CAR PERFORMANCE PREDICTION

Using Ibm Watson Machine Learning

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Smart Bridge – Mini Project Report

1. INTRODUCTION

1.1 Overview:

Predicting the performance level of automobiles is a challenging and fascinating topic. The major purpose is to predict the car's performance in order to optimize the vehicle's specific behavior. This can considerably reduce fuel usage and increase efficiency in the system.

The car's performance is evaluated based on the engine type, number of cylinders, fuel type, and horsepower, among other factors. These are the variables that can be used to forecast the car's health. It is a continuous process of gathering, studying, analyzing, and documenting information about one's health based on the three variables listed above. Mileage, dependability, flexibility, and affordability are all performance objectives that can be paired together to help the prediction engine and engine management system. This method is critical for fully comprehending the vehicle's performance.

1.2 Purpose

Prior to the last decade, cars were constructed for high-speed operation, comfort, and safety due to a surplus of gasoline. As the scarcity of fuel grows due to the excessive use of fuel in automobiles, numerous researchers have begun to study alternative fuels, car body redesign, and aerodynamic loss reduction. To compensate for these losses, spoilers are employed, necessitating the optimization of its shape. This research is primarily focused on determining the optimal design of a car spoiler in order to reduce mass and hence fuel consumption while maintaining aerodynamic qualities and strength. The results of a Computational Fluid Dynamics (CFD) analysis of a two-dimensional model of a spoiler are validated by previous research in this field for understanding changes in aerodynamic property of cross-section. The results of the three-dimensional CFD analysis of the spoiler provide aerodynamic properties and pressure data that can be used to compare the results of the optimized model generated by the optimized cross-sectional shape. The Shape Optimization tool in ANSYS 14.0 is used to optimize the shape, which is then tested for design failure in ABAQUS.

2.LITERATURE SURVEY

[1] Artificial Neural Network (ANN) model was used to help cars dealers recognize the many characteristics of cars, including manufacturers, their location and classification of cars according to several categories including: Make, Model, Type, Origin, DriveTrain, MSRP, Invoice, EngineSize, Cylinders, Horsepower, MPG_Highway, Weight, Wheelbase, Length. ANN was used in prediction of the number of miles per gallon when the car is driven in the city(MPG_City). The results showed that ANN model was able to predict MPG_City with 97.50 % accuracy. The factor of DriveTrain has the most influence on MPG_City evaluation. Similar studies can be carried out for the evaluation of other characteristics of cars.

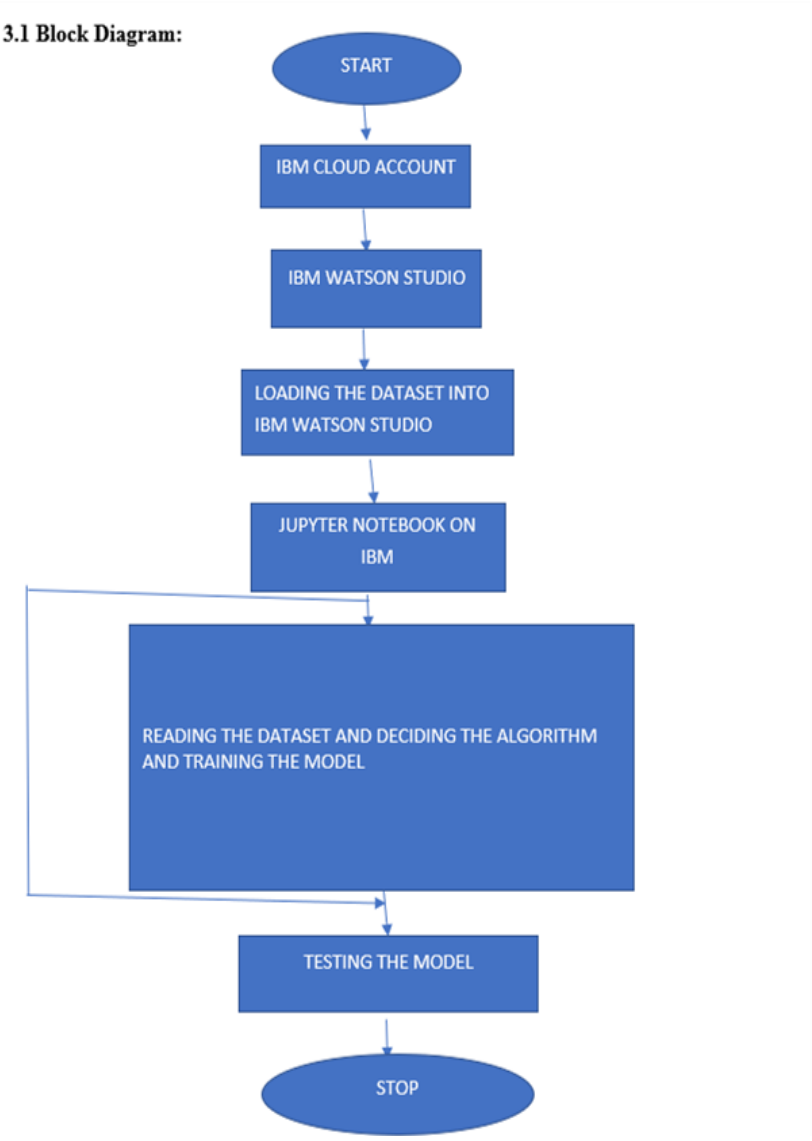
Artificial Neural Network for Forecasting Car Mileage per Gallon in the City. Afana, Mohsen; Ahmed, Jomana; Harb, Bayan; Abu-Nasser, Bassem S.; Abu-Naser, Samy S.

[2]The ability to model and predict fuel usage is critical for improving vehicle fuel economy and preventing fraud in fleet management. Internal factors such as distance, load, vehicle attributes, and driver conduct, as well as external factors such as road conditions, traffic, and weather, all influence a vehicle's fuel usage. However, not all of these variables may be measured or available for the analysis of fuel usage. We explore a scenario in which just a subset of the above elements is accessible as a multivariate time series from a long-distance public bus. As a result, the task is to model and/or anticipate fuel usage using only known data while capturing as much as possible indirect effects from other internal and external elements.Machine Learning (ML) is appropriate for this type of analysis since the model may be built by learning data patterns. We analyze the predictive abilities of three machine learning algorithms in estimating bus fuel consumption given all relevant characteristics as a time series in this study. In comparison to both gradient boosting and neural networks, the random forest technique generates a more accurate forecast, according to the analysis.

Fuel consumption prediction of fleet vehicles using Machine Learning: A comparative study
Sandareka Wickramanayake; H.M.N. Dilum Bandara.

3.THEORITICAL ANALYSIS:

3.1 Block Diagram:



Project Work Flow:

1. Data Collection
2. Data Pre-processing
3. Model Building
4. Application Building

3.1. HARDWARE AND SOFTWARE REQUIREMENTS IN THE PROJECT:

For running a machine learning model on the system you need a system with minimum of 16 GB RAM in it and you require a good processor for high performance of the model.

In the list of **software requirements** you must have:

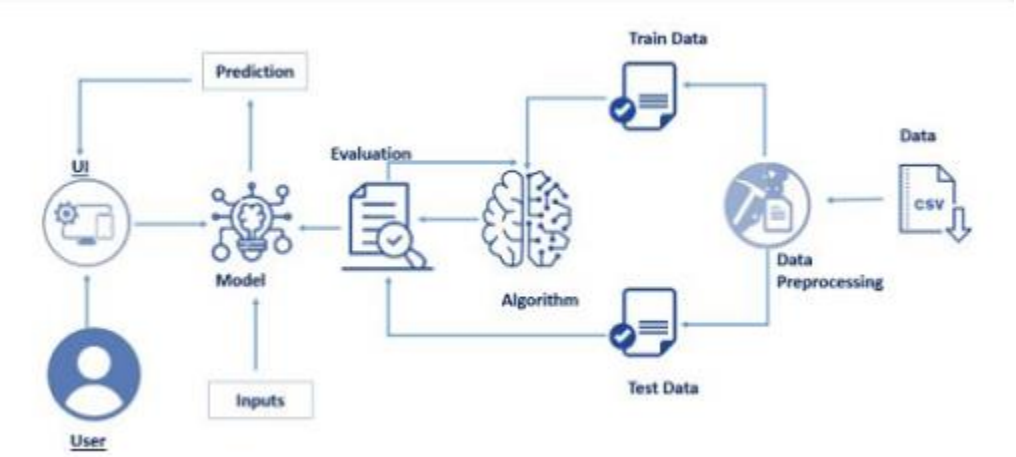
- Jupyter Notebook for programming, which can be installed by Anaconda IDE.
- Python packages
- A better software for running the html and css files for application building phase e.g. spyder.

4.EXPERIMENTAL INVESTIGATIONS:

4.1 Data Preprocessing:-

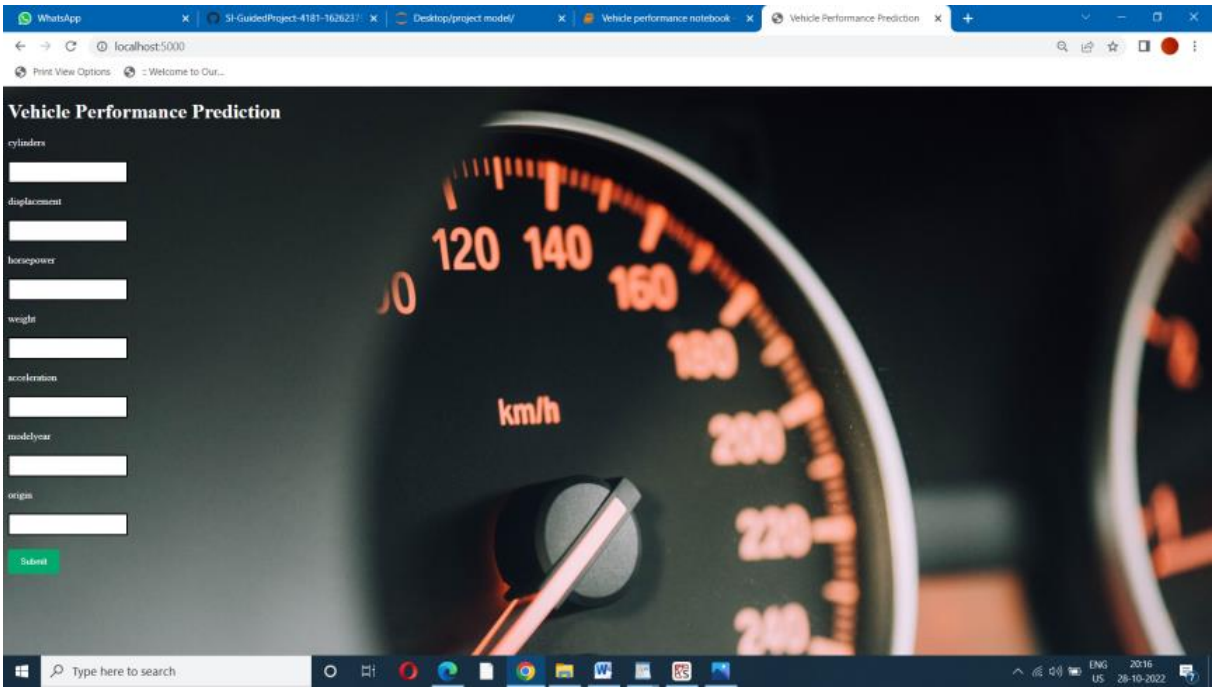
(i) First check is there any null value in the dataset
(ii) Check whether the dataset contains numerical or categorical features
(iii) Dividing dataset into dependent and independent features
(iv) Plotting Correlation
(v) Training and testing data

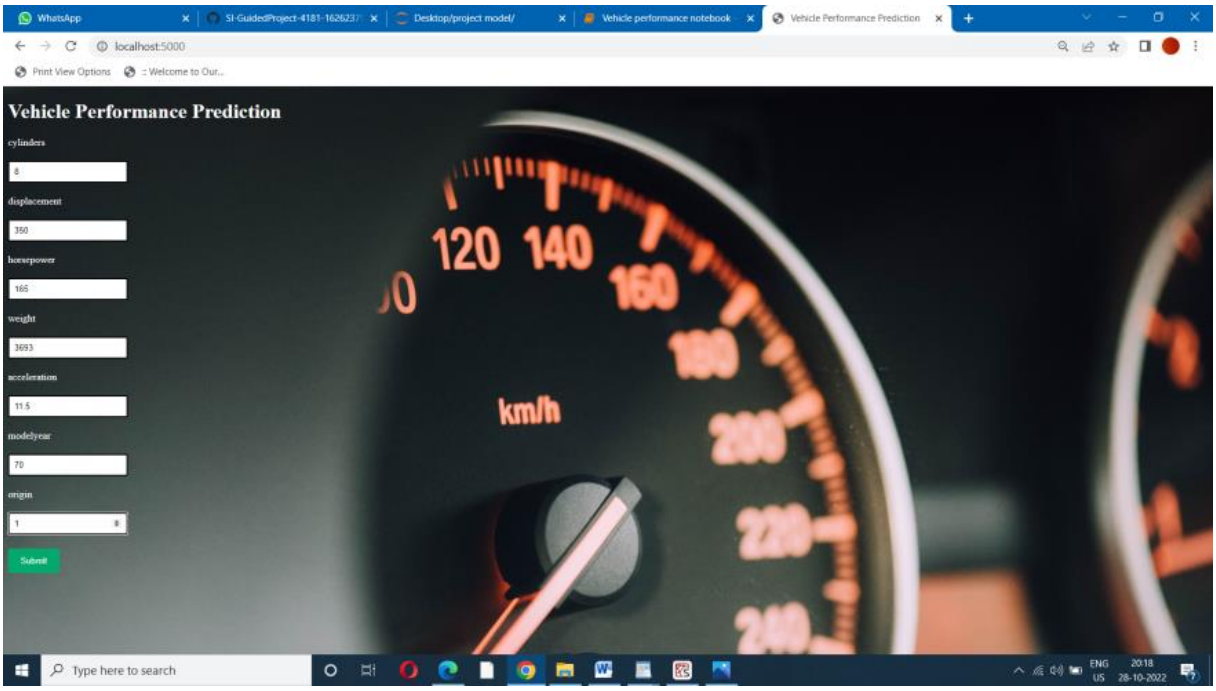
5. FLOW CHART:-

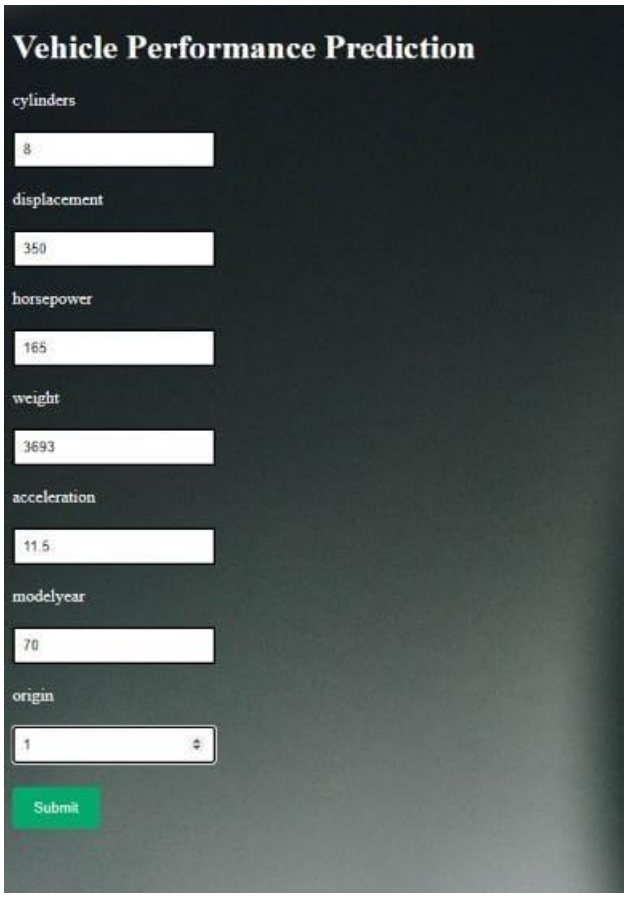


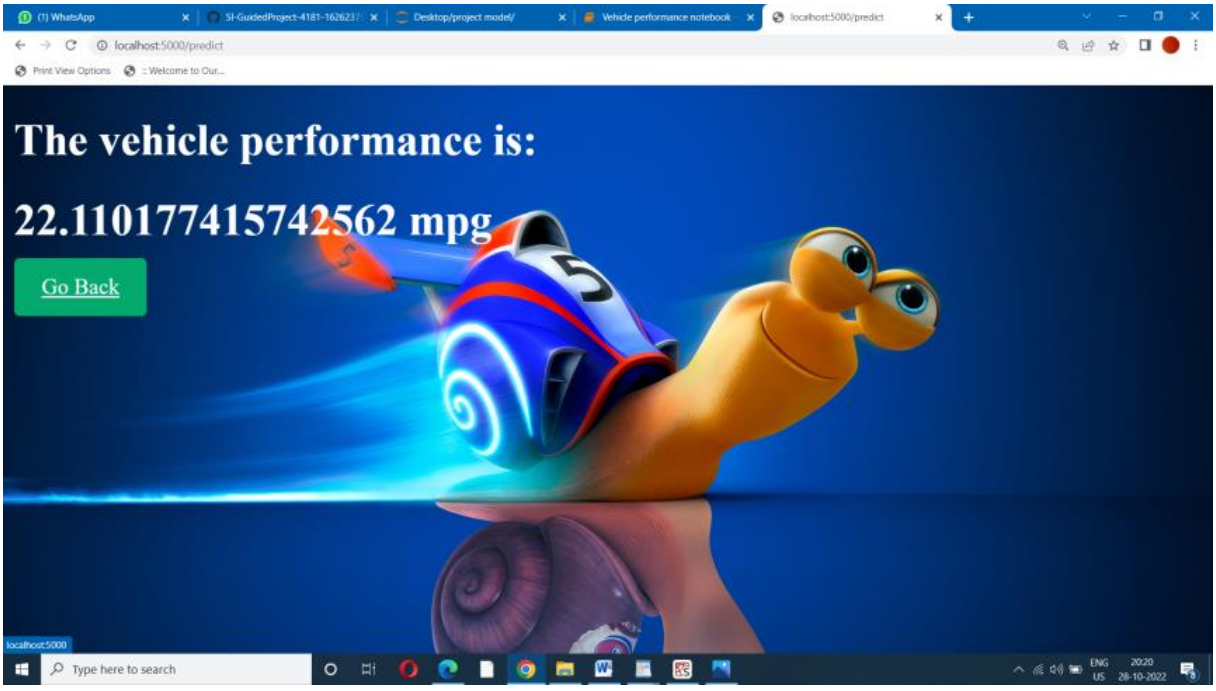
6. RESULTS:-

Final output of the project:



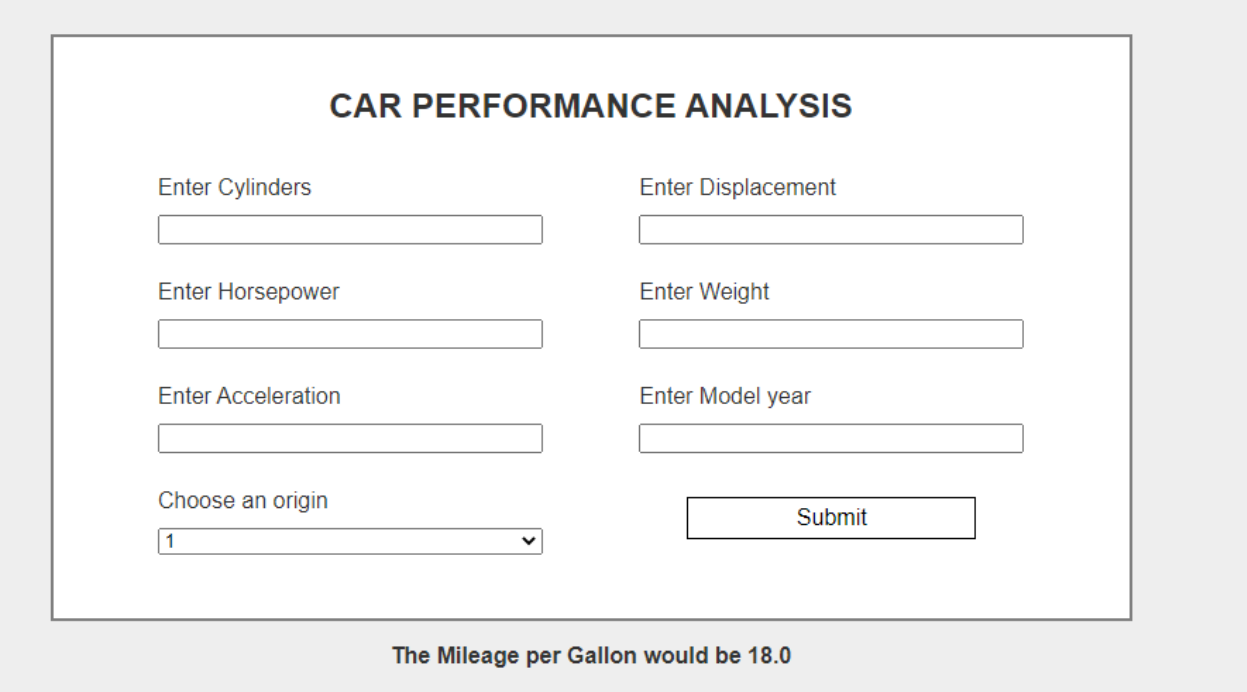



Vehicle Performance Prediction
cylinders
8
displacement
350
horsepower
165
weight
3693
acceleration
11.5
modelyear
70
origin
1
Submit


localhost:5000/predict
The vehicle performance is:
22.110177415742562 mpg
Go Back
Type here to search

7. APPLICATIONS:-

The prediction system was deployed on IBM Watson Cloud and a web application was created for the prediction system. In the application we have to enter the input values such as the number of cylinders the vehicle contains, its displacement , its horsepower and its acceleration. After giving these inputs, Mileage per Gallon (mpg) will be displayed based on the calculations.



With the above parameters we can predict the performance of the vehicle. And with the given ranges of mileage and horsepower we can estimate where and in what kind of activities are best suited for the vehicle.

For example a low power high mileage could be used as a taxi fare system whereas a high power low mileage system could be used for heavy lifting such as JCBs and tractors.
Also the prediction system could be used to determine the health of a car and to estimate its resale value. To find out how much of a depreciation has happened to vehicle and what not

8.CONCLUSION-

Therefore, after predicting performance of the car prediction system, it was deployed on IBM Watson Cloud and a web application was launched using Flask.

9. FUTURE SCOPE:-

Predicting the performance level of cars is an important and interesting problem. The main goal is to predict the performance of the car to improve the certain behavior of the vehicle. This can significantly help to improve the system's fuel consumption and increase efficiency.

The performance analysis of the car is based on the engine type, no of engine cylinders, fuel type, and horsepower, etc. These are the factors on which the health of the car can be predicted. It is an on-going process of obtaining, researching, analyzing, and recording the health based on the above three factors. The performance objectives like mileage, dependability, flexibility, and cost can be grouped together to play a vital role in the prediction engine and engine management system. This approach is a very important step towards understanding the vehicle's performance.

10. REFERENCES:-

[1] Artificial Neural Network for Forecasting Car Mileage per Gallon in the City
Afana, Mohsen; Ahmed, Jomana; Harb, Bayan; Abu-Nasser, Bassem S.; Abu-Naser, Samy S.

[2] Fuel consumption prediction of fleet vehicles using Machine Learning: A comparative study by Sandareka Wickramanayake; H.M.N. Dilum Bandara.

11.BIBILOGRAPHY:-

https://github.com/SmartPracticeschool/llSPS-INT-182-Car-Performance-Prediction

APPENDIX :-

app.py

```
import flask
from flask import Flask,request, render_template
#from flask_cors import CORS
import joblib




app = Flask(_name_)



@app.route('/', methods=['GET'])
def sendHomePage():
    return render_template('index.html')


@app.route('/predict', methods=['POST'])
def predictPerformance():
    cylinders = float(request.form['cylinders'])
    displacement = float(request.form['displacement'])
```

```
    horsepower = float(request.form['horsepower'])
    weight = float(request.form['weight'])
    acceleration = float(request.form['acceleration'])
    modelyear = float(request.form['modelyear'])
    origin = float(request.form['origin'])

    X = [[cylinders,displacement,horsepower,
          weight,acceleration,modelyear,origin]]

    model = joblib.load('gbr_performance.pkl')

    rating = model.predict(X)[0]
    return render_template('predict.html',predict=rating)

# if _name_ == '_main_':
#     app.run()
if _name_ == '_main_':
    # app.debug = True
    app.run()
```

index.html

```
<!DOCTYPE html>
```

```
<html lang="en">
<head>
 <style>
 /* Style inputs with type="name", select elements and textareas */
 input[type=number], select, textarea {

   align: center;
   width: 10%; /* Full width */
   padding: 8px; /* Some padding */
   border: 2px solid #000000; /* Gray border */
   border-radius: 2px; /* Rounded borders */
   box-sizing: border-box; /* Make sure that padding and width stays in place */
   margin-top: 4px; /* Add a top margin */
   margin-bottom: 4px; /* Bottom margin */
   resize: vertical /* Allow the user to vertically resize the textarea (not horizontally) */
 }

 /* Style the submit button with a specific background color etc */
 button[type=submit] {
   background-color: #04AA6D;
   color: white;
   padding: 12px 20px;
   border: none;
   border-radius: 4px;
   cursor: pointer;
 }

 /* When moving the mouse over the submit button, add a darker green color */
 bitton[type=submit]:hover {
   background-color: #45a049;
 }

 /* Add a background color and some padding around the form */
 .container {
   border-radius: 5px;
   background-color: #f2f2f2;
   padding: 20px;
 }

body {
```

```
      color: white;
   background-size: cover;
  background-image: url('https://speedwaymedia.com/wp-content/uploads/2020/11/chuttersnap-gts_Eh4g1lk-unsplash-scaled.jpg');
}
</style>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Vehicle Performance Prediction</title>
</head>
<body>
    <h1>Vehicle Performance Prediction</h1>
    <form method="POST" action="/predict">
        <p>cylinders</p>
        <input type="number"   name="cylinders" required>
        <p>displacement</p>
        <input type="number" name="displacement" required>
        <p>horsepower</p>
        <input type="number" name="horsepower" required>
        <p>weight</p>
        <input type="number" name="weight" required>
        <p>acceleration</p>
        <input type="number" name="acceleration" required>
        <p>modelyear</p>
        <input type="number" name="modelyear" required>
        <p>origin</p>
        <input type="number" name="origin" required>
        <br>
        <br>
        <button type="submit">Submit</button>
    </form>
</body>
</html>
```

Predict.html

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



  /* Add a background color and some padding around the form */
  .container {
    border-radius: 5px;
    background-color: #f2f2f2;
    padding: 20px;
  }

  a[type=submit]{
  background-color: #04AA6D;
  color: white;
  padding: 12px 20px;
  border: none;
  border-radius: 4px;
  cursor: pointer;
  }

body {
color:white;
   background-size: cover;
  background-image: url('https://cdn.wallpapersafari.com/48/59/SD3pTI.jpg');
}
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Vehicle Performance Prediction</title>
</style>
</head>
<body>
    <h1>The vehicle performance is: </h1>
    <h1>{{predict}} mpg</h1>
```

```
    <a href="/" type="submit">Go Back</a>
</body>
</html>
```