

..................................................................................................... font-size:1rem;

}

.form-control.success input{

.......................................................................................... border-

color:#2ecc71; }

.form-control.error input{

.......................................................................................... border-

color:#e743c3; }

.form-control.error span{

.............................................................................................................. color:red;

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

visibility:visible; }

.form-control.success i.fa-check-circle {

.......................................................................................... border-color:#2ecc71;

.................................................................................................. visibility:visible;

}

.form-control.error i.fa-exclamation-circle {

.......................................................................................... border-color:#e73c3c;

.................................................................................................. visibility:visible;

}

.form #submit{

............................................................................... background-color:#E74C3C;

......................................................................................................... border:none;

........................................................................................................ outline:none;

.......................................................................................................... color:white;

........................................................................................................ width:500px;

................................................................................................ border-radius:4px;

...................................................................................................... padding:10px;

...................................................................................................... cursor:pointer;

................................................................................................... transition:all .5s;

..................................................................................................... font-size:1rem;

.............................................................................................. margin-left: 100px;

}

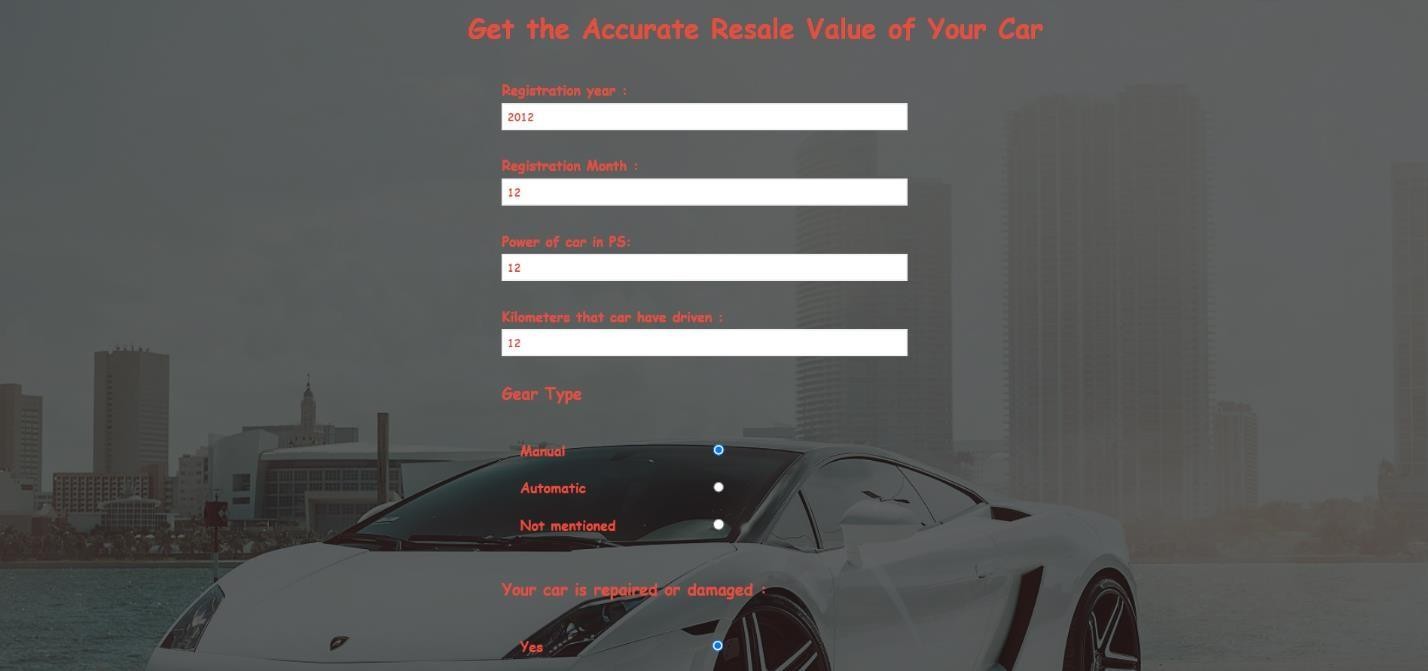
.form #submit:hover{

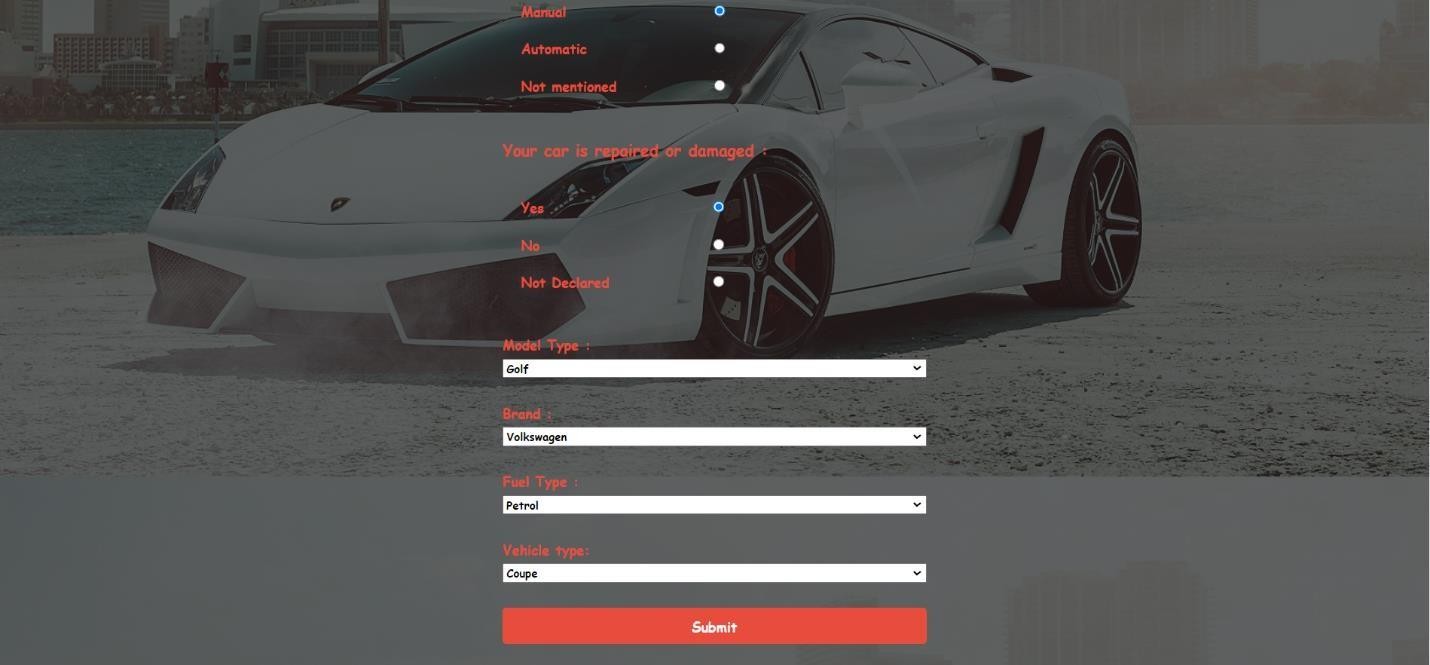
................................................................................. background-

color:#6441a5; }

.form-control #manual{

......................................................................................... padding-bottom: 20%; }

**Output**



### Output Display Page

The predicted resale car value is displayed in this page.

**Code**

* + 1. **predict.html**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

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

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<link rel="stylesheet" href="../static/css/predict.css">

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

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

</head>

<body>

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

<nav>

<a href="/"><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>

* + 1. **predict.css**

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

background-image: linear-

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

}

.text-box{ text-align:

center; position:

relative; color:

#FFE4C4;

top:50%;

}

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

}

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

15px;

}

body{

............................................................................................................. margin: 0;

}

nav{ display:flex; padding: 2%

6%;

justify-content: space-between; align- items: center;

}

**Output**

* 1. **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/naalaiya- thiran/Preprocessed/autos\_preprocessed.csv', header=0, sep=',', encoding='Latin1')

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

for i in

labels:

mapper[i] = LabelEncoder() mapper[i].fit(data[i]) tr = mapper[i].transform(data[i])

np.save(str('classes'+i+'.npy'), mapper[i].classes\_) data.loc[:, i+'\_labels'] = pd.Series(tr, index=data.index)

labeled = data[['price', 'yearOfRegistration','powerPS','kilometer','monthOfRegistration']

+[x+"\_labels" for x in labels]] print(labeled.columns)

def find\_scores(Y\_actual, Y\_pred, X\_train):

mae = mean\_absolute\_error(Y\_actual, Y\_pred) mse = mean\_squared\_error(Y\_actual, Y\_pred)

rmse = np.sqrt(mse) rmsle

= np.log(rmse) r2 = r2\_score(Y\_actual, Y\_pred) n, k = X\_train.shape

adj\_r2\_score = 1 - ((1-r2)\*(n-1)/(n-k-1))

wandb.log({"mae": mae, "mse": mse, 'rmse':rmse, 'rmsle':rmsle, 'r2':r2, 'adj\_r2':adj\_r2\_score})

def bagging\_regressor(): config\_defaults = {

'n\_estimators':100, 'max\_samples':0.4, 'bootstrap':True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = BaggingRegressor( n\_estimators=config.n\_estimators, bootstrap=config.bootstrap, max\_samples=config.max\_samples,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test)

find\_scores(Y\_test, Y\_pred, X\_train)

bagging\_regressor\_configs = { "name":'BaggingRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "n\_estimators": {

"values": [100, 200, 300]

},

"max\_samples": { "values": [0.4,0.5, 0.6]

}

}

}

sweep\_id = wandb.sweep(sweep=bagging\_regressor\_configs, project="car\_resale\_value")

wandb.agent(sweep\_id=sweep\_id, function=bagging\_regressor)

def random\_forest\_regressor(): config\_defaults = {

'n\_estimators':100, 'max\_samples':0.4, 'criterion':'squared\_error', 'bootstrap': True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = RandomForestRegressor( n\_estimators=config.n\_estimators, criterion = config.criterion, bootstrap=config.bootstrap, max\_samples=config.max\_samples,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

random\_forest\_configs = { "name":'RandomForestRegressor',

"method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "n\_estimators": {

"values": [100, 200, 300]

},

"max\_samples": { "values": [0.4,0.5, 0.6]

}

}

}

sweep\_id = wandb.sweep(sweep=random\_forest\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=random\_forest\_regressor)

def hist\_gradient\_boost\_regressor(): config\_defaults = {

'loss':'squared\_error', 'learning\_rate': 0.1, 'max\_iter':100, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = HistGradientBoostingRegressor( loss=config.loss,

learning\_rate = config.learning\_rate, max\_iter=config.max\_iter, random\_state = config.random\_state)

model.fit(X\_train, Y\_train) Y\_pred = model.predict(X\_test)

find\_scores(Y\_test, Y\_pred, X\_train)

hist\_gradient\_boost\_configs = { "name":'HistGradientBoostingRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "loss": {

"values": ['squared\_error', 'absolute\_error']

},

"learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"max\_iter": {

"values": [100,200,300]

},

"random\_state": { "values": [42]

}

}

}

sweep\_id = wandb.sweep(sweep=hist\_gradient\_boost\_configs, project="car\_resale\_value")

wandb.agent(sweep\_id=sweep\_id, function=hist\_gradient\_boost\_regressor)

def extra\_tree\_regressor(): config\_defaults = {

'criterion':'squared\_error', 'max\_samples':0.4, 'bootstrap': True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = ExtraTreesRegressor( criterion=config.criterion, bootstrap = config.bootstrap,

max\_samples=config.max\_samples, random\_state = config.random\_state)

model.fit(X\_train, Y\_train) Y\_pred = model.predict(X\_test)

find\_scores(Y\_test, Y\_pred, X\_train)

extra\_tree\_configs = { "name":'ExtraTreesRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "criterion": {

"values": ['squared\_error', 'absolute\_error']

},

"max\_samples": { "values": [0.4,0.5,

0.6] }

}

}

sweep\_id = wandb.sweep(sweep=extra\_tree\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=extra\_tree\_regressor)

def XGB\_regressor(): config\_defaults = {

'learning\_rate':0.1, 'n\_estimators': 500, 'booster':'gbtree',

'eta':0.01,

'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = XGBRegressor( learning\_rate=config.learning\_rate, n\_estimators = config.n\_estimators,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

extra\_tree\_configs = { "name":'XGBRegressor',

"method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"n\_estimators": { "values": [100,200,300]

},

"booster": {

"values": ['gbtree','gblinear']

},

"eta": {

"values": [0.01, 0.03, 0.05, 0.07]

}

}

}

sweep\_id = wandb.sweep(sweep=extra\_tree\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=XGB\_regressor)

def LGBM\_regressor(): config\_defaults = {

'objective':'root\_mean\_squared\_error', 'reg\_sqrt': True,

'metric':'rmse', 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = LGBMRegressor( learning\_rate=config.learning\_rate, n\_estimators = config.n\_estimators,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

lgbm\_configs = { "name":'LGBMRegressor', "method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"objective": {

"values": ['root\_mean\_squared\_error']

},

"boosting\_type": {

"values": ['gbdt','dart','goss','rf']

},

"reg\_sqrt": {

"values": [True]

},

"metric": { "values": ['rmse']

},

"n\_estimators": { "values": [100,200,300]

},

"random\_state": { "values": [42]

}

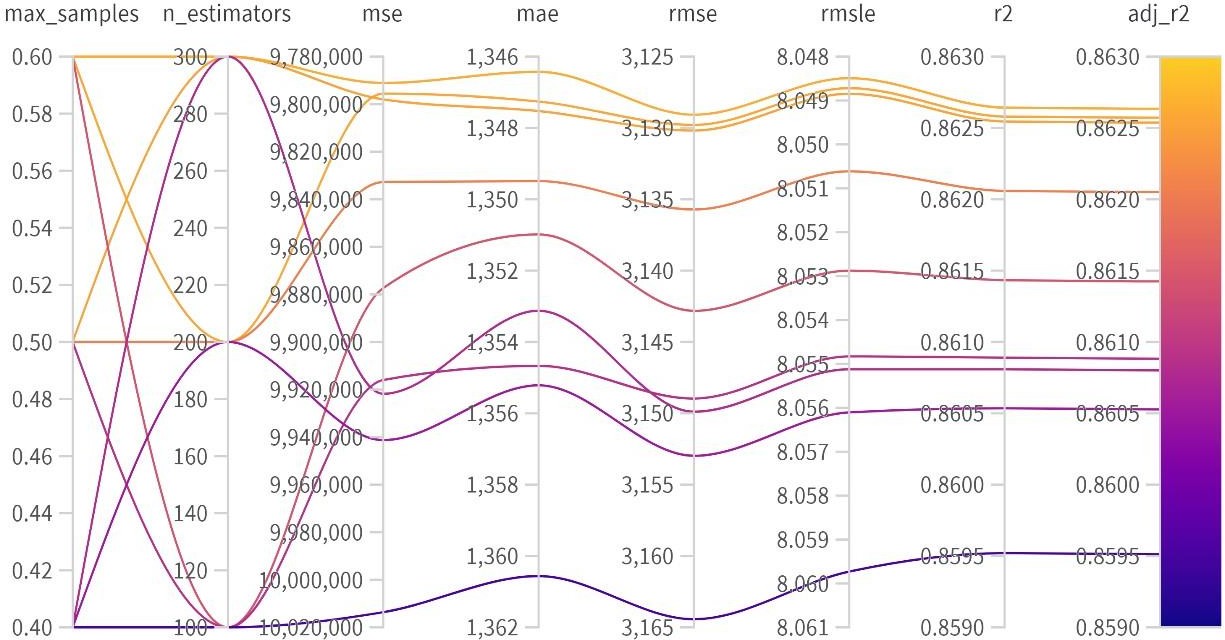
}

}

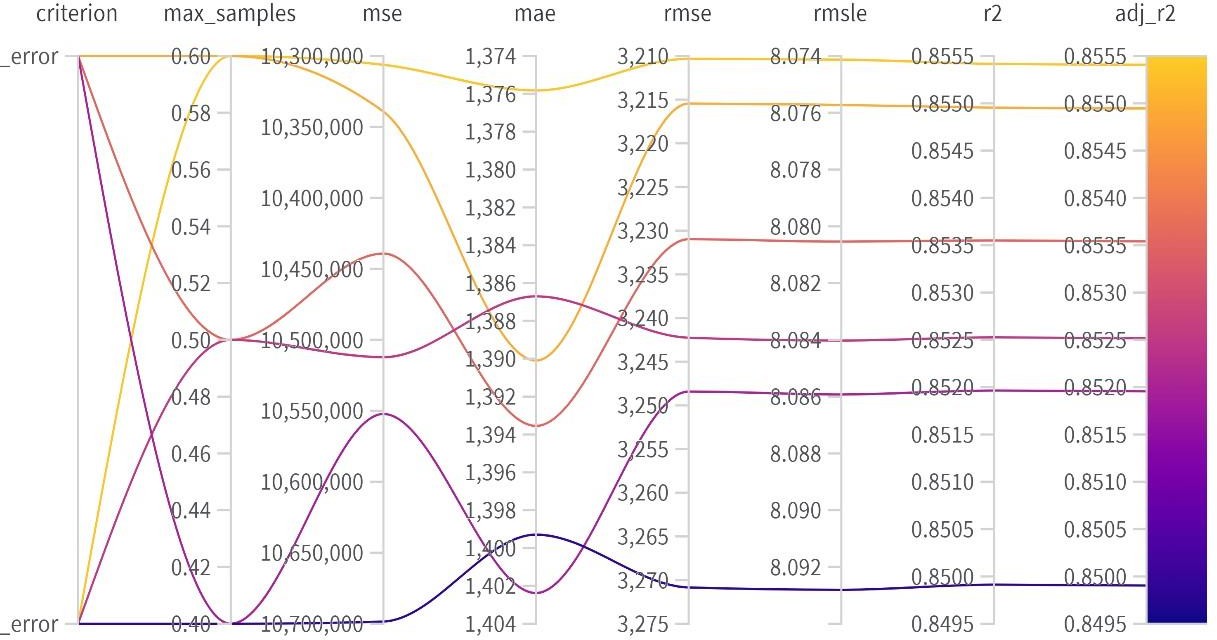
sweep\_id = wandb.sweep(sweep=lgbm\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=LGBM\_regressor)

**Output:**

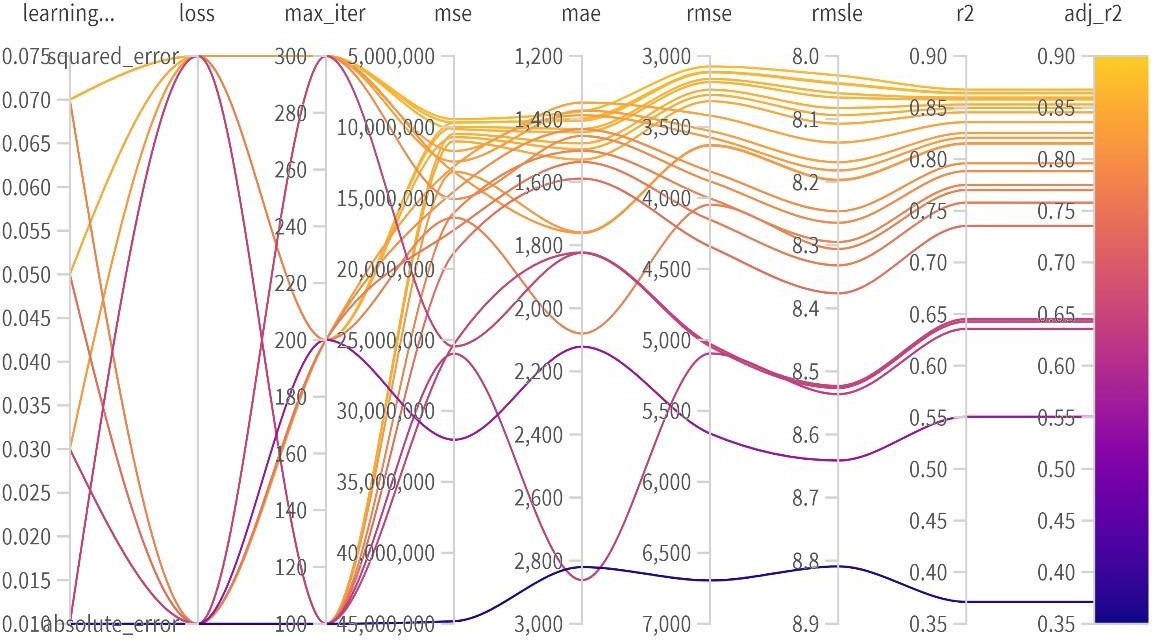
* + 1. **Bagging Regressor**



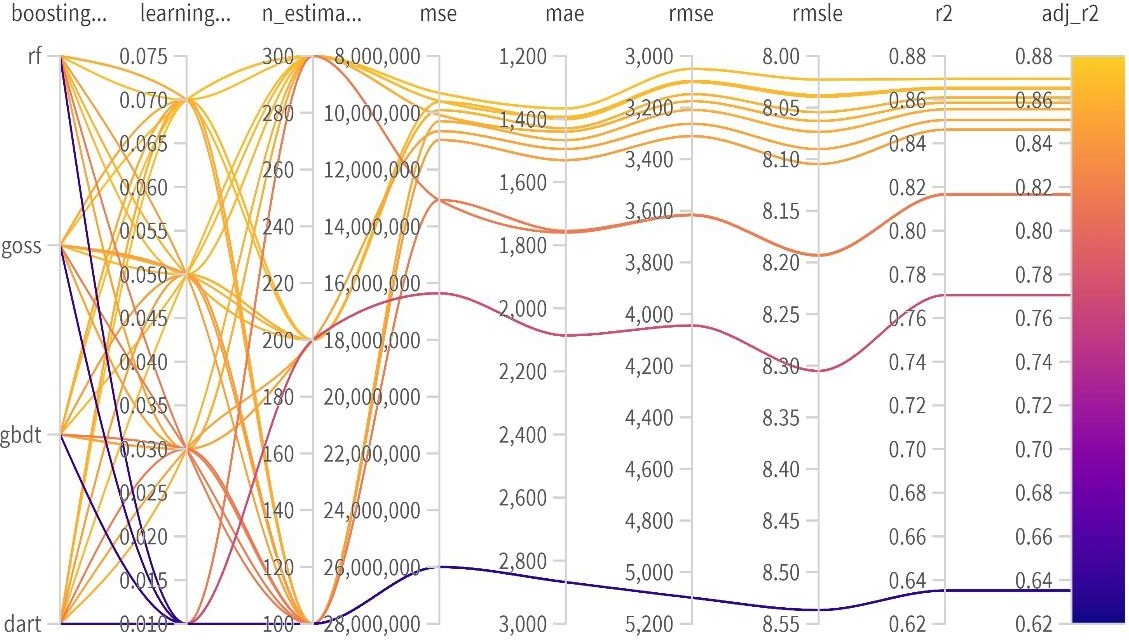
* + 1. **Extra Tree Regressor**



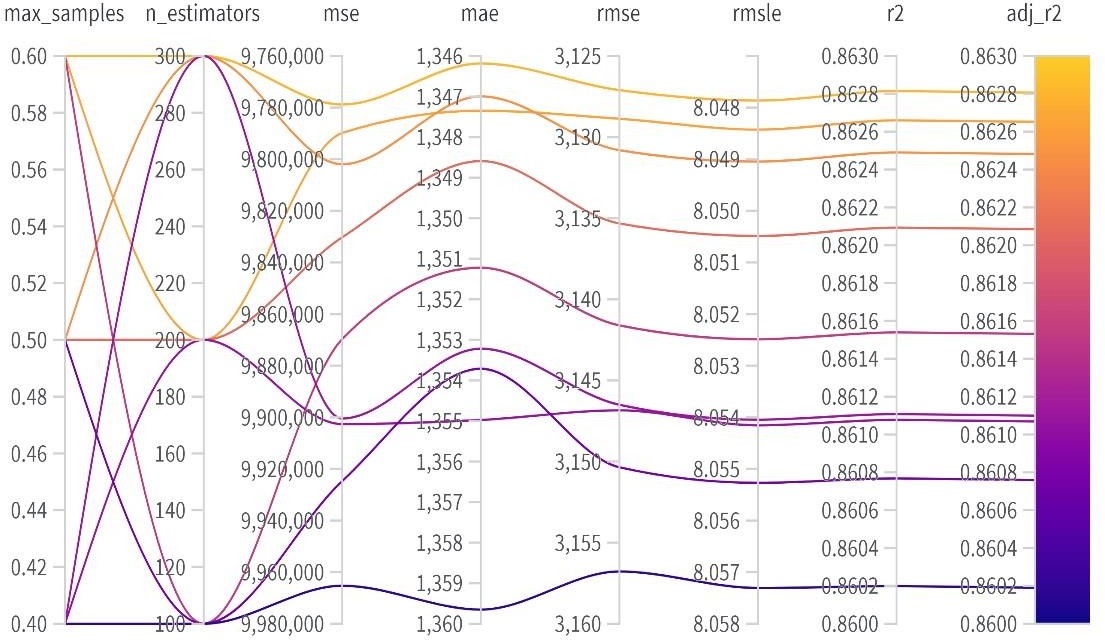
* + 1. **HOG Boosting Regressor**



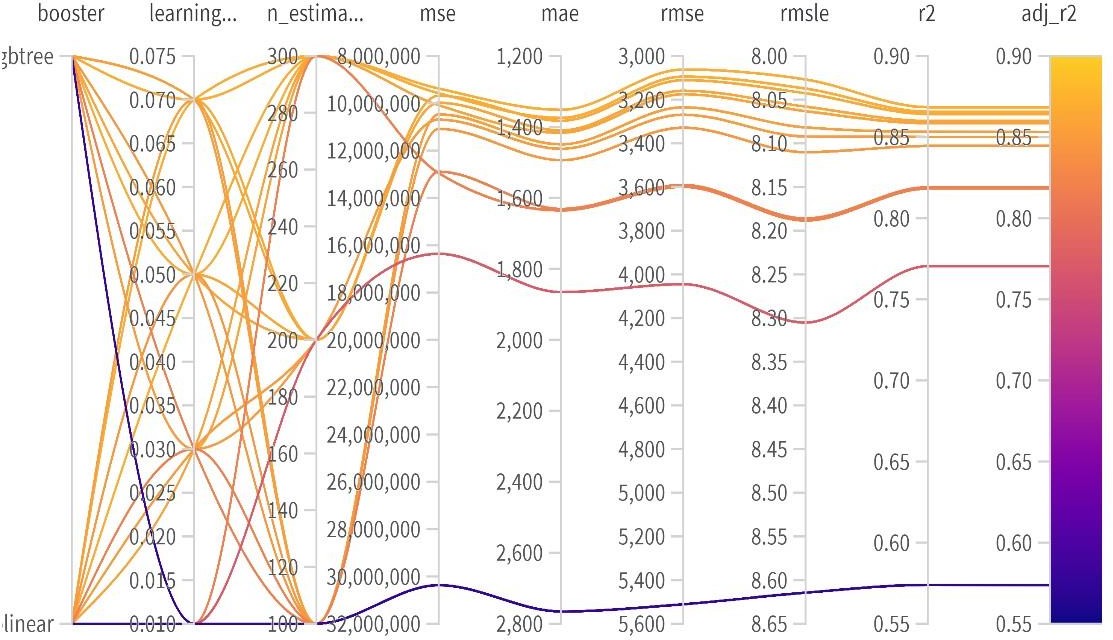
* + 1. **LGBM Regressor**



* + 1. **Random Forest Regressor**



* + 1. **XGB Regressor**



* 1. **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 = "04ZW6LlrLwAfofEU2VHPt69RKCWVc9U1o5LXkAU\_66qA"

token\_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":API\_KEY, "grant\_type": 'urn:ibm:params:oauth:grant-type:apikey'}) mltoken = token\_response.json()["access\_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken} app = Flask( name )#initiate flask app

def load\_model(file='../Result/resale\_model.sav'):#load the saved model

.............................................................................. return pickle.load(open(file,

'rb')) @app.route('/') def index():#main page

.............................................................................. return

render\_template('car.html') @app.route('/predict\_page') def predict\_page():#predicting page

.......................................................................... return

render\_template('value.html') @app.route('/predict', methods=['GET','POST']) def predict():

................................................................. reg\_year = int(request.args.get('regyear'))

............................................................. powerps = float(request.args.get('powerps'))

............................................................................ kms= float(request.args.get('kms'))

...........................................................reg\_month = int(request.args.get('regmonth'))

....................................................................... gearbox = request.args.get('geartype')

......................................................................... damage = request.args.get('damage')

.............................................................................. model = request.args.get('model')

................................................................................ brand = request.args.get('brand')

.....................................................................fuel\_type = request.args.get('fuelType')

................................................................. veh\_type = request.args.get('vehicletype')

................ new\_row = {'yearOfReg':reg\_year, 'powerPS':powerps, 'kilometer':kms,

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

.............................................. 'monthOfRegistration':reg\_month, 'gearbox':gearbox,

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

................................................................................... 'notRepairedDamage':damage,

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

................................................... 'model':model, 'brand':brand, 'fuelType':fuel\_type,

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

.............................................................................................. 'vehicletype':veh\_type}

.......................................................................................................... print(new\_row)

.................. new\_df = pd.DataFrame(columns=['vehicletype','yearOfReg','gearbox',

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

............................... 'powerPS','model','kilometer','monthOfRegistration','fuelType',

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

................................................................................... 'brand','notRepairedDamage'])

........................................ new\_df = new\_df.append(new\_row, ignore\_index=True)

.... labels = ['gearbox','notRepairedDamage','model','brand','fuelType','vehicletype']

............................................................................................................... mapper = {}

............................................................................................................. for i in labels:

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

...................................................................................... mapper[i] = LabelEncoder()

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

. mapper[i].classes = np.load('../Result/'+str('classes'+i+'.npy'), allow\_pickle=True)

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

....................................................... transform = mapper[i].fit\_transform(new\_df[i])

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

.................... new\_df.loc[:,i+'\_labels'] = pd.Series(transform, index=new\_df.index)

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

.......................................................................................... X = labeled.values.tolist()

............................................................................................................. print('\n\n', X)

............................................................................... #predict = reg\_model.predict(X)

# NOTE: manually define and pass the array(s) of values to be scored in the next line payload\_scoring = {"input\_data": [{"fields": [['yearOfReg', 'powerPS', 'kilometer', 'monthOfRegistration','gearbox\_labels', 'notRepairedDamage\_labels', 'model\_labels','brand\_labels', 'fuelType\_labels', 'vehicletype\_labels']], "values": X}]}

response\_scoring = requests.post('https://us- south.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 ':

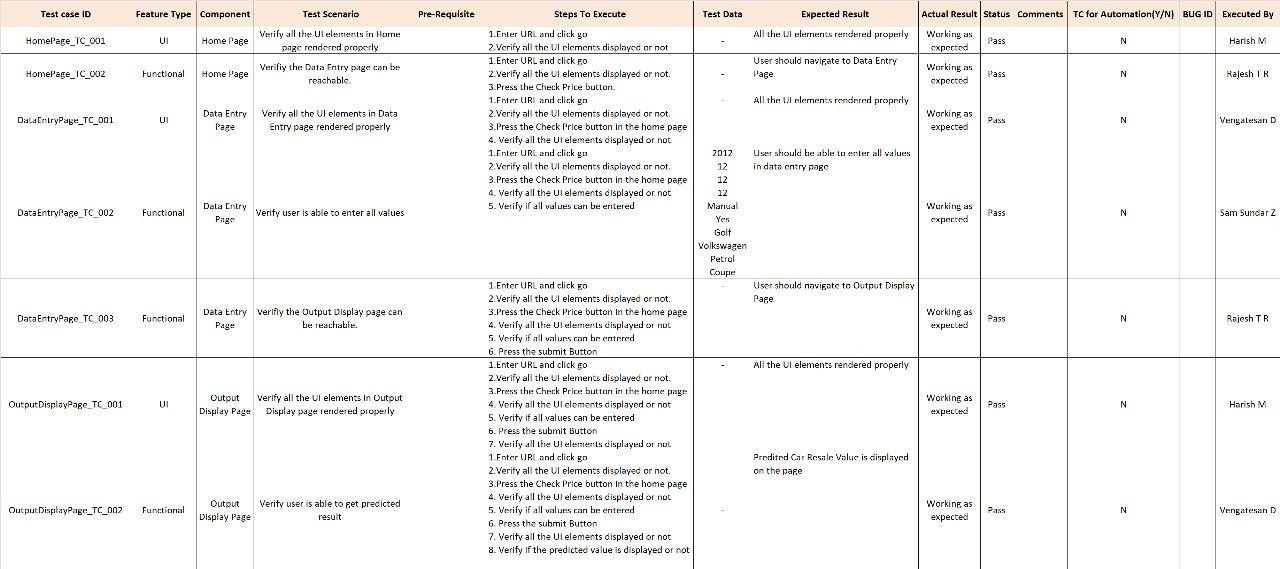
..................................................... reg\_model = load\_model()#load the saved model

............................................ app.run(host='localhost', debug=True, threaded=False)

* 1. **Test Cases Scenarios**

# TESTING

|  |  |
| --- | --- |
| 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? |

* 1. **User Acceptance Testing**
  2. **UAT Report**
     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 |

* + 1. **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 |

# RESULTS

### 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]   1. **Boosting Type**: ['gbdt','dart','goss','rf'] 2. **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 |

# 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

# 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.

# 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.

# APPENDIX

## Source Code

**User Interface**

car.html

<!DOCTYPE html>

<html lang="en" dir="ltr">

<head>

<meta charset="utf-8">

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

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

<link rel="stylesheet" href="../static/css/style.css">

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

</head>

<body>

<section class="header">

<nav>

<a href="/"><img src="../static/Images/sang.png" width="100" height="100"></a>

</nav>

<div class="text-box">

<h1>Car resale value Predictor</h1>

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

<a href="./predict\_page" class="visit-btn ">Check price</a>

</div>

</section>

</body>

</html>

style.css

\*{ margin:

0;

padding:

0;

}

.header{ min-height: 100vh; width: 100%; background-image: linear-

gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car1.png); background- position: center;

background-size:

cover; position:

relative; } nav{

display:flex; padding: 2%

6%; justify-content: space- between; align-items:

center; } .nav-links{ flex: 1; text-align: right; } .nav-links ul li{ list-style: none; display: inline-block; padding: 8px 12px; position: relative; } .nav- links ul li a{ color:white; text-decoration: none; font- size: 13px; } .text-box{ text-align: center; position:

relative; color: #FFE4C4; top:50%; } .text-box h1{ margin-top: 50px; font-size:

55px; } .text-box p{ margin:

10px 0 40px; font-size:

15px; } .visit-btn{ display:

inline; border: 3px solid #fff; padding:10px 14px; font-size: 15px; background: transparent; color: white; text- decoration:none;

}

value.html

<!DOCTYPE html>

<html lang="en" dir="ltr">

<head>

<link rel="stylesheet" href="../static/css/value.css">

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

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

<script src="https://kit.fontawesome.com/b9b6bac803.js" crossorigin="anonymous"></script> <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/fontawesome.min.css">

<style>

table, th, td

{

padding: 10px;

}

</style>

</head>

<body>

<div class="container">

<div class="header">

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

</div>

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

<div class="form-control">

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

<input id="year" maxlength="50" name="regyear" type="text" autocomplete="off"/>

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

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

<span></span>

</div>

<div class="form-control">

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

<input id="month" maxlength="50" name="regmonth" type="text" autocomplete="off"/>

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

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

<span></span>

</div>

<div class="form-control">

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

<input id="power" maxlength="50" name="powerps" type="text" autocomplete="off"/>

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

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

<span></span>

</div>

<div class="form-control">

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

<input id="kilometer" maxlength="50" name="kms" type="text" autocomplete="off"/>

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

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

<span></span>

</div>

<div class="form-control">

<h3>Gear Type</h3>

<table style="width:50%">

<tr>

<th></th>

<th></th>

</tr>

<tr>

<td>Manual</td>

/></td>

</tr>

<tr>

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

<td>Automatic</td>

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

</tr>

<tr>

/></td>

</tr>

</table>

<td>Not mentioned</td>

<td><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>

<table style="width:50%">

<tr>

<th></th>

<th></th>

</tr>

<tr>

<td>Yes</td>

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

</tr>

<tr>

id="no"/></td>

</tr>

<tr>

<td>No</td>

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

<td>Not Declared</td>

id="notdec"/></td>

<td><input type="radio" name="damage" value="not-declared"

</tr>

</table>

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

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

<span></span>

</div>

<div class="form-control">

<label for="model">Model Type : </label>

<select name="model" id="model">

<option value="" disabled selected hidden>Choose Model Name...</option>

<option value="golf">Golf </option>

<option value="grand">Grand </option>

<option value="fabia">Fabia </option>

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

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

<option value="andere">Andere </option>

<option value="c\_max">C Max </option>

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

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

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

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

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

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

<option value="a\_klasse">A klasse </option>

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

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

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

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

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

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

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

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

<option value="e\_klasse">E Klasse </option>

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

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

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

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

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

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

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

<option value="b\_klasse">B Klasse </option>

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

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

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

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

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

<option value="c\_klasse">C Klasse </option>

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

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

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

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

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

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

<option value="xc\_reihe">Xc Reihe </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<option value="z\_reihe">Z Reihe </option>

<option value="sportage">Sportage </option>

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

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

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

<option value="ibiza">Ibiza </option>

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

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

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

<option value="touran">Touran </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<option value="m\_klasse">M Klasse </option>

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

<option value="i\_reihe">I Reihe </option>

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

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

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

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

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

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

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

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

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

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

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

<option value="rx\_reihe">Rx Reihe </option>

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

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

<option value="fox">Fox </option>

<option value="matiz">Matiz </option>

<option value="beetle">Beetle </option>

<option value="c1">C1 </option>

<option value="rio">Rio </option>

<option value="touareg">Touareg </option>

<option value="logan">Logan </option>

<option value="spider">Spider </option>

<option value="cuore">Cuore </option>

<option value="s\_max">S Max </option>

<option value="a2">A2 </option>

<option value="x\_reihe">X Reihe </option>

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

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

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

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

<option value="s\_klasse">S Klasse </option>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<option value="picanto">Picanto </option>

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

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

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

<option value="alhambra">Alhambra </option>

<option value="911">911 </option>

<option value="mx\_reihe">Mx Reihe </option>

<option value="m\_reihe">M Reihe </option>

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

<option value="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

<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>

<option value="volkswagen">Volkswagen </option>

<option value="audi">Audi </option>

<option value="jeep">Jeep </option>

<option value="skoda">Skoda </option>

<option value="bmw">Bmw </option>

<option value="peugeot">Peugeot </option>

<option value="ford">Ford </option>

<option value="mazda">Mazda </option>

<option value="nissan">Nissan </option>

<option value="renault">Renault </option>

<option value="mercedes\_benz">Mercedes Benz </option>

<option value="opel">Opel </option>

<option value="seat">Seat </option>

<option value="citroen">Citroen </option>

<option value="honda">Honda </option>

<option value="fiat">Fiat </option>

<option value="mini">Mini </option>

<option value="smart">Smart </option>

<option value="hyundai">Hyundai </option>

<option value="sonstige\_autos">Sonstige Autos </option>

<option value="alfa\_romeo">Alfa Romeo </option>

<option value="subaru">Subaru </option>

<option value="volvo">Volvo </option>

<option value="mitsubishi">Mitsubishi </option>

<option value="kia">Kia </option>

<option value="suzuki">Suzuki </option>

<option value="lancia">Lancia </option>

<option value="porsche">Porsche </option>

<option value="toyota">Toyota </option>

<option value="chevrolet">Chevrolet </option>

<option value="dacia">Dacia </option>

<option value="daihatsu">Daihatsu </option>

<option value="trabant">Trabant </option>

<option value="saab">Saab </option>

<option value="chrysler">Chrysler </option>

<option value="jaguar">Jaguar </option>

<option value="daewoo">Daewoo </option>

<option value="rover">Rover </option>

<option value="land\_rover">Land Rover </option>

<option value="lada">Lada </option>

</select>

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

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

<span></span>

</div>

<div class="form-control">

<label for="fuelType">Fuel Type :</label>

<select name="fuelType" id="fuel">

<option value="" disabled selected hidden>Choose Fuel Type...</option>

<option value="petrol"> Petrol </option>

<option value="diesel"> Diesel </option>

<option value="not-declared"> Not Declared </option>

<option value="lpg">LPG </option>

<option value="cng">CNG </option>

<option value="hybrid">Hybrid </option>

<option value="others">Others </option>

<option value="electric">Electric </option>

</select>

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

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

<span></span>

</div>

<div class="form-control">

<label for="vehicletype">Vehicle type: </label>

<select name="vehicletype" id="vehicle" >

<option value="" disabled selected hidden>Choose Vehicle Type...</option>

<option value="coupe">Coupe </option>

<option value="suv">SUV </option>

<option value="kleinwagen">Kleinwagen </option>

<option value="limousine">Limousine </option>

<option value="cabrio">Cabrio </option>

<option value="bus">Bus </option>

<option value="kombi">Kombi </option>

<option value="andere">Andere </option>

<option value="volkswagen">Volkswagen </option>

</select>

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

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

</div>

<span></span>

</div>

<input type="submit" id="submit"></input>

</form>

</body>

</html>

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

}

body{

background-image: linear-

gradient(rgba(25,30,30,0.7),rgba(25,30,30,0.7)),url(../Images/car2.png); min-height:100vh;

display:flex; justify- content:center;

align-items:center;

}

.header{

color:Black; text- align:center;

padding:10px 0px 10px 100px;

}

#model{

width:500px; color: black;

}

#brand{

width:500px; color: black;

}

#fuel{

width:500px; color: black;

}

#vehicle{

width:500px; color: black;

}

.form{

}

padding:30px 40px;

.form-control{

margin-bottom:10px; padding-bottom: 20px; position:relative;

margin-left: 100px;

}

.form-control label{

display:block; margin- bottom:5px;

}

.form-control input{ border: 2px solid

#f0f0f0; width:80%;

font-size :.8rem; padding:5px; display:inline-table;

}

.form-control i{

position:absolute; right:20px; top:35px;

visibility:hidden;

}

.form-control span{ position:absolute

; left:0; bottom:0;

visibility:hidden; font- weight:bolder; font-style:italic;

font-size:1rem;

}

.form-control.success input{

border-color:#2ecc71;

}

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

}

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

}

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

visibility:visible;

}

.form-control.error i.fa-exclamation-circle { border- color:#e73c3c;

visibility:visible;

}

.form #submit{

background- color:#E74C3C; border:none;

outline:none; color:white; width:500px; border-

radius:4px;

padding:10px; cursor:pointer; transition:all .5s; font-

size:1rem;

margin-left: 100px;

}

.form #submit:hover{ background- color:#6441a5;

}

.form-control #manual{

padding-bottom: 20%;

}

predict.html

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

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

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<link rel="stylesheet" href="../static/css/predict.css">

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

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

</head>

<body>

<section class="header">

<nav>

<a href="/"><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('\n\n', X)

#predict = reg\_model.predict(X)

# NOTE: manually define and pass the array(s) of values to be scored in the next line payload\_scoring = {"input\_data": [{"fields": [['yearOfReg', 'powerPS', 'kilometer',

'monthOfRegistration','gearbox\_labels', 'notRepairedDamage\_labels', 'model\_labels','brand\_labels', 'fuelType\_labels', 'vehicletype\_labels']], "values": X}]}

response\_scoring = requests.post('https://ussouth.ml.cloud.ibm.com/ml/v4/deployments/c0f74260-1f5f-43ad- 8d71eb12ef099507/predictions?version=2022-11-13', json=payload\_scoring, headers={'Authorization': 'Bearer ' + mltoken})

predictions = response\_scoring.json() print(response\_scoring.json())

predict = predictions['predictions'][0]['values'][0][0] print("Final prediction :",predict)

return render\_template('predict.html',predict=predict) if name ==' main ':

reg\_model = load\_model()#load the saved model

app.run(host='localhost', debug=True, threaded=False)

car\_resale\_value\_prediction\_modellin g.py import pandas as pd import numpy as np

from sklearn.preprocessing import LabelEncoder

from sklearn.model\_selection import train\_test\_split, GridSearchCV

from sklearn.metrics import mean\_absolute\_error, mean\_squared\_error, r2\_score import pickle

import wandb

#regression models

from sklearn.ensemble import BaggingRegressor, RandomForestRegressor,

HistGradientBoostingRegressor, ExtraTreesRegressor from xgboost.sklearn import XGBRegressor

from lightgbm import LGBMRegressor wandb.login(key='b75e0564aba32dce859c60044418df71ce7389a8')

data = pd.read\_csv('../input/naalaiya-thiran/Preprocessed/autos\_preprocessed.csv', header=0, sep=',', encoding='Latin1')

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

for i in

labels:

mapper[i] = LabelEncoder() mapper[i].fit(data[i]) tr = mapper[i].transform(data[i]) np.save(str('classes'+i+'.npy'), mapper[i].classes\_)

data.loc[:, i+'\_labels'] = pd.Series(tr, index=data.index)

labeled = data[['price', 'yearOfRegistration','powerPS','kilometer','monthOfRegistration']

+[x+"\_labels" for x in labels]] print(labeled.columns)

def find\_scores(Y\_actual, Y\_pred, X\_train):

mae = mean\_absolute\_error(Y\_actual, Y\_pred) mse = mean\_squared\_error(Y\_actual, Y\_pred)

rmse = np.sqrt(mse) rmsle

= np.log(rmse) r2 = r2\_score(Y\_actual, Y\_pred) n, k = X\_train.shape

adj\_r2\_score = 1 - ((1-r2)\*(n-1)/(n-k-1))

wandb.log({"mae": mae, "mse": mse, 'rmse':rmse, 'rmsle':rmsle, 'r2':r2, 'adj\_r2':adj\_r2\_score})

def bagging\_regressor(): config\_defaults = {

'n\_estimators':100, 'max\_samples':0.4, 'bootstrap':True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42) model = BaggingRegressor(

n\_estimators=config.n\_estimators, bootstrap=config.bootstrap, max\_samples=config.max\_samples,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

bagging\_regressor\_configs = { "name":'BaggingRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "n\_estimators": {

"values": [100, 200, 300]

},

"max\_samples": { "values": [0.4,0.5, 0.6]

}

}

}

sweep\_id = wandb.sweep(sweep=bagging\_regressor\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=bagging\_regressor)

def random\_forest\_regressor(): config\_defaults = {

'n\_estimators':100, 'max\_samples':0.4, 'criterion':'squared\_error', 'bootstrap': True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42) model = RandomForestRegressor(

n\_estimators=config.n\_estimators, criterion = config.criterion, bootstrap=config.bootstrap, max\_samples=config.max\_samples,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test)

find\_scores(Y\_test, Y\_pred, X\_train)

random\_forest\_configs = { "name":'RandomForestRegressor',

"method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "n\_estimators": {

"values": [100, 200, 300]

},

"max\_samples": { "values": [0.4,0.5, 0.6]

}

}

}

sweep\_id = wandb.sweep(sweep=random\_forest\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=random\_forest\_regressor)

def hist\_gradient\_boost\_regressor(): config\_defaults = {

'loss':'squared\_error', 'learning\_rate': 0.1, 'max\_iter':100, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42) model = HistGradientBoostingRegressor(

loss=config.loss,

learning\_rate = config.learning\_rate, max\_iter=config.max\_iter,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

hist\_gradient\_boost\_configs = { "name":'HistGradientBoostingRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "loss": {

"values": ['squared\_error', 'absolute\_error']

},

"learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"max\_iter": {

"values": [100,200,300]

},

"random\_state": { "values": [42]

}

}

}

sweep\_id = wandb.sweep(sweep=hist\_gradient\_boost\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=hist\_gradient\_boost\_regressor)

def extra\_tree\_regressor(): config\_defaults = {

'criterion':'squared\_error', 'max\_samples':0.4, 'bootstrap': True, 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = ExtraTreesRegressor( criterion=config.criterion, bootstrap = config.bootstrap,

max\_samples=config.max\_samples, random\_state = config.random\_state)

model.fit(X\_train, Y\_train) Y\_pred = model.predict(X\_test)

find\_scores(Y\_test, Y\_pred, X\_train)

extra\_tree\_configs = { "name":'ExtraTreesRegressor', "method": "grid",

"metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "criterion": {

"values": ['squared\_error', 'absolute\_error']

},

"max\_samples": { "values": [0.4,0.5, 0.6]

}

}

}

sweep\_id = wandb.sweep(sweep=extra\_tree\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=extra\_tree\_regressor)

def XGB\_regressor(): config\_defaults = {

'learning\_rate':0.1, 'n\_estimators': 500, 'booster':'gbtree',

'eta':0.01,

'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = XGBRegressor( learning\_rate=config.learning\_rate, n\_estimators = config.n\_estimators,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

extra\_tree\_configs = { "name":'XGBRegressor',

"method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"n\_estimators": { "values": [100,200,300]

},

"booster": {

"values": ['gbtree','gblinear']

},

"eta": {

"values": [0.01, 0.03, 0.05, 0.07]

}

}

}

sweep\_id = wandb.sweep(sweep=extra\_tree\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=XGB\_regressor)

def LGBM\_regressor(): config\_defaults = {

'objective':'root\_mean\_squared\_error', 'reg\_sqrt': True,

'metric':'rmse', 'random\_state':42

}

wandb.init(config=config\_defaults) config = wandb.config

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42) model = LGBMRegressor(

learning\_rate=config.learning\_rate, n\_estimators = config.n\_estimators,

random\_state = config.random\_state) model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train)

lgbm\_configs = { "name":'LGBMRegressor', "method": "grid", "metric": {

"name": "adj\_r2", "goal": "maximize"

},

"parameters": { "learning\_rate": {

"values": [0.01, 0.03, 0.05, 0.07]

},

"objective": {

"values": ['root\_mean\_squared\_error']

},

"boosting\_type": {

"values": ['gbdt','dart','goss','rf']

},

"reg\_sqrt": {

"values": [True]

},

"metric": { "values": ['rmse']

},

"n\_estimators": { "values": [100,200,300]

},

"random\_state": {

"values": [42]

}

}

}

sweep\_id = wandb.sweep(sweep=lgbm\_configs, project="car\_resale\_value") wandb.agent(sweep\_id=sweep\_id, function=LGBM\_regressor)

car\_resale\_value\_prediction\_LGBM.py import pandas as pd import numpy as np from sklearn.preprocessing import LabelEncoder from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import mean\_absolute\_error, mean\_squared\_error, r2\_score import pickle

#regression model

from lightgbm import LGBMRegressor

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

import ibm\_boto3

def iter (self): return 0 # @hidden\_cell

# The following code accesses a file in your IBM Cloud Object Storage. It includes your

credentials.

# You might want to remove those credentials before you share the notebook. cos\_client = ibm\_boto3.client(service\_name='s3',

ibm\_api\_key\_id='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]) tr = mapper[i].transform(data[i]) np.save(str('classes'+i+'.npy'), mapper[i].classes\_) data.loc[:, i+'\_labels'] = pd.Series(tr, index=data.index)

labeled = data[['price', 'yearOfRegistration','powerPS','kilometer','monthOfRegistration']

+[x+"\_labels" for x in labels]] print(labeled.columns)

def find\_scores(Y\_actual, Y\_pred, X\_train): scores = dict()

mae = mean\_absolute\_error(Y\_actual, Y\_pred) mse = mean\_squared\_error(Y\_actual, Y\_pred)

rmse = np.sqrt(mse) rmsle

= np.log(rmse) r2 = r2\_score(Y\_actual, Y\_pred) n, k = X\_train.shape

adj\_r2\_score = 1 - ((1-r2)\*(n-1)/(n-k-1))

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

scores['adj\_r2\_score']=adj\_r2\_score return scores

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

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

X\_train, X\_test, Y\_train, Y\_test = train\_test\_split(X, Y, test\_size=0.4, random\_state=42)

model = LGBMRegressor(boosting\_type="gbdt",learning\_rate=0.07,metric="rmse",n\_estimators=300, obj ective="root\_mean\_squared\_error",random\_state=42,reg\_sqrt=True)

model.fit(X\_train, Y\_train)

Y\_pred = model.predict(X\_test) find\_scores(Y\_test, Y\_pred, X\_train) pickle.dump(model, open('resale\_model.sav', 'wb'))

get\_ipython().system('pip install -U ibm-watson-machine-learning')

from ibm\_watson\_machine\_learning import APIClient import json

wml\_credentials = { "apikey":"Qo9j8ni7qMJ8j1C8VFDRFHbuGRAhYWcTlkVqnYg1AGkE", "url":"https://us-south.ml.cloud.ibm.com"

}

wml\_client = APIClient(wml\_credentials) wml\_client.spaces.list()

SPACE\_ID= "bf7bc386-40bf-4d85-91e6-eedd2c53f245" wml\_client.set.default\_space(SPACE\_ID) wml\_client.software\_specifications.list(100)

import sklearn sklearn. version

MODEL\_NAME = 'CRVP' DEPLOYMENT\_NAME = 'CRVP'

DEMO\_MODEL = model

software\_spec\_uid = wml\_client.software\_specifications.get\_id\_by\_name('runtime-22.1- py3.9') model\_props = { wml\_client.repository.ModelMetaNames.NAME: MODEL\_NAME, wml\_client.repository.ModelMetaNames.TYPE: 'scikit-learn\_1.0',

wml\_client.repository.ModelMetaNames.SOFTWARE\_SPEC\_UID: software\_spec\_uid

}

model\_details = wml\_client.repository.store\_model( model=DEMO\_MODEL, meta\_props=model\_props,

training\_data=X\_train, training\_target=Y\_train

)

model\_details model\_id =

wml\_client.repository.get\_model\_id(model\_details)

model\_id deployment\_props = { wml\_client.deployments.ConfigurationMetaNames.NAME:DEPLOYMENT\_NAME,

wml\_client.deployments.ConfigurationMetaNames.ONLINE: {}

}

deployment = wml\_client.deployments.create( artifact\_uid=model\_id, meta\_props=deployment\_props

)

## 