

CAR RESALE VALUE PREDICTION

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Project Report Format

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INTRODUCTION ABSTRACT

Car resale value prediction helps the user to predict the resale value of the car depending upon various features like kilometres driven, fuel type, etc. This resale value prediction system is made for general purpose to just predict the amount that can be roughly acquired by the user. The most essential elements for forecast are brand and model, period use of vehicle, mileage of vehicle, gear type and fuel type utilised in the vehicle just as fuel utilisation 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 value forecast has been done precisely.

A car price prediction has been a high interest research area, as it requires noticeable effort and knowledge of the field expert. Considerable number of distinct attributes are examined for the reliable and accurate prediction

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

Several studies and related works have been done previously to predict used car prices around the world using different methodologies and approaches, with varying results of accuracy from 50% to 90%. In (Pudaruth, 2014) the researcher proposed to predict used car prices in Mauritius, where he applied different machine learning techniques to achieve his results like decision tree, K-nearest neighbours, Multiple Regression and Naïve Bayes algorithms to predict the used cars prices, based on historical data gathered from the newspaper.

Achieved results ranged from accuracy of 60-70 percent, the author suggested using more sophisticated models and algorithms to make the evaluation, with the main weakness off the decision tree and naïve Bayes that it is required to discretize the price and classify it which accrue to more inaccuracies. Moreover, he suggested a larger set of data of data to train the models hence the data gathered was not sufficient.

(Monburinon, et al., 2018) Gathered data from a German e-commerce site that totalled to 304,133 rows and 11 attributes to predict the prices of used car using different techniques and measured their results using Mean Absolute Error (MEA) to compare their results. Same training dataset and testing dataset was given to each model. Highest results achieved was by using gradient boosted regression tree with a MAE of 0.28, and MEA of 0.35 and 0.55 for mean absolute error and multiple linear regression respectively. Authors suggested adjusting the parameters in future works to yield better results, as well as using one hot encoding instead of label encoding for more realistic data interpretations on categorical data.

(Gegic, Isakovic, Keco, Masetic, & Kevric, 2019) from the International Burch University in Sarajevo, used three different machine learning techniques to predict used car prices. Using data scrapped from a local Bosnian website for used cars totalled at 797 car samples after pre-processing, and proposed using these methods: Support Vector Machine, Random Forest and Artificial Neural network. Results have shown using only one machine learning algorithm achieved results less

than 50%, whereas after combining the algorithms with pre calcification of prices using Random Forest, results with accuracies up to 87.38% was recorded.

(Noor & Jan, 2017) were able to achieve high level of accuracy using Multiple linear regression models to predict the price of cars collected from used cars website in Pakistan called Pak Wheels that totalled to 1699 records after pre-processing, and were able to achieve accuracy of 98%, this was done after reducing the total amount of attributes using variable selection technique to include significant attributes only and to reduce the complexity of the model.

(K.Samruddhi & Kumar, 2020) Proposed using Supervised machine learning model using K-Nearest Neighbour to predict used car prices from a data set obtained from Kaggle containing 14 different attributes, using this method accuracy reached up to 85% after different values of K as well as Changing the percent of training data to testing data, expectedly when increasing the percent of data that is tested better accuracy results are achieved. The model was also cross validated with 5 and 10 folds by using K fold method.

(Gongqi, Yansong, & Qiang, 2011) proposed using Artificial Neural Network (ANN) through a combined method of BP neural network and nonlinear curve fit and have achieved accurate value prediction with a feasible model.

(Listiani, 2009) used Support Vector Machines to evaluate leased cars prices, results have shown that SVM is far more accurate in large dataset with high dimensional data than Multiple linear regression. Whereas the computation Multiple linear regression can take several minutes and the SVM would take up to a day to compute the results. Multiple linear regression may be simple, but SVM is far more accurate. Moreover, the study includes Samples with up to 178 attributes which is far more than the proposed variable in our study, hence the use of multiple linear regression may be more suitable in our case.

(Kuiper, 2008) Collected data from General Motor of cars that are produced in 2005, where he as well used variable selection technique to include the most relevant attributes in his model to reduce the

complexity of the data. He proposed used Multivariate regression model that would be more suitable for values with numeric format.

In order to predict the price of used cars, researchers (Nabarun Pal, 2018) used a supervised learning method known as Random Forest. Kaggle's dataset was used as a basis for predicting used car prices. In order to determine the price impact of each feature, careful exploratory data analysis was performed. 500 Decision Trees were trained with Random Forests. It is most commonly used for classification, but they turned it into a regression model by transforming the problem into an equivalent regression problem. Using experimental results, it was found that training accuracy was 95.82%, and testing accuracy was 83.63%. By selecting the most correlated features, the model can accurately predict the car price.

In light of the number of works that have been done in this field, another group of researchers (Jian Da Wu, 2017) conducted research on this topic and tried to develop a system that consists of three components: a data acquisition system, a price forecasting algorithm, and a performance analysis. Due to its adaptive learning capability, a conventional artificial neural network (ANN) with a back-propagation network is compared to the proposed ANFIS. In the ANFIS, qualitative fuzzy logic approximation as well as adaptive neural network capabilities are included. Using ANFIS as an expert system in predicting used car prices showed better results in the experiment. Using GUI, the consumer can get accurate and convenient

information about used cars' purchasing prices, and experiments proved that the proposed system could provide accurate and convenient price forecasting.

Hence, from all literature review it is concluded that used cars price prediction is an important topic which is the area of many researchers nowadays. So far, the best achieved accuracy is 83.63% on kaggle's dataset using random forest technique. The researchers have tested multiple regressors and final model is regression model using linear regression.

Method :

The topic such as this can be assessed with mathematical models derived from quantitative data. A multiple variable regression can analyze the data by assessing the role each independent variable plays in determining the dependent variable (in this case, resale value). Significance can also be assessed by observing the p-values for each variable. The use of a statistical model will aid in making a claim on this, and to identify some of the major contributors to resale value in automobiles.

Data Collection :

The data used for this regression will be quantitative in nature. The sources of data are what someone would expect for used car information. Four sources that are used include Kelly Blue Book, Edmunds, a government fuel economy resource, and Car and Driver. Kelly Blue Book and Edmunds will both serve as data sources, with each source providing different aspects of the independent variables used. With the cooperation of these sources, data regarding price of a car-including new and used-with the respective age, mileage, make, condition, miles per gallon, safety ratings, and hybrid technology information will be obtained. These variables will allow for a regression to be run and an equation to be estimated.

Expected Outcomes :

Before I can make predictions regarding the influence each variable will have on resale value, a review of prior research and literature is appropriate. This will allow me to make a more confident prediction as well as confirm which variables are needed to produce a strong equation that explains much of the variations in vehicle depreciation. An expected equation could look like this:

$$\text{Resale Value (DV)} = \text{Intercept} - B3(\text{Age}) - B4(\text{Mileage}) + B1(\text{Make}) + B2(\text{MPG}) + B5(\text{Hybrid Tech})$$

2.2.

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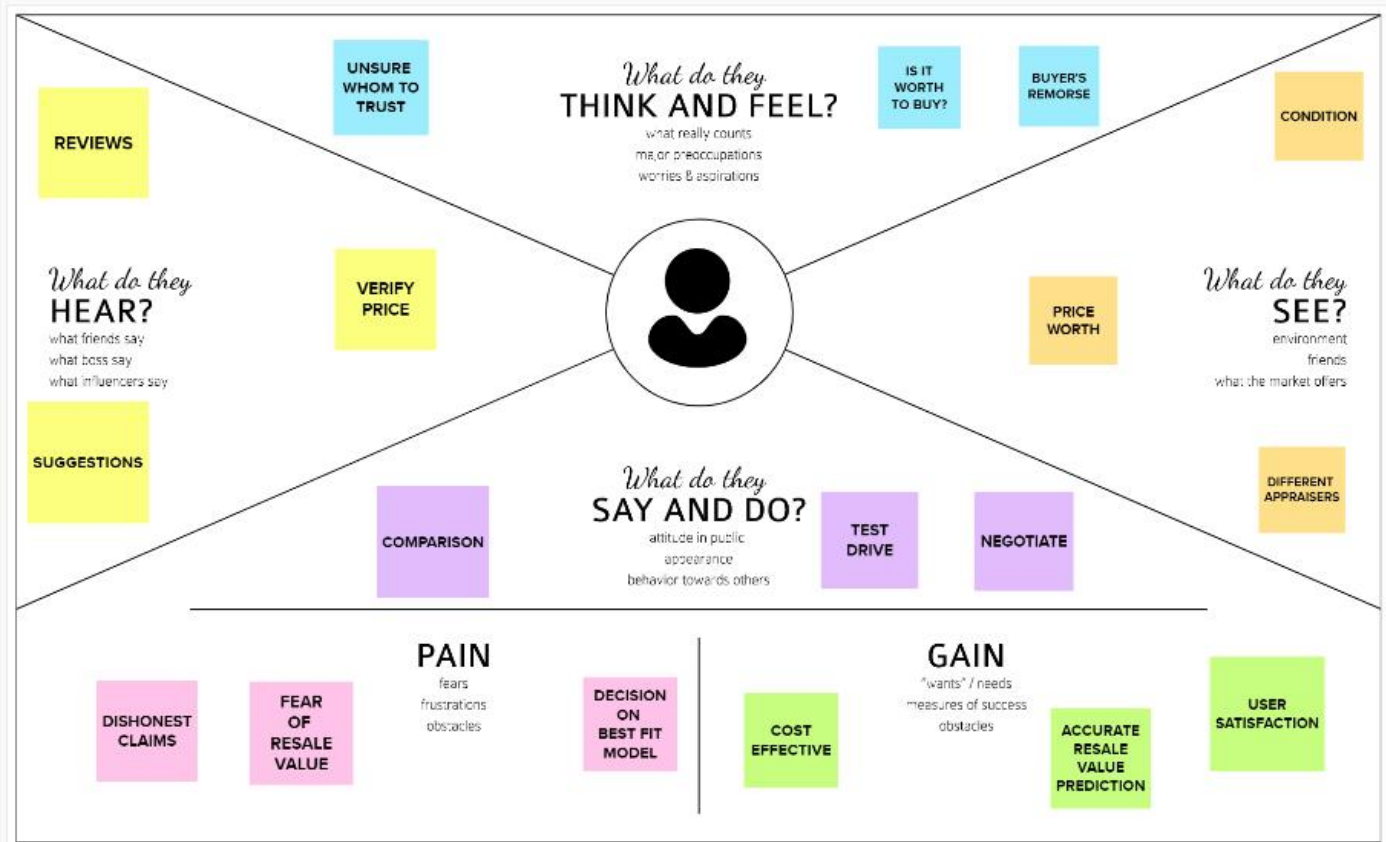
3.

3.1.

IDEATION PHASE

EMPATHY MAP

CAR RESALE VALUE PREDICTION



3.2. BRAINSTROMING

1

Define your problem statement

5 minutes

CAR RESALE VALUE PREDICTION

PROBLEM

To predict the accurate car resale value price using machine learning techniques

2

Brainstorm

10 minutes

KISHORE M M

The system works on the trained dataset of the machine learning program that evaluates the precise value of the car.

Distance travelled by the car can be used for prediction

Quotation of the car must be provided to the users

A web application using flask can be developed to integrate the model

JAGADEEP N

Finding drawbacks in existing solutions

Random forest regressor can be used

Analyze various data sources for a wide range of data

Chatbot can be added for user's queries

KANNAN M

Prediction can be made by using the images of the car uploaded

Provide search results based on the filters specified by user

Support vector regression can be used

Suggestions based on closest location of the seller

KISHAN UMAR E

Engine condition can be considered for value prediction

ANN can be used for prediction

Best accuracy must be ensured while choosing algorithms

Simple UI can be made

3

Group Ideas

30 minutes

BASED ON FACTORS TO BE CONSIDERED

Distance travelled by the car can be used for prediction

Engine condition can be considered for value prediction

Mileage and the life of car can be considered

Prediction can be made by using the images of the car uploaded

BASED ON MODELS THAT CAN BE USED

Random forest regressor can be used

Support vector regression can be used

ANN can be used for prediction

BASED ON USER EXPERIENCE

Simple UI can be made

Suggestions based on closest location of the seller

Quotation of the car must be provided to the users

Chatbot can be added for user's queries

Provide search results based on the filters specified by user

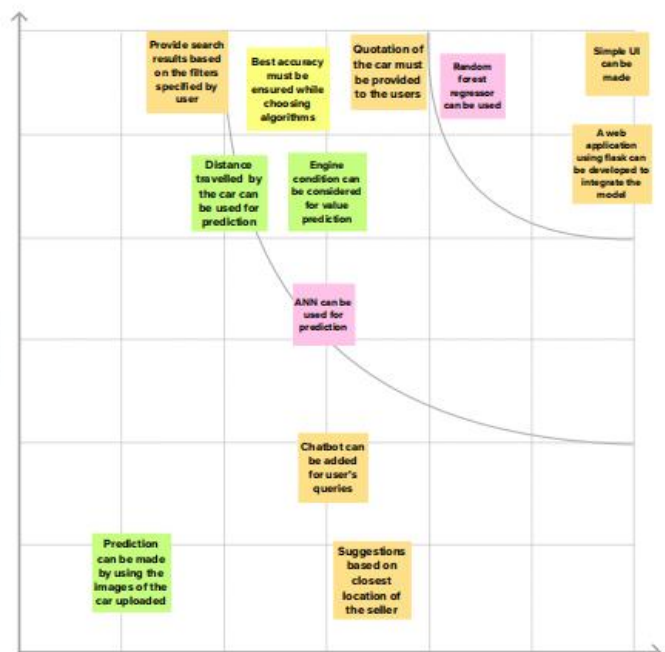
A web application using flask can be developed to integrate the model

4

Prioritize

30 minutes

Importance
If each of these tasks could get done without any difficulty or cost, which one of these the most problem solved?



3.3.

PROPOSED SOLUTION

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The Statement is to built a system to predict the resale value of the car using the regression algorithm
2.	Idea / Solution description	To forecast the car's resale value by taking into account the key elements that influence a car's resale value. Building a regression model that would give the closest estimate of the car's resale value.Using a variety of regression algorithms,The most accurate algorithm will be if adopted as a remedy, it will then be integrated into the user's web-based application receives information on the status of his goods
3.	Novelty / Uniqueness	The goal of this thesis is to analyse the behaviour of various different machine learning models for used automobile price prediction. Machine learning's understanding as it relates to automobile valuations and other comparable price prediction issues will grow as a result of this.
4.	Social Impact / Customer Satisfaction	It can be the ideal platform for purchasing or selling used vehicles. The ideal worth of the car is forecasted , preventing individuals from being let down by resale car price predictions.The customer's requirement is taken into consideration and the ultimate aim would be to bring customer satisfaction by accurate prediction.
5.	Business Model (Revenue Model)	A revenue model is a plan that outlines how a new company will make money from its regular business operations and how it will cover its operational costs and expenses.The price is predicted not only by using the condition and previous status of the car, but also it considers the current market value of the particular model.
6.	Scalability of the Solution	The model is trained by setting vast population. The sample data include all possible model and features of the car. So, it can predict the rate for all type of car in world wide.

3.4. PROBLEM SOLUTION FIT

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) Who is your customer? CS	6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choice of solutions? CC i.e. spending power, budget, no cash, network connection, available devices.	5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper (an alternative to digital note-taking) AS	Explore AS, differentiate
	<ul style="list-style-type: none"> ✓ Some who using car will use this website for selling a car. ✓ Who wants to buy second hand cars 	<ul style="list-style-type: none"> ✓ The car owners have to use this website for selling purpose. ✓ The license verification is compulsory to access the website. ✓ Replacement option is valid for a week. 	<ul style="list-style-type: none"> ✓ It is helpful for the person, who doesn't have basic knowledge on car value prediction. ✓ The replacement of regression algorithm with KNN, The accuracy increases with speed. 	

Focus on JSP, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. BE	9. PROBLEM ROOT CAUSE What is the real reason that this problem existed? What is the back RC	7. BEHAVIOUR What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and generate; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) BE	Focus on JSP, tap into BE, understand RC
	<ul style="list-style-type: none"> ✓ Working condition of a car. ✓ Chance of fake documentation. ✓ Distance Driven. ✓ Chance of false rate prediction in other sites. 	<ul style="list-style-type: none"> ✓ Chance of buying the theft cars. ✓ Worst working of engine. ✓ The rate is fixed incorrectly without the knowledge of current market-rate and the usage of car. 	<ul style="list-style-type: none"> ✓ Customer can address the outliers in prediction model with causes false output. ✓ They can address the delay in delivery and any disappointment they face in reality of using a car. 	

3. TRIGGERS What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. TR	10. YOUR SOLUTION If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behavior. SL	8. CHANNELS of BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7. CH
<ul style="list-style-type: none"> ✓ The website correctness, time compatibility. ✓ Feedback of the previous user. 		<ul style="list-style-type: none"> ✓ Customers can choose the car on their own. ✓ Can pre-book the car which is valid till a week
4. EMOTIONS: BEFORE / AFTER How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. EM	<ul style="list-style-type: none"> ✓ The model is to predict the accurate value of the resale car. ✓ By considering all the factors the output is determined with less confusing comparison. ✓ By using our application customer can know the current rate of the car in the market. 	8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.
<ul style="list-style-type: none"> ✓ Before: No accurate result which makes the customer feel hopeless and disappointment due to false prediction. ✓ After: Hopeful, Satisfied Customer, Trust. 		<ul style="list-style-type: none"> ✓ Dealers are required to choose a car and to fix the price. ✓ Suggestion from friends.

4. Solution Requirements (Functional & Non-functional)

4.1. 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

4.2. Non-functional Requirements

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

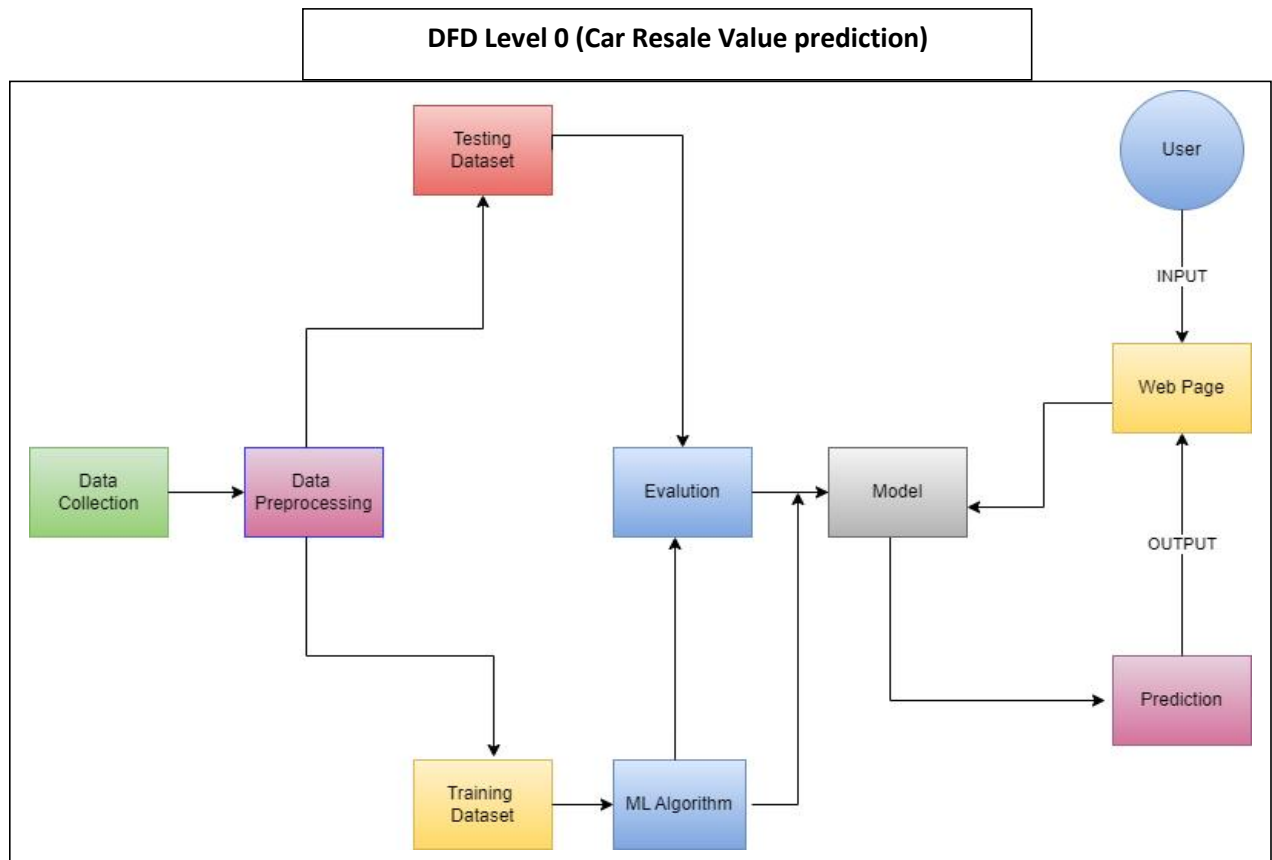
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Predicting the resale value
NFR-2	Security	Providing security to the website
NFR-3	Reliability	Providing high reliability by predicting values for different types of cars
NFR-4	Performance	Providing high performance by using some machine learning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

5.

Project Design Phase-I

5.1.

Data Flow Diagram & User Stories

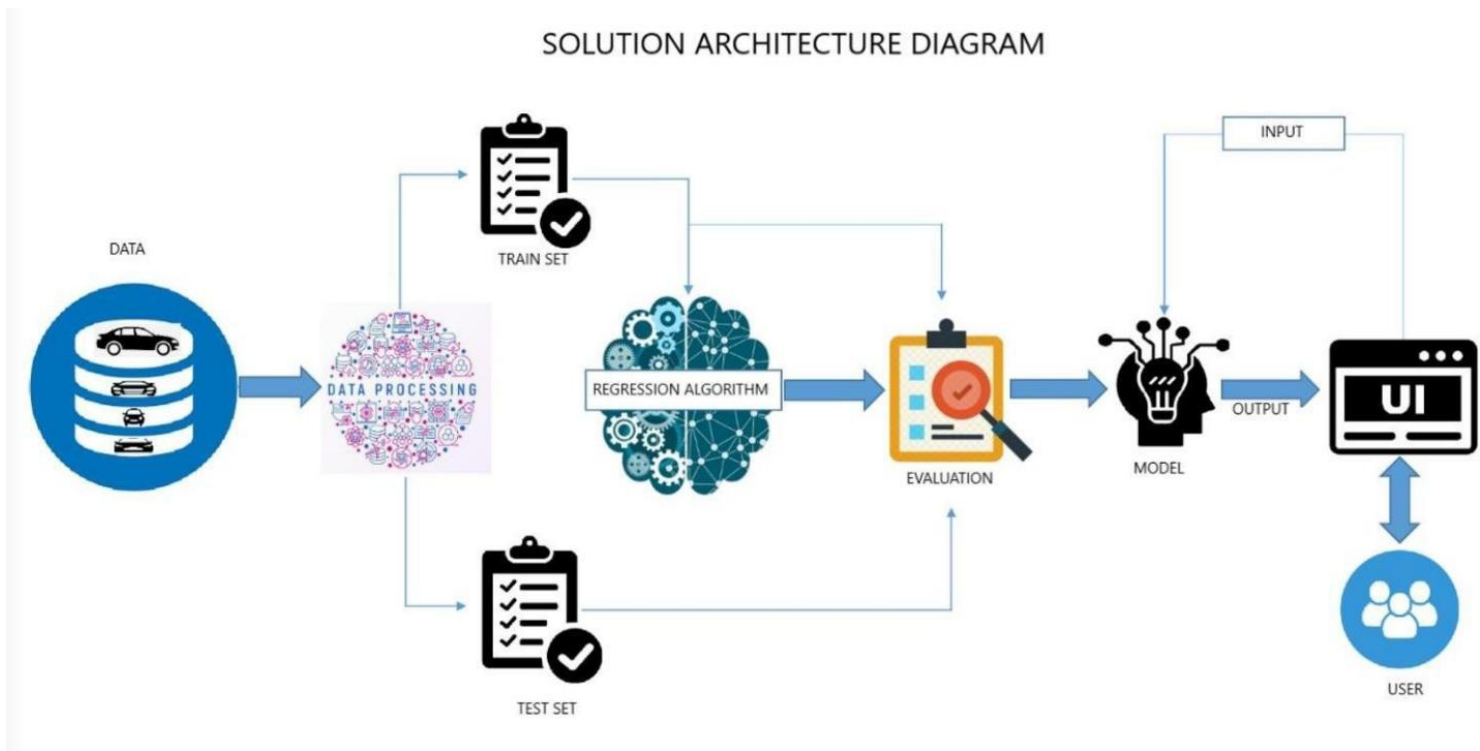


User Stories

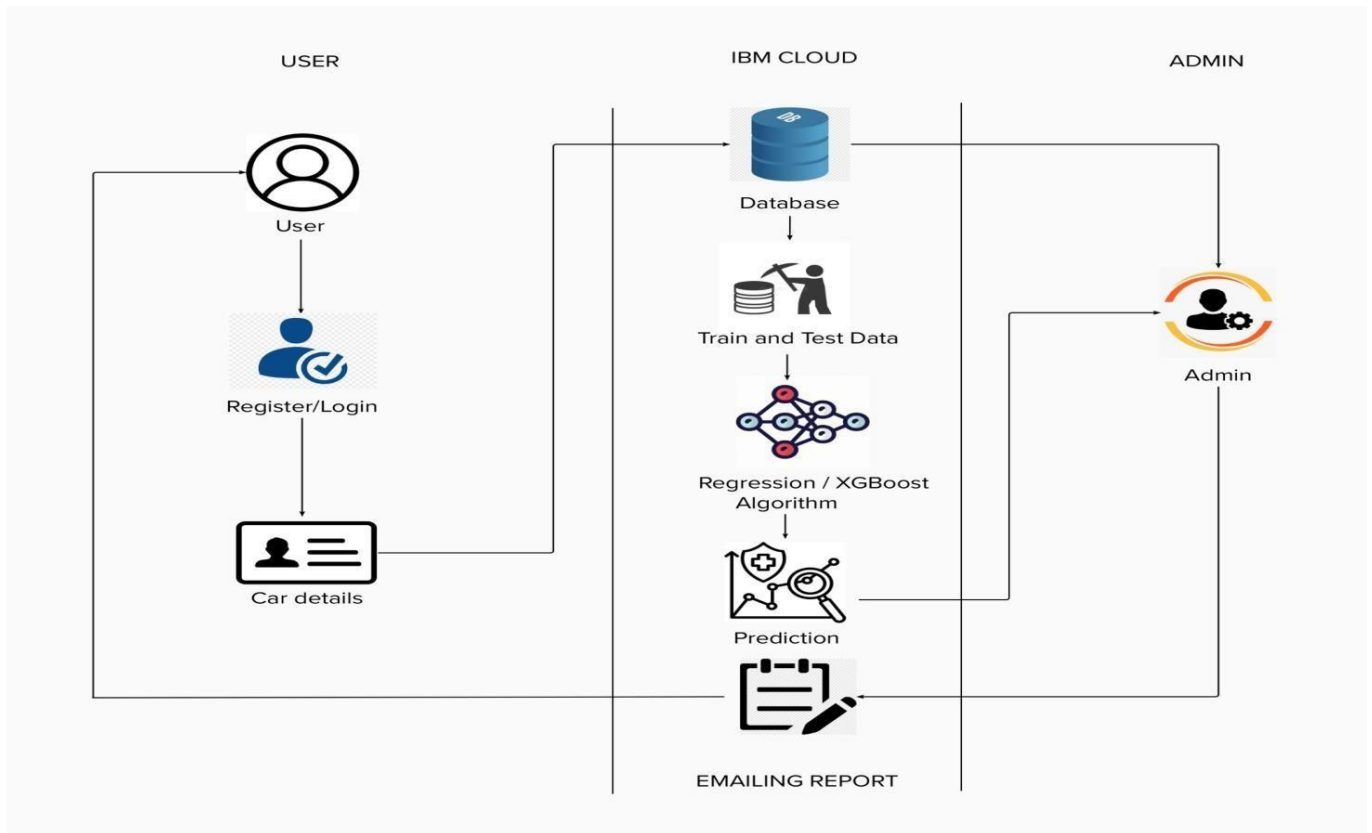
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the car details application by entering my email, password, and confirming my password.	I can access my dashboard and view the car details	High	Sprint-1
		USN-2	As a user, I will receive car resale value in the application.	I can receive my car resale value in the application	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register & access the dashboard with Gmail Login	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can access my dashboard and view the car details	High	Sprint-1
	Dashboard	USN-1-5	Show the details of different varieties of used cars.	I can know the resale value of a car	High	Sprint-1

5.2.

SOLUTION ARCHITECTURE



5.2. Technology Architecture



Technical Architecture:

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Using a Web UI, the user engages with the application	Python flask
2.	Dataset	The dataset containing the price and specification of the cars details is used for training the model	Python libraries like numpy, pandas, etc
3.	Cloud Database	The dataset is stored in the IBM cloud	IBM cloud
4.	Machine Learning Model	The machine learning algorithm is used to predict the used car rates	Regression model

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open- source framework is used for building webapplication	Python Flask , Python , IBM Cloud
2.	Security Implementations	Authentication process Implementation	Encryptions
3.	Scalable Architecture	Scalability of architecture consist of 3 tiers like: Web server, Application server, Database server	Web server- HTML,CSS, Java script Application server- Python flask Database server- IBM cloud
4.	Availability	The user can access through web browser	IBM cloud hosting
5.	Performance	Multiple users can access the web application	IBM load balance

CUSTOMER JOURNEY

up)	<p>Searching for resale car to buy</p> <p>User want to search for the suitable for buying it</p> <p>Getting information about the source</p> <p>After getting the source to buy, the customer may have a doubt about the price and whether the car may be fixed.</p>	<p>Browsing about the car</p> <p>After they can get several suitable source about the car, they can find the correct customer who is buying within the correct market.</p> <p>Comparing every cars to buy</p> <p>After they can get several suitable source about the car, they can find the correct customer who is buying within the correct market.</p>	<p>Searching for the car</p> <p>While Searching, user may find other offers about the selected product.</p> <p>Choosing the car</p> <p>After they can get several suitable source about the car, they can find the correct customer who is buying within the correct market.</p>	<p>Booking after looking the car</p> <p>User will eagerly wait for their car to come and booking it with many confirmations.</p>	<p>Using the car</p> <p>The user will be happy if the car is the good customer or else will worry about the car and condition.</p>
	<p>The interaction is made via the internet or phone, where most customer interaction is made via the internet or phone.</p> <p>Information may be provided to the customer through website or phone.</p> <p>When user can get the right information, they can get the right product to buy.</p>	<p>Information may be provided to the customer through website or phone.</p> <p>When user can get the right information, they can get the right product to buy.</p>	<p>The interaction is made via the internet or phone, where most customer interaction is made via the internet or phone.</p> <p>Information may be provided to the customer through website or phone.</p> <p>When user can get the right information, they can get the right product to buy.</p>	<p>The interaction is made via the internet or phone, where most customer interaction is made via the internet or phone.</p> <p>Information may be provided to the customer through website or phone.</p> <p>When user can get the right information, they can get the right product to buy.</p>	<p>Information may be provided to the customer through website or phone.</p> <p>When user can get the right information, they can get the right product to buy.</p>
	<p>Help me to avoid any problem while buying car.</p> <p>Help me to avoid any problem while buying car.</p>	<p>Help me to avoid any problem while buying car.</p> <p>Help me to avoid any problem while buying car.</p>	<p>Help me to avoid any problem while buying car.</p> <p>Help me to avoid any problem while buying car.</p>	<p>Help me to avoid any problem while buying car.</p> <p>Help me to avoid any problem while buying car.</p>	<p>Help me to avoid any problem while buying car.</p> <p>Help me to avoid any problem while buying car.</p>
	<p>Knowing about Good experience of car.</p> <p>Good customer care service will be provided to the customer about the car.</p>	<p>Knowing about Good experience of car.</p> <p>Good customer care service will be provided to the customer about the car.</p>	<p>Knowing about Good experience of car.</p> <p>Good customer care service will be provided to the customer about the car.</p>	<p>Knowing about Good experience of car.</p> <p>Good customer care service will be provided to the customer about the car.</p>	<p>Knowing about Good experience of car.</p> <p>Good customer care service will be provided to the customer about the car.</p>
	<p>Not getting proper responses from customer service officers.</p> <p>Less rating for an application.</p>	<p>Not getting proper responses from customer service officers.</p> <p>Less rating for an application.</p>	<p>Not getting proper responses from customer service officers.</p> <p>Less rating for an application.</p>	<p>Not getting proper responses from customer service officers.</p> <p>Less rating for an application.</p>	<p>Not getting proper responses from customer service officers.</p> <p>Less rating for an application.</p>
	<p>Having best customer service.</p> <p>After they can get the right information, they can get the right product to buy.</p>	<p>Having good experience of car.</p> <p>After they can get the right information, they can get the right product to buy.</p>	<p>Having good experience of car.</p> <p>After they can get the right information, they can get the right product to buy.</p>	<p>Having good experience of car.</p> <p>After they can get the right information, they can get the right product to buy.</p>	<p>Having good experience of car.</p> <p>After they can get the right information, they can get the right product to buy.</p>

6. Project Planning Phase

6.1. SPRINT DELIVERY PHASE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Dataset Reading and Preprocessing	USN-1	Cleaning the dataset and splitting to dependent and independent variables	2	High	KISHAN KUMAR E KANNAN M
Sprint-2	Building the Model	USN-2	Choosing the appropriate model for building and saving the models pickle file	1	High	KISHORE M M JAGADEEP N
Sprint-3	Application Building	USN-3	Using flask deploying the ML model	2	Medium	KISHORE M M KANNAN M
Sprint-4	Train the Model in IBM	USN-4	Finally train the model on IBM cloud and deploy the application	2	Medium	JAGADEEP N KISHAN KUMAR E

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	5 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	5 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	5 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

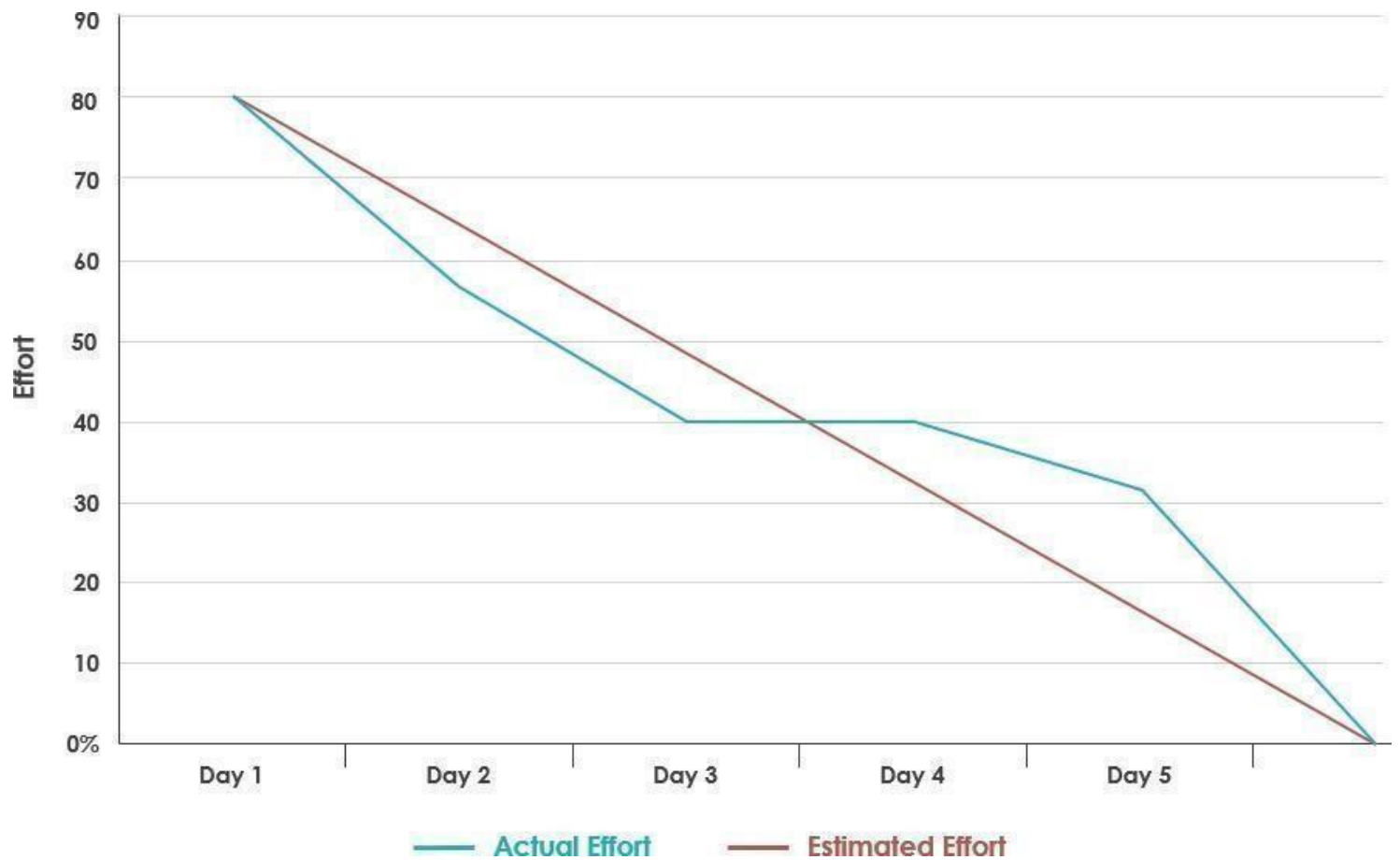
Velocity:

We have a 5-day sprint duration, and the velocity of the team is 15 (points per sprint). The team's average velocity (AV) per iteration unit (story points per day)

$$\text{Actual Velocity} = \frac{\text{Sprint Duration}}{\text{Velocity}} = \frac{15}{5} = 3$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time



6.2. MILESTONE AND ACTIVITY LIST

TITLE	DESCRIPTION	ASSIGNED TO
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc	KISHORE M M
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	JAGADEEP N
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	KISHORE M M JAGADEEP N KISHAN KUMAR E KANNAN M
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	KISHORE M M KANNAN M KISHAN KUMAR E
Problem Solution Fit	Prepare problem - solution fit document.	KISHORE M M KANNAN M JAGADEEP N
Solution Architecture	Prepare solution architecture document.	JAGADEEP N KISHAN KUMAR E

Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences withthe application (entry to exit).	KISHORE M M KANNAN M
Functional Requirement	Prepare the functional requirement document	KANNAN M KISHAN KUMAR E
Data Flow Diagrams	Draw the data flow diagramsand submit for review.	KISHORE M M JAGADEEP N
Technology Architecture	Prepare the technology architecture diagram	JAGADEEP N KISHAN KUMAR E
Prepare Milestone & ActivityList	Prepare the milestones & activity list of the project.	KISHORE M M JAGADEEP N
Sprint Delivery Plan	Prepare the Sprint Delivery Plan	KANNAN M KISHAN KUMAR E
Project Development Phase	<p>Coding & Solutioning Sprint-1 Delivery-Develop the code,Test and Push it to GitHub</p> <p>Acceptance Testing Sprint-2 Delivery-Develop the code,Test and Push it to GitHub</p> <p>Sprint-3 Delivery-Develop the code,Test and Push it to GitHub</p> <p>Performance Testing Sprint-4 Delivery-Develop the code,Test and Push it to GitHub</p>	KISHORE M M JAGADEEP N KISHAN KUMAR E KANNAN M

Milestone:

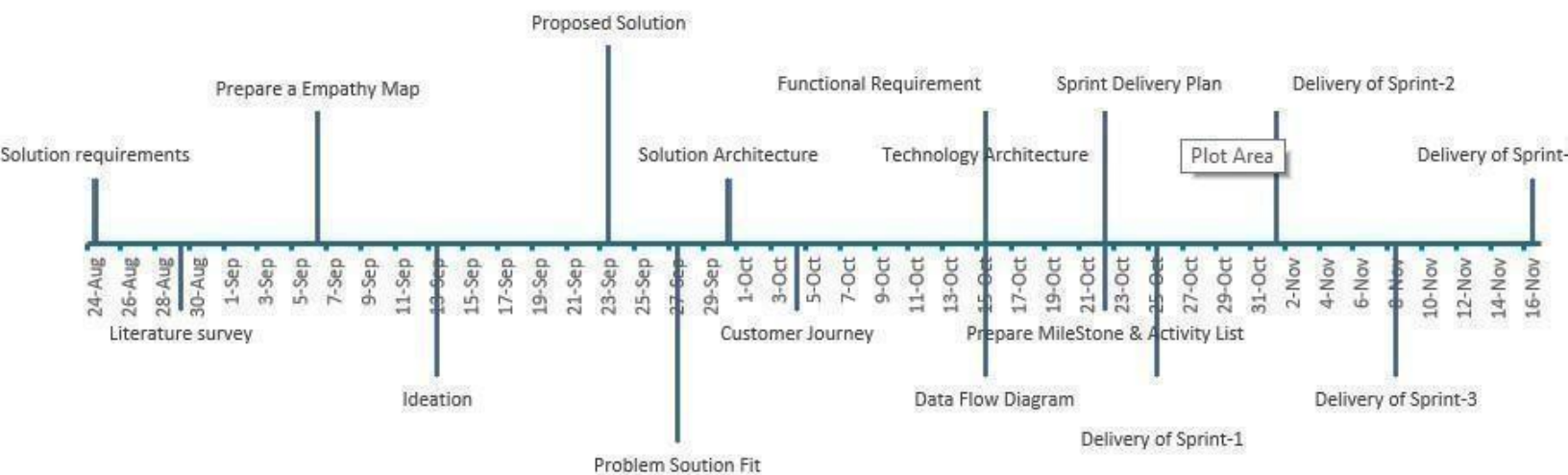
When project begins then it is expected that project related activities must be initiated. In project planning, series of milestones must be established. Milestone can be defined as recognizable endpoint of software project activity. At each milestone, report must be generated.

Milestone is distinct and logical stage of the project. It is used as signal post for project start and end date, need for external review or input and for checking budget, submission of the deliverable, etc. It simply represents clear sequence of events that are incrementally developed or build until project gets successfully completed. It is generally referred to as task with zero-time duration because they are used to symbolize an achievement or point of time in project. It helps in signifying change or stage in development.

6.3.

REPORTS FROM JIRA

Milestone Timeline Chart



7. CODING & SOLUTIONING

7.1. FEATURE 1

Initially we have planned for Downloading the dataset, import the libraries, Read the dataset, Understanding data types and summary of features, Handling missing values, Replacing the missing values, Label encoding, Split the dataset into dependent and independent variable, split the dataset into train and test set, Model building, Test the model, Evaluate the model and save the model.

```
localhost:8888/notebooks/Desktop/carresale/Model_building.ipynb
jupyter Model_building (autosaved) Python 3 (ipykernel)

File Edit View Insert Cell Kernel Widgets Help Trusted

In [1]: import pandas as pd
import numpy as np
import matplotlib as plt
from sklearn.preprocessing import LabelEncoder
import pickle

In [2]: df = pd.read_csv("autos.csv", header=0, sep=',', encoding='Latin1',)

In [3]: #print the column names for having a breif idea about the data,
#via shape and nound of rows and columns
print(df.columns ,df.shape)

Index(['dateCrawled', 'name', 'seller', 'offerType', 'price', 'abtest',
       'vehicleType', 'yearOfRegistration', 'gearbox', 'powerPS', 'model',
       'kilometer', 'monthOfRegistration', 'fuelType', 'brand',
       'notRepairedDamage', 'dateCreated', 'nrOfPictures', 'postalCode',
       'lastSeen'],
      dtype='object') (371528, 20)

In [4]: #print al the different sellers
print(df.seller.value_counts())

privat      371525
gewerblich      3
```

```
+ %>  Run Code
In [5]: #remove the seller type having only 3 cars
df[df.seller != 'gewerblich']

Out[5]:
```

	dateCrawled	name	seller	offerType	price	abtest	vehicleType	yearOfRegistration	gearbox	powerPS	n
0	2016-03-24 11:52:17	Golf_3_1.6	privat	Angebot	480	test	NaN	1993	manuell	0	
1	2016-03-24 10:58:45	A5_Sportback_2.7_Tdi	privat	Angebot	18300	test	coupe	2011	manuell	190	
2	2016-03-14 12:52:21	Jeep_Grand_Cherokee_“Overland”	privat	Angebot	9800	test	suv	2004	automatik	163	
3	2016-03-17 16:54:04	GOLF_4_1.4__3TÜRER	privat	Angebot	1500	test	kleinwagen	2001	manuell	75	
4	2016-03-31 17:25:20	Skoda_Fabia_1.4_TDI_PD_Classic	privat	Angebot	3600	test	kleinwagen	2008	manuell	69	
...
371523	2016-03-14 17:48:27	Suche_t4__vito_ab_6_sitze	privat	Angebot	2200	test	NaN	2005	NaN	0	
371524	2016-03-05 19:56:21	Smart_smart_leistungssteigerung_100ps	privat	Angebot	1199	test	cabrio	2000	automatik	101	f

File Edit View Insert Cell Kernel Widgets Help

Trusted

Python 3 (ipykernel)

```
In [7]: #print al the different sellers
print(df.offerType.value_counts())
```

```
Angebot    371516
Gesuch       12
Name: offerType, dtype: int64
```

```
In [8]: #remove the Offer Type having only 12 Listings
df[df.offerType != 'Gesuch']
```

Out[8]:

	dateCrawled	name	offerType	price	abtest	vehicleType	yearOfRegistration	gearbox	powerPS	model
0	2016-03-24 11:52:17	Golf_3_1.6	Angebot	480	test	NaN	1993	manuell	0	golf
1	2016-03-24 10:58:45	A5_Sportback_2.7_Tdi	Angebot	18300	test	coupe	2011	manuell	190	NaN
2	2016-03-14 12:52:21	Jeep_Grand_Cherokee_"Overland"	Angebot	9800	test	suv	2004	automatik	163	grand
3	2016-03-17 16:54:04	GOLF_4_1.4__3TÜRER	Angebot	1500	test	kleinwagen	2001	manuell	75	golf
4	2016-03-31 17:25:20	Skoda_Fabia_1.4_TDI_PD_Classic	Angebot	3600	test	kleinwagen	2008	manuell	69	fabia

```
In [10]: #Cars having power less than 50ps and above 900ps seems a little suspicious,
#let's remove them and see what we've got now
print(df.shape)
df = df[(df.powerPS > 50) & (df.powerPS < 900)]
```

(371528, 18)

```
In [11]: print(df.shape)
#around 50000 cars have been removed which could have introduced error to our data
```

(319789, 18)

```
In [12]: #similarly, filtering out the cars having registration years not in the mentioned range
#print(df.shape)
df = df[(df.yearOfRegistration >= 1950) & (df.yearOfRegistration < 2017)]
```

```
In [13]: print(df.shape)
# not much of a difference but still, 10000 rows have been reduced. it's better to
#get rid of faulty data instead of keeping them just to increase the size.
```

(309171, 18)

```
In [14]: #removing irrelevant columns which are either the same for all the cars in the dataset, or can
#introduce bias, so removing them too.
df.drop(['name', 'abtest', 'dateCrawled', 'nrOfPictures', 'lastSeen',
        'postalCode', 'dateCreated'], axis='columns', inplace=True)
```

```
In [15]: #final data that we have now
print(df.shape)
```

(309171, 11)

```
In [16]: #dropping the duplicates from the dataframe and storing it in a new df.
#here all rows having same value in all the mentioned columns will be deleted and by default,
#only first occurrence of any such row is kept
new_df = df.copy()
new_df = new_df.drop_duplicates(['price', 'vehicleType', 'yearOfRegistration',
                                'gearbox', 'powerPS', 'model', 'kilometer', 'monthOfRegistration', 'fuelType',
                                'notRepairedDamage'])
```

```
In [17]: #after removing duplicates
print(new_df.shape)
```

(285145, 11)

```
In [18]: #As the dataset contained some german words for many features, changing them to english
new_df.gearbox.replace(('manuell', 'automatik'), ('manual', 'automatic'), inplace=True)
new_df.fuelType.replace(('benzin', 'andere', 'elektro'), ('petrol', 'others', 'electric'), inplace=True)
new_df.vehicleType.replace(('kleinwagen', 'cabrio', 'kombi', 'andere'),
                            ('small car', 'convertible', 'combination', 'others'), inplace=True)
new_df.notRepairedDamage.replace(('ja', 'nein'), ('Yes', 'No'), inplace=True)
```

```
In [19]: ### Removing the outliers
```

```

In [20]: #Filling NaN values for columns whose data might not be there with the information provider,
#which might lead to some variance but our model
#but we will still be able to give some estimate to the user
new_df['notRepairedDamage'].fillna(value='not-declared', inplace=True)
new_df['fuelType'].fillna(value='not-declared', inplace=True)
new_df['gearbox'].fillna(value='not-declared', inplace=True)
new_df['vehicleType'].fillna(value='not-declared', inplace=True)
new_df['model'].fillna(value='not-declared', inplace=True)

In [21]: #can save the csv for future purpose.
new_df.to_csv("autos(2).csv")

In [22]: #Columns which contain categorical values, which we'll need to convert via Label encoding
labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fuelType', 'vehicleType']

In [23]: #Looping over the labels to do the Label encoding for all at once and
#saving the LABEL ENCODING FILES
mapper = {}
for i in labels:
    mapper[i] = LabelEncoder()
    mapper[i].fit(new_df[i])
    tr = mapper[i].transform(new_df[i])
    np.save(str('classes'+i+'.npy'), mapper[i].classes_)
    print(i,":",mapper[i])
    new_df.loc[:, i + '_labels'] = pd.Series(tr, index=new_df.index)

gearbox : LabelEncoder()

```

Train-Test Split

```

In [26]: #Storing price in Y and rest of the data in X
Y = labeled.iloc[:,0].values
X = labeled.iloc[:,1:].values

In [27]: #need to reshape the Y values
Y = Y.reshape(-1,1)

In [28]: from sklearn.model_selection import cross_val_score, train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.3, random_state = 3)

```

Model building and Fitting

```

In [29]: from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import r2_score
regressor = RandomForestRegressor(n_estimators=1000,max_depth=10,random_state=34)

In [30]: #fitting the model
regressor.fit(X_train, np.ravel(Y_train,order='C'))

Out[30]: RandomForestRegressor(max_depth=10, n_estimators=1000, random_state=34)

```

jupyter Model_building (autosaved) Python 3 (ipykernel)

```

File Edit View Insert Cell Kernel Widgets Help
In [31]: #predicting the values fo test test
y_pred = regressor.predict(X_test)

In [32]: #printing the Accuracy for test set
print(r2_score(Y_test,y_pred))

0.834527626497731

In [33]: #for testing on user input values
y_pred1 = regressor.predict([[2011,190,125000,5,1,0,163,1,3,3]])
#predicting price for a user input values
print(y_pred1)

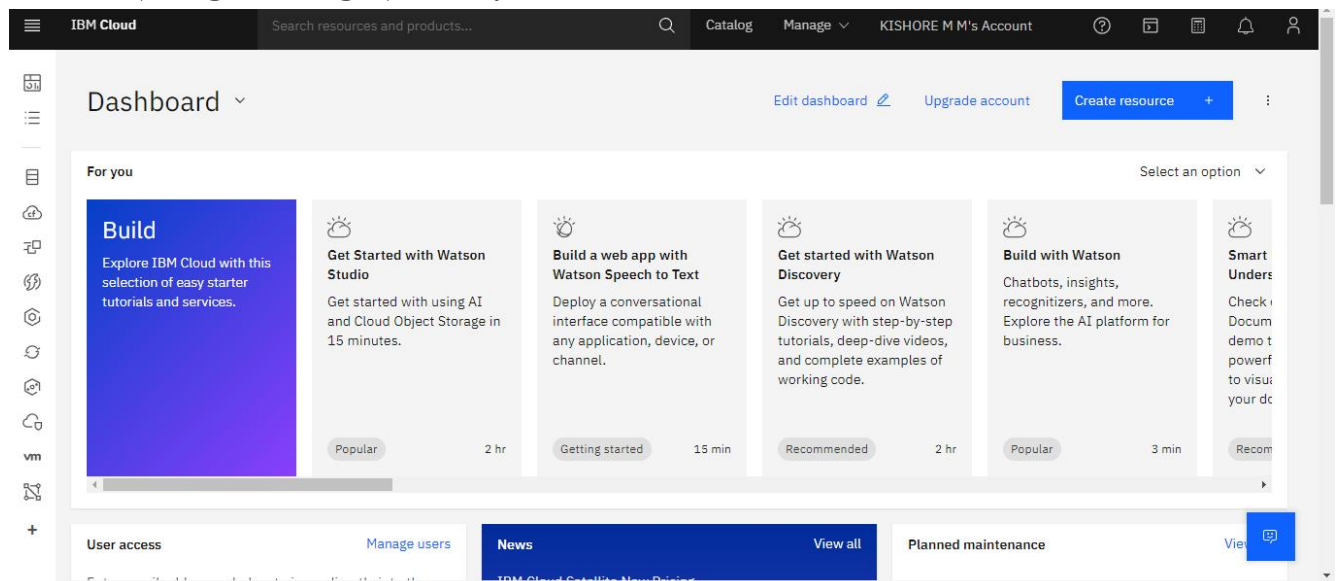
[19559.28944983]

In [35]: #saving the model for future use.
filename = 'car_resale_value.sav'
pickle.dump(regressor, open(filename, 'wb'))

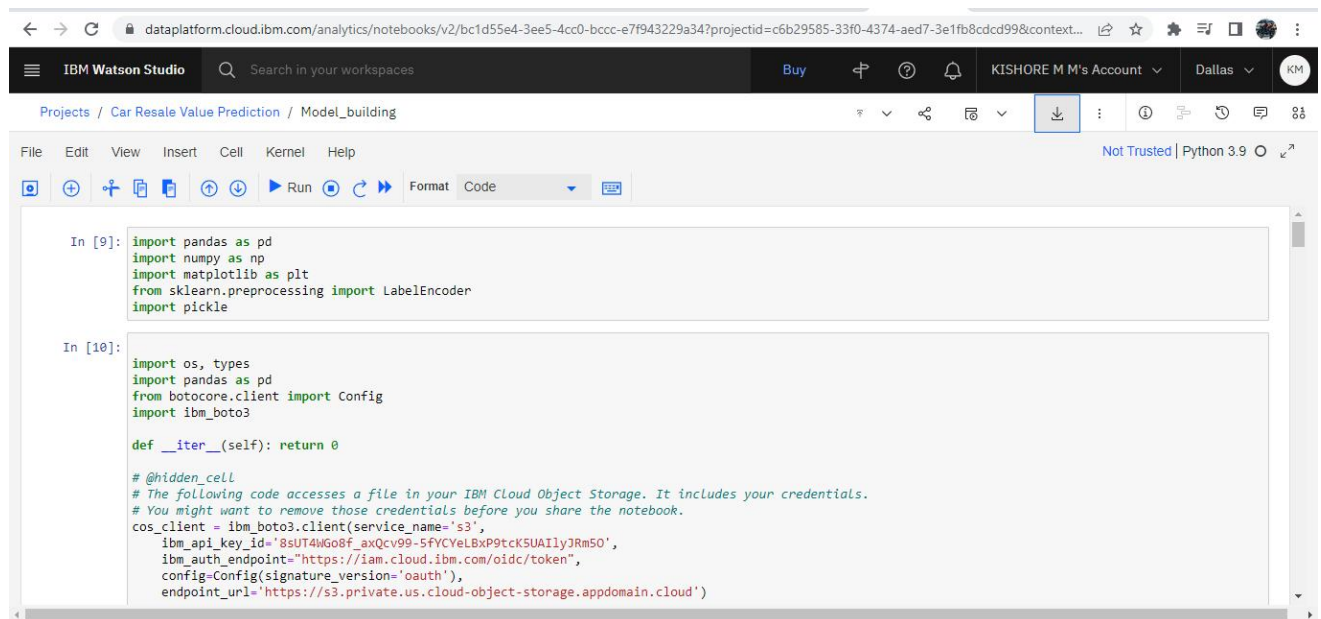
In [ ]:

```

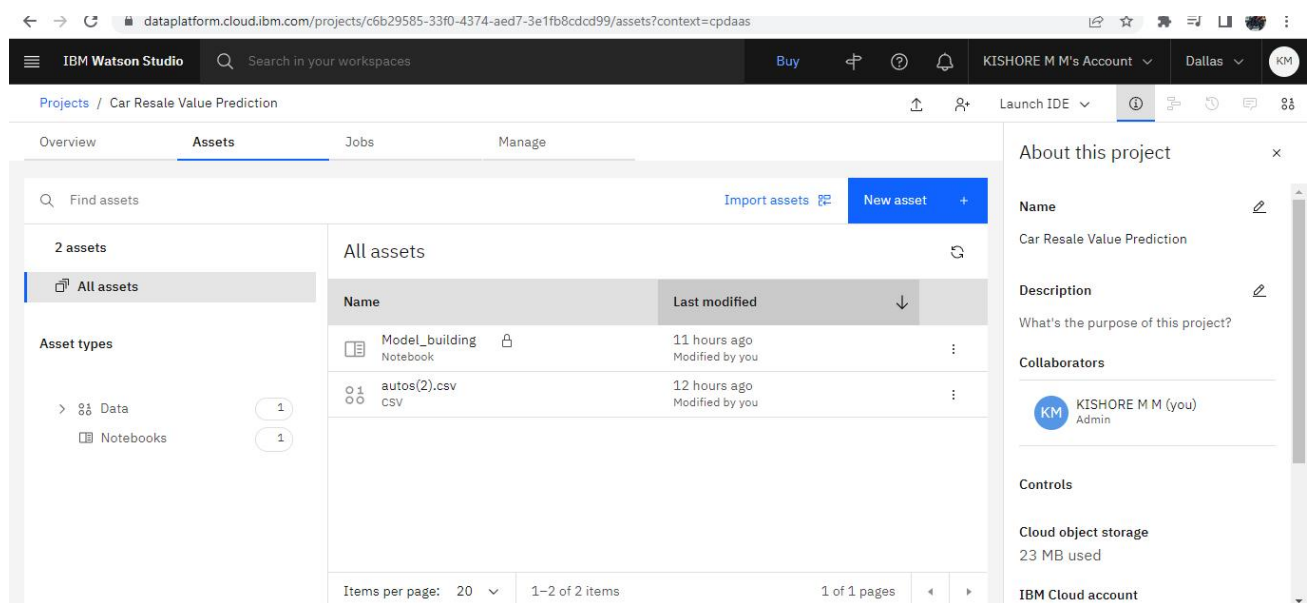
TRAIN MODEL ON IBM:



The screenshot shows the IBM Cloud Dashboard. At the top, there's a navigation bar with 'IBM Cloud', a search bar, and links for 'Catalog', 'Manage', and 'KISHORE M M's Account'. The main section is titled 'Dashboard' and includes a 'Create resource' button. Below this, there's a 'For you' section with several cards: 'Build' (Explore IBM Cloud with this selection of easy starter tutorials and services.), 'Get Started with Watson Studio' (Get started with using AI and Cloud Object Storage in 15 minutes.), 'Build a web app with Watson Speech to Text' (Deploy a conversational interface compatible with any application, device, or channel.), 'Get started with Watson Discovery' (Get up to speed on Watson Discovery with step-by-step tutorials, deep-dive videos, and complete examples of working code.), 'Build with Watson' (Chatbots, insights, recognizers, and more. Explore the AI platform for business.), and 'Smart Under' (Check i Docum demo t power to visu: your dc). At the bottom, there are links for 'User access', 'Manage users', 'News', 'View all', and 'Planned maintenance'.



The screenshot shows the IBM Watson Studio Notebook interface. The top bar includes 'IBM Watson Studio', a search bar, and links for 'Buy', 'KISHORE M M's Account', and 'Dallas'. The main section is titled 'Projects / Car Resale Value Prediction / Model_building'. Below this, there's a 'File Edit View Insert Cell Kernel Help' menu and a 'Run' button. The notebook content shows two code cells. The first cell (In [9]) imports pandas, numpy, matplotlib, sklearn.preprocessing, and pickle. The second cell (In [10]) imports os, types, pandas, boto3, and Config, and defines a class with a __iter__ method. The notebook is running on Python 3.9.



The screenshot shows the IBM Watson Studio Assets page. The top bar includes 'IBM Watson Studio', a search bar, and links for 'Buy', 'KISHORE M M's Account', and 'Dallas'. The main section is titled 'Projects / Car Resale Value Prediction'. Below this, there's a 'Launch IDE' button. The 'Assets' tab is selected, showing a list of assets. The table has columns for 'Name' and 'Last modified'. The assets listed are 'Model_building Notebook' (11 hours ago) and 'autos(2).csv CSV' (12 hours ago). A sidebar on the left shows 'Asset types' with 'Data' (1) and 'Notebooks' (1). A right sidebar titled 'About this project' shows the project name 'Car Resale Value Prediction', description 'What's the purpose of this project?', collaborators (KISHORE M M (you) Admin), and controls (Cloud object storage 23 MB used, IBM Cloud account).

Name	Last modified
Model_building Notebook	11 hours ago Modified by you
autos(2).csv CSV	12 hours ago Modified by you

dataplatform.cloud.ibm.com/home?context=cpdaas

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- Build and manage ML models with Watson Studio
- Query data anywhere with Watson Query

Projects

Car Resale Value Prediction Today at 12:12 AM

Notifications

Online deployment ready
The online deployment newdeployment in space models is ready to accept
Today at 01:08 AM

Deployments

models Today at 01:07 AM

New in gallery

NOTEBOOK +

Use AutoAI and Lale to predict credit risk with...

Learn how to use AutoAI experiments in this notebook by getting a German credit data set and train the model to predict banking credit. Then, compare several trained models for

dataplatform.cloud.ibm.com/ml-runtime/spaces/3b80e41d-7d6d-42ce-a317-184bbb596456/deployments?context=cpdaas

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Deployments /

models

Overview Assets **Deployments** Jobs Manage

Search

Name	Type	Status	Asset	Last modified
(p) newdeployment	Online	Deployed	Car_Resale_model	11 hours ago KISHORE M M (You)

Items per page: 20 1-1 of 1 items 1 of 1 pages

Drop files here or browse for files to upload.

Stay on the page until upload completes. Incomplete uploads are cancelled.

dataplatform.cloud.ibm.com/ml-runtime/deployments/4965bcba-59dc-4c55-8155-c45be9923199/implementation?space_id=3b80e41d-7d6d-42ce-a317-184...

IBM Watson Studio Search in your workspaces Buy ? KISHORE M M's Account Dallas KM

Deployments / models / Car_Resale_model /

newdeployment Deployed Online

API reference Test

Direct link

Endpoint

`https://us-south.ml.cloud.ibm.com/ml/v4/deployments/4965bcba-59dc-4c55-8155-c45be9923199/predictions?version=2022-11-16`

Bearer <token> IAM

Code snippets

cURL Java JavaScript **Python** Scala

```
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "<your API key>"
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"]
```

Integrate flask with scoring end point

```
File Edit Selection View Go Run Terminal Help app_ibm.py - Visual Studio Code

app_ibm.py X
C:\Users\KISHORE\Desktop> flaskapp > app_ibm.py > ...
1 import requests
2 import pickle
3 import numpy as np
4 import pandas as pd
5 from flask import Flask, render_template, request
6 from sklearn.preprocessing import LabelEncoder
7 import json
8
9 app = Flask(__name__, template_folder='templates')
10 API_KEY = "XLRnkM12L6Dz9nQ2xxbnVnISiD9KtcKgLiioS1uU0380"
11 token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
12 | API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
13 mltoken = token_response.json()["access_token"]
14
15 header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}
16
17 @app.route('/')
18 def index():
19 | return render_template('index.html')
20
21
22 @app.route("/predict")
23 def predict():
24 | return render_template('prediction.html')
25
26 @app.route('/y_predict', methods=['GET', 'POST'])
27 def y_predict():
28 | Fuel_Type_Diesel = 0
29 | regyear = int(request.form['regyear'])
30 | powerps = float(request.form['powerps'])
31 | kms = float(request.form['kms'])
32 | regmonth = int(request.form.get('regmonth'))
33 | resinhv = request.form['resinhv']
```

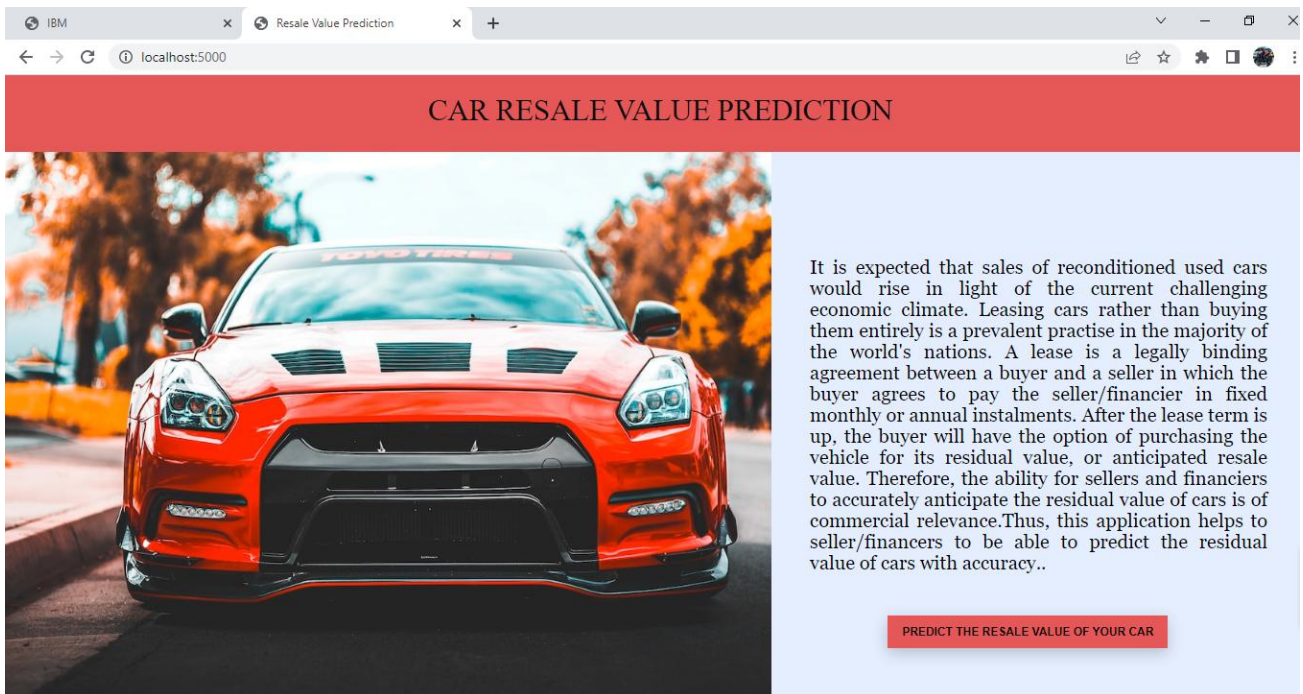
```
File Edit Selection View Go Run Terminal Help app_ibm.py - Visual Studio Code

app_ibm.py X
C:\Users\KISHORE\Desktop> flaskapp > app_ibm.py > ...
48 labels = ['gearbox', 'notRepairedDamage', 'model', 'brand', 'fueltype', 'vehicletype']
49 mapper = {}
50 for i in labels:
51 | mapper[i] = LabelEncoder()
52 | mapper[i].classes_ = np.load(str('classes' + i + '.npy'), allow_pickle=True)
53 | tr = mapper[i].fit_transform(new_df[i])
54 | new_df.loc[:, i + '_labels'] = pd.Series(tr, index=new_df.index)
55 labeled = new_df[['yearOfRegistration',
56 | 'powerPS',
57 | 'kilometer',
58 | 'monthOfRegistration',
59 | ]]
60 | + [x + '_labels' for x in labels]]
61 X = labeled.values
62 print(X)
63
64 payload_scoring = {"input_data": [{"field": [['yearOfRegistration', 'powerPS', 'kilometer',
65 | 'monthOfRegistration', 'gearbox', 'notRepairedDamage',
66 | 'model', 'brand', 'fuelType',
67 | 'vehicleType']], "values": X.tolist()}]}
68 response_scoring = requests.post('https://us-south.ml.cloud.ibm.com/ml/v4/deployments/4965bcb4-59dc-4c55-8155-c45be9923199/predictions?version=2
69 | json=payload_scoring, headers={'Authorization': 'Bearer ' + mltoken})
70 pred = response_scoring.json()
71 print(pred)
72 out = pred['predictions'][0]['values'][0][0]
73 return render_template('prediction.html', ypred='The resale value predicted is ${:.2f}'.format(out))
74
75
76
77
78 if __name__ == '__main__':
79 | app.run(host='localhost', debug=True, threaded=False)
```

OUTPUT SCREENSHOTS

```
C:\Windows\System32\cmd.exe - python app_ibm.py
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\KISHORE\Desktop\carresale\flaskapp>python app_ibm.py
* Serving Flask app 'app_ibm'
* Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
* Running on http://localhost:5000
Press CTRL+C to quit
* Restarting with stat
* Debugger is active!
* Debugger PIN: 498-621-506
127.0.0.1 - - [19/Nov/2022 08:45:21] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [19/Nov/2022 08:45:23] "GET /static/img.jpg HTTP/1.1" 304 -
127.0.0.1 - - [19/Nov/2022 08:45:23] "GET /favicon.ico HTTP/1.1" 404 -
```



PREDICT THE ACCURATE RESALE VALUE OF YOUR CAR!!

Please fill the following details of your car:

Registration Year	<input type="text" value="2019"/>
Registration Month	<input type="text" value="March"/>
Power of car in PS	<input type="text" value="420"/>
Kilometers the car has driven	<input type="text" value="50000"/>
Gear Box Type	<input type="radio"/> Manual <input checked="" type="radio"/> Automatic <input type="radio"/> Not declared
Your car is damaged or repaired	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not declared
Model Type	<input type="text" value="1_reihe"/>
Brand of the car	<input type="text" value="ford"/>

PREDICT THE ACCURATE RESALE VALUE OF YOUR CAR!!

Kilometers the car has driven	<input type="text" value="Enter no. of kms"/>
Gear Box Type	<input type="radio"/> Manual <input type="radio"/> Automatic <input type="radio"/> Not declared
Your car is damaged or repaired	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not declared
Model Type	<input type="text" value="100"/>
Brand of the car	<input type="text" value="alfa_romeo"/>
Fuel type of the car	<input type="text" value="cng"/>
Vehicle type	<input type="text" value="bus"/>

PREDICT

The resale value predicted is \$49720.31

8.

TESTING

8.1.USER ACCEPTANCE TESTING

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1					Date	19-Nov-22											
2					Team ID	PNT2022TMD02177											
3					Project Name	Project - Car Resale Value Prediction											
4					Maximum Marks	4 marks											
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments						
6	InitialScreen_TC_001	Functional	Home Page	Verify user able to see the Prediction page		1.Enter URL 2.Click on Prediction button 3.Validate user able to see the page	https://localhost:5000/	Entering into data input page	Working as expected	Pass	Normal test case						
7	Input_data_TC_002	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into prediction page 2.Check if user can enter value	http://localhost:5000/prediction	Application should show below UI elements to enter numeric values: a.Registration Year b.Power of car in PS c.Kilometers the car has driven Software should accept only numeric values	Should allow entering numeric values	Pass	Normal test case						
8	Input_data_TC_003	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into prediction page 2.Check if user can select option from drop down box	https://localhost:5000/prediction	Application should show below UI elements to select from drop down menu: a.Registration Month b.Model Type c.Brand of the car d.Fuel type of the car e.Vehicle Type	should allow selection from pull down menu	Pass	Normal test case						
9	Input_data_TC_004	Functional	Prediction value input page UI	Verify user able to enter input value		1.Check entering into prediction page 2.Check if user can select option from radio button	https://localhost:5000/prediction	Application should show below UI elements to select from drop down menu: a.Gear Box Type b.Your car is damaged or repaired	should allow selection from Radio button	Pass	Normal test case						
10	Result_data_TC_008	Functional	Prediction Result Page	Verify No Chronic Kidney Disease (No CKD) test values		1.Enter submit button after entering values 2.Redirect to index page and display correct result	http://localhost:5000/verify-prediction	Application should show predicted price value of car	should show price of car	Pass	Robustness test case						
11																	

2. 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	0	1	1	0	2
Duplicate	0	0	0	0	0
External	2	2	0	1	5
Fixed	1	0	0	0	1
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	2	3	2	1	8

3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

8.2.Model Performance Test

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Metrics	Regression Model R Squared = 0.8396847388211943 MAE = 1615.420354114289 MSE = 11204674.310407598 RMSE = 3347.3383919776616	See below

```
In [39]: from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
print ('R Squared =',r2_score(Y_test, y_pred))
print ('MAE =',mean_absolute_error(Y_test, y_pred))
print ('MSE =',mean_squared_error(Y_test, y_pred))
print('RMSE =', mean_squared_error(Y_test, y_pred, squared=False))
```

```
R Squared = 0.8396847388211943
MAE = 1615.420354114289
MSE = 11204674.310407598
RMSE = 3347.3383919776616
```

9. RESULTS

```
In [39]: #fitting the model
regressor.fit(X_train, np.ravel(Y_train,order='C'))
```

```
Out[39]: RandomForestRegressor(max_depth=10, n_estimators=1000, random_state=34)
```

```
In [40]: #predicting the values fo test test
y_pred = regressor.predict(X_test)
```

```
In [41]: #printing the Accuraccy for test set
print(r2_score(Y_test,y_pred))

0.8387903149180778
```

```
In [42]: #for testing on user input values
y_pred1 = regressor.predict([[2011,190,125000,5,1,0,163,1,3,3]])
#predicting price for a user input values
print(y_pred1)

[19070.72434796]
```

```
In [43]: #saving the model for future use.
filename = 'car_resale_value.sav'
pickle.dump(regressor, open(filename, 'wb'))
```

```
In [44]: !pip install ibm_watson_machine_learning
```

10. ADVANTAGES & DISADVANTAGES

Advantages:

- Variants usually don't matter in the used car market. If you search well, you can get a top-spec less driven car in the used car market at a price which you would have otherwise paid for a lower variant in case of buying a new car.
- If you buy a car from a brand authorised dealership, you get a warranty on the repair.
- If we are buying a used car that was launched a year ago, you can save up to 20% on its original cost.

Disadvantages:

- Some cars may be lemons. They look fine on the outside but can land in huge repair costs while you use them.
- Be a very informed customer and check each and every possible detail before buying.

11. CONCLUSION

The increased prices of new cars and the financial incapability of the customers to buy them, Used Car sales are on a global increase. Therefore, there is an urgent need for a Used Car Price Prediction system which effectively determines the worthiness of the car using a variety of features. The proposed system will help to determine the accurate price of used car price prediction.

12. FUTURE SCOPE

In future this machine learning model may bind with various websites which can provide real time data for price prediction. Also we may add large historical data of car price which can help to improve accuracy of the machine learning model. We can build an android app as a user interface for interacting with users. For better performance, we plan to judiciously design deep learning network structures, use adaptive learning rates and train on clusters of data rather than the whole dataset.

13. APPENDIX

Source code screenshots:

app.py

```
File Edit Selection View Go Run Terminal Help app.py - Visual Studio Code

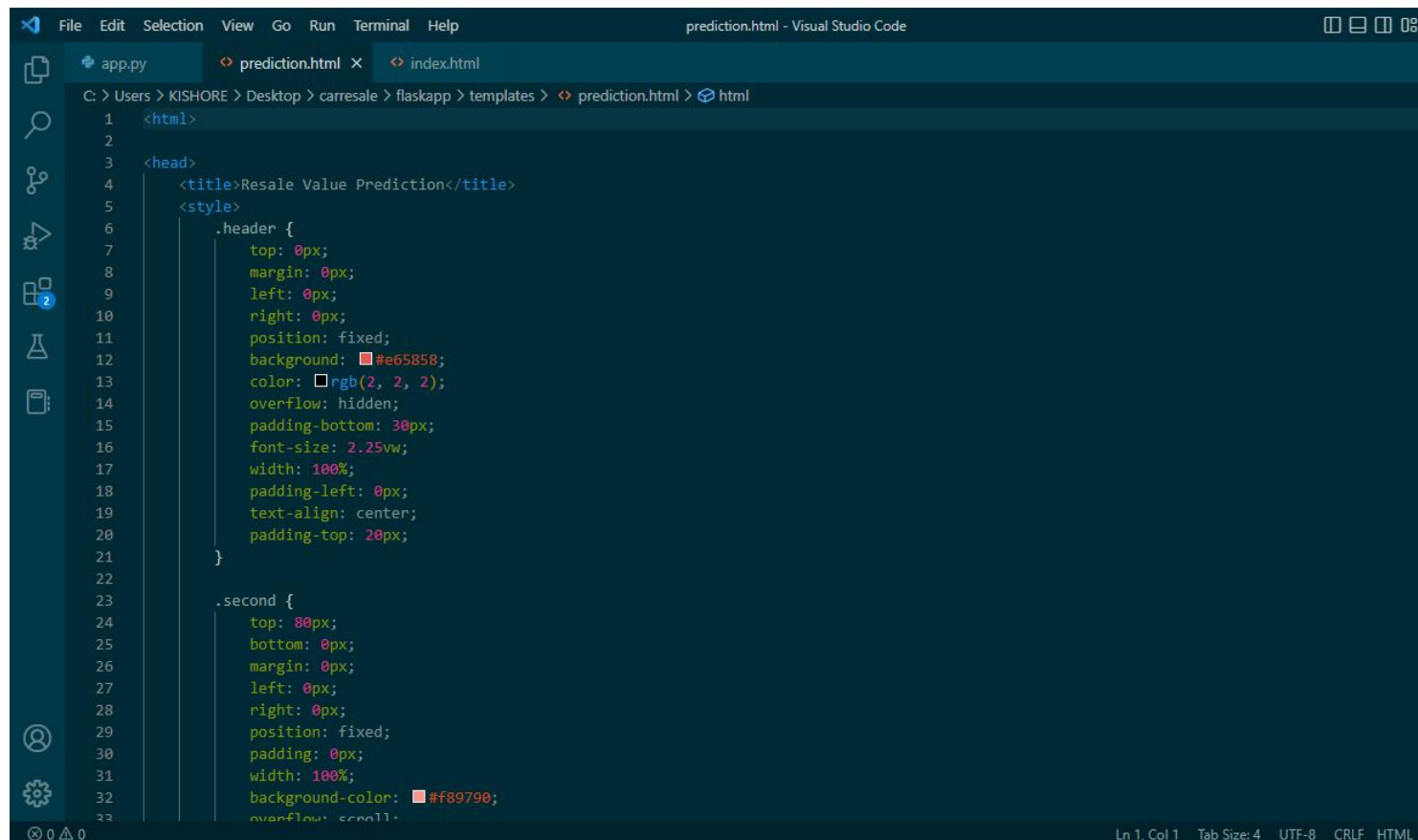
C: > Users > KISHORE > Desktop > carresale > flaskapp > app.py
1 import pickle
2 import numpy as np
3 import pandas as pd
4 from flask import Flask, render_template, request
5 from sklearn.preprocessing import LabelEncoder
6
7 app = Flask(__name__, template_folder='templates')
8 filename = 'car_resale_value.sav'
9 model_rand = pickle.load(open(filename, 'rb'))
10
11 @app.route('/')
12 def index():
13     return render_template('index.html')
14
15 @app.route('/predict')
16 def predict():
17     return render_template('prediction.html')
18
19 @app.route('/y_predict', methods=['GET', 'POST'])
20 def y_predict():
21     regyear = int(request.form['regyear'])
22     powerps = float(request.form['powerps'])
23     kms = float(request.form['kms'])
24     regmonth = int(request.form.get('regmonth'))
25     gearbox = request.form['gearbox']
26     damage = request.form['dam']
27     model = request.form.get('modeltype')
28     brand = request.form.get('brand')
29     fuelType = request.form.get('fuel')
30     vehicletype = request.form.get('vehicletype')
31     new_row = {'yearOfRegistration': regyear, 'powerPS': powerps, 'kilometer': kms,
32               'monthOfRegistration': regmonth, 'gearbox': gearbox, 'notRepairedDamage': damage,
33               'model': model, 'brand': brand, 'fuelType': fuelType, 'vehicletype': vehicletype}
```

index.html

```
File Edit Selection View Go Run Terminal Help index.html - Visual Studio Code

C: > Users > KISHORE > Desktop > carresale > flaskapp > templates > index.html > html
1 <html>
2
3 <head>
4     <title>Resale Value Prediction</title>
5     <style>
6         .header {
7             top: 0px;
8             margin: 0px;
9             left: 0px;
10            right: 0px;
11            position: fixed;
12            background: #e65858;
13            color: rgb(14, 13, 13);
14            overflow: hidden;
15            padding-bottom: 30px;
16            font-size: 2.25vw;
17            width: 100%;
18            padding-left: 0px;
19            text-align: center;
20            padding-top: 20px;
21        }
22
23        .second {
24            top: 80px;
25            bottom: 0px;
26            margin: 0px;
27            left: 0px;
28            right: 0%;
29            position: fixed;
30            padding: 0px;
31            width: 100%;
32            background-repeat: no-repeat;
33            background-size: contain;
```

prediction.html



```
1 <html>
2
3 <head>
4   <title>Resale Value Prediction</title>
5   <style>
6     .header {
7       top: 0px;
8       margin: 0px;
9       left: 0px;
10      right: 0px;
11      position: fixed;
12      background: #e65858;
13      color: rgb(2, 2, 2);
14      overflow: hidden;
15      padding-bottom: 30px;
16      font-size: 2.25vw;
17      width: 100%;
18      padding-left: 0px;
19      text-align: center;
20      padding-top: 20px;
21    }
22
23    .second {
24      top: 80px;
25      bottom: 0px;
26      margin: 0px;
27      left: 0px;
28      right: 0px;
29      position: fixed;
30      padding: 0px;
31      width: 100%;
32      background-color: #f89790;
33      overflow: scroll;
```

GitHub :

<https://github.com/IBM-EPBL/IBM-Project-19118-1659693410>

Project Demo Link:

https://drive.google.com/file/d/1WujVAXvfQFGS4tPBeRwyPo-HjSwKJPSc/view?usp=share_link