CAR PERFORMANCE PREDICTION

AN INDUSTRY ORIENTED MINI REPORT

Submitted to

JAWAHARLAL NEHRU TECNOLOGICAL UNIVERSITY, HYDERABAD

In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING(DATASCIENCE)

Submitted By

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CERTIFICATE OF COMPLETION
INDUSTRY ORIENTED MINI PROJECT

This is to certify that the UG Project Phase-1 entitled " CAR PERFORMANCE PREDICTION"is being submitted by DINESHSINGH(21UK1A6790),SRIKAR(21UK1A6772), MAMATHA(21UK1A6775),VAMSHI(22UK56711) in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science & Engineering(Data science) to Jawaharlal Nehru Technological University Hyderabad during the academic year 2024 - 2025.

Project Guide	**HOD**
Mrs.P.Prasanna	**Dr.K.Sharmila Reddy**
(Assistant professor)	(Professor)

External

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ABSTRACT

Machine learning is becoming increasingly important in different sectors of the digital world. This study has developed a prediction method to detect the performance level of automobiles using machine learning. To increase the vehicle performance efficiency, it is critical to analyze the elements by utilizing several well-known machine learning algorithms such as linear regression, decision tree, and random forest. The primary objective of this research study is to predict the vehicle performance in order to enhance specific vehicle characteristics. This can considerably reduce fuel usage and boost *efficiency* of the proposed system. These are the elements that may be used to predict the health of a vehicle. This study has developed a machine learning model called "Car Performance Prediction" to forecast a car's mileage. While the existing system makes use of acceleration capacity and measured equipment to measure the overall car performance to predict the result by using the physical equipment called Dynamometer to get the results, the proposed system automatically forecasts the performance of a car by using existing datasets and algorithms.

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1.INTRODUCTION

1.1.OVERVIEW

This paper describes a method of vehicle performance prediction which adapts readily to digital programming. A prime mover which may be a gas turbine or a reciprocating internal combustion engine, a hydraulic torque converter, and/or a mechanical transmission, comprising the vehicle drive train, are transformed into numerical equivalents. The performance prediction itself is in three major parts, namely, the engine-converter compatibility, the converter range performance, and the lockout or direct drive performance. The computer transforms the engine data into equation form by curve fitting; predicts the optimum shift point as the intersection of the net tractive effort in converter drive with net tractive effort in direct drive; calculates; stores; interpolates; and prints a complete set of data.

1.2.PURPOSE

Machhine learning is becoming increasingly important in different sectors of the digital world. This study has developed a prediction method to detect the performance level of automobiles using machine learning. To increase the vehicle performance efficiency, it is critical to analyze the elements by utilizing several well-known machine learning algorithms such as linear regression, decision tree, and random forest. The primary objective of this research study is to predict the vehicle performance in order to enhance specific vehicle characteristics. This can considerably reduce fuel usage and boost efficiency of the proposed system. These are the elements that may be used to predict the health of a vehicle. This study has developed a machine learning model called “Car Performance Prediction” to forecast a car’s mileage. While the existing system makes use of acceleration capacity and measured equipment to measure the overall car performance to predict the result by using the physical equipment called Dynamometer to get the results, the proposed system automatically forecasts the performance of a car by using existing datasets and algorithms

2.LITERATURE SURVEY

2. [1]LITERATURE REVIEW With the recent arrival of internet portals, buyers and sellers may obtain an appropriate status of the factors that ascertain the market price of a used automobile. Lasso Regression, Multiple Regression, and Regression Trees are examples of machine learning algorithms. We will try to develop a statistical model that can forecast the value of a pre-owned automobile based on prior customer details and different parameters of the vehicle.

[2] This paper aims to compare the efficiency of different models' predictions to find the appropriate one. On the subject of used automobile price prediction, several previous studies have been conducted. To anticipate the value of pre-owned automobiles in Mauritius, Pudaruth employed naive Bayes, k-nearest neighbours, multiple linear regression, and decision trees. However, because there were fewer cars observed, their results were not good for prediction. In his article, Pudaruth concluded that decision trees and naive Bayes are ineffective for continuous-valued variables.

[3] To anticipate the price of a vehicle, Noor and Jan employed multiple linear regression. They used a variable selection methodology to determine the variables that had the highest influence and then eliminated the remainder. Only a few variables are included in the data, which were utilised to create the linear regression model. With an R-square of 98 percent, the outcome was outstanding.

[4] Peerun et al. conducted study to assess the neural network's performance in predicting used automobile prices. However, especially on higher-priced cars, the estimated value is not very close to the real price. In forecasting the price of a used car, they found that support vector machine regression outperformed neural networks and linear regression by a little margin.

[5] To accurately anticipate the price of a car, many different approaches have been used in the digital world, ranging from machine learning approaches like multiple linear regression, k-nearest neighbor, and naive bayes to random forest and decision tree to the SAS enterprise miner.

In [7], [8], [9], [10] and [11] all of these solutions took into account distinct sets of attributes when making predictions based on the historical data used to train the model. We attempted to construct a web application where a user may verify the effective market price of their automobiles using a model for prediction based on the factors that have the greatest impact on vehicle prices

2.2 PROPOSED SOLLUTION

* Predicting car performance can involve a combination of different methods and technologies. Here are some proposed solutions

1. Machine Learning Models

Machine learning (ML) can be highly effective in predicting car performance based on various parameters.

Supervised Learning: Using historical data of car performance to train models like linear regression, decision trees, random forests, and support vector machines (SVM).

Neural Networks: For more complex, non-linear relationships between variables, deep learning models like neural networks can be used.

Time Series Analysis: If performance data is time-dependent, models like ARIMA or LSTM (Long Short-Term Memory) networks can be useful.

2. Simulation Software

Software that simulates car dynamics can predict performance based on input parameters like engine specs, weight, aerodynamics, etc.

Multibody Dynamics (MBD) Software: Tools like ADAMS or Simpack.
Computational Fluid Dynamics (CFD) Software: For aerodynamic performance predictions, tools like ANSYS Fluent or OpenFOAM.

3. Data Analytics and Statistical Methods

Statistical analysis can uncover trends and correlations that can inform predictions.

--> Descriptive Statistics: Mean, median, standard deviation, etc., to summarize data.
--> Inferential Statistics: Hypothesis testing, regression analysis, etc.

4. IoT and Real-Time Data Collection

Using sensors and IoT devices to collect real-time data on car performance, which can then be analyzed using ML models.

--> Telematics: Devices that collect data on speed, fuel consumption, engine performance, etc.
--> Edge Computing: Processing data at the source for real-time insights.

5. Hybrid Models

Combining different models for better accuracy.

--> Ensemble Learning: Combining predictions from multiple models (e.g., bagging, boosting).
--> Physics-Informed Machine Learning: Integrating physical laws into ML models to improve predictions.

6. Domain-Specific Algorithms

Using algorithms specifically designed for automotive applications.

--> Vehicle Dynamics Models: Algorithms that take into account the physics of vehicle motion.
--> Engine Performance Models: Specific models for predicting engine behavior under various condition

7. Cloud Computing and Big Data

Leveraging cloud computing for processing large datasets and complex models.

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--> Big Data Platforms: Tools like Hadoop and Spark for handling large volumes of data.
--> Cloud Services: Using cloud platforms (AWS, Azure, Google Cloud) for scalable computing resources.

Implementation Steps:

Data Collection: Gather data from multiple sources (sensors, historical records, simulation results).
Data Preprocessing: Clean and preprocess the data (handling missing values, normalization, etc.).
Feature Engineering: Identify and create relevant features for the prediction model.
Model Selection: Choose appropriate models based on the problem and data characteristics.
Model Training and Validation: Train models on the training dataset and validate their performance on a separate validation set.
Hyperparameter Tuning: Optimize model parameters for better performance.
Deployment: Deploy the model into a production environment for real-time predictions.
Monitoring and Maintenance: Continuously monitor model performance and update as needed.

3.THEORITICAL ANALYSIS

3.1. BLOCK DIAGRAM

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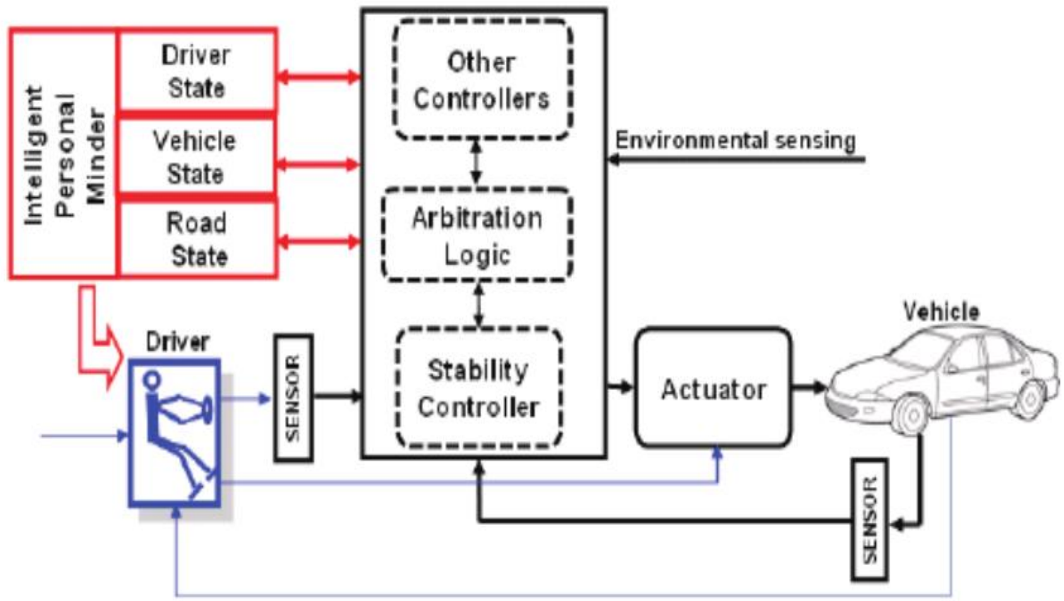

3.2. SOFTWARE DESIGNING

The following is the Software required to complete this project:

- **Google Colab**: Google Colab will serve as the development and execution environment for your predictive modeling, data preprocessing, and model training tasks. It provides a cloud-based Jupyter Notebook environment with access to Python libraries and hardware acceleration.

- **Dataset (CSV File)**: The dataset in CSV format is essential for training and testing your predictive model. It should include historical air quality data, weather information, pollutant levels, and other relevant features.
- **Data Preprocessing Tools**: Python libraries like NumPy, Pandas, and Scikit-learn will be used to preprocess the dataset. This includes handling missing data, feature scaling, and data cleaning.
- **Feature Selection/Drop**: Feature selection or dropping unnecessary features from the dataset can be done using Scikit-learn or custom Python code to enhance the model's efficiency.

- **Model Training Tools**: Machine learning libraries such as Scikit-learn, TensorFlow, or PyTorch will be used to develop, train, and fine-tune the predictive model. Regression or classification models can be considered, depending on the nature of the AQI prediction task.
- **Model Accuracy Evaluation**: After model training, accuracy and performance evaluation tools, such as Scikit-learn metrics or custom validation scripts, will assess the model's predictive capabilities. You'll measure the model's ability to predict car performance prediction based on historical data.
- **UI Based on Flask Environment**: Flask, a Python web framework, will be used to develop the user interface (UI) for the system. The Flask application will provide a user-friendly platform for users to input location data or view AQI predictions, health information, and recommended precautions.
- Google Colab will be the central hub for model development and training, while Flask will facilitate user interaction and data presentation. The dataset, along with data preprocessing, will ensure the quality of the training data, and feature selection will optimize the model. Finally, model accuracy evaluation will confirm the system's predictive capabilities, allowing users to rely on the car performance predictions and associated data information.

4.EXPERIMENTAL INVESTIGATION

Conducting an experimental investigation for car performance prediction involves systematically collecting and analyzing data to build predictive models. Here is a detailed plan for such an investigation:

1. Define Objectives and Hypotheses

Objective: Predict car performance metrics (e.g., acceleration, fuel efficiency, braking distance) based on various factors (e.g., engine specifications, vehicle weight, aerodynamics).

Hypotheses: Formulate hypotheses about the relationships between variables (e.g., "Larger engine displacement improves acceleration but reduces fuel efficiency").

2. Literature Review

Existing Studies: Review previous research to understand methodologies and findings.
Gaps Identification: Identify gaps that your investigation can address.

3. Experimental Design

Variables Selection: Identify independent variables (e.g., engine power, weight, aerodynamics) and dependent variables (e.g., 0-60 mph time, fuel efficiency).
Control Variables: Determine variables that need to be controlled (e.g., tire pressure, driving conditions).
Sample Size: Decide on the number of vehicles/tests required for statistical significance.

4. Instrumentation and Equipment

Sensors and Data Acquisition Systems: Use GPS, accelerometers, fuel flow meters, and OBD-II scanners to collect data.
Test Tracks and Facilities: Utilize controlled environments like test tracks for consistency.

5. Data Collection Protocol

Standardized Procedures: Develop standardized testing procedures to ensure consistency.
Multiple Trials: Conduct multiple trials for each test to ensure reliability and accuracy.
Safety Measures: Implement safety protocols to protect test drivers and equipment.

6. Data Collection

Baseline Measurements: Record initial conditions before each test.
Performance Tests: Conduct various performance tests such as acceleration (0-60 mph), braking, fuel efficiency, and handling tests.
Environmental Conditions: Record environmental conditions (temperature, humidity, wind speed) during each test.

7. Data Preprocessing

Data Cleaning: Handle missing values, outliers, and noise in the collected data.
Normalization: Normalize data to ensure consistency across different scales.

8. Data Analysis

Descriptive Statistics: Summarize data using mean, median, standard deviation, etc.

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Exploratory Data Analysis (EDA): Visualize data to identify patterns and relationships.
Correlation Analysis: Assess correlations between independent and dependent variables.

9. Model Development

Feature Engineering: Create and select features that best represent the data.
Model Selection: Choose appropriate models (linear regression, decision trees, neural networks, etc.).
Training and Validation: Train models on a training dataset and validate them on a separate validation set.

10. Model Evaluation

Performance Metrics: Evaluate models using metrics such as R-squared, Mean Absolute Error (MAE), Mean Squared Error (MSE), etc.
Validation: Use cross-validation techniques to assess model robustness.

11. Interpretation and Validation of Results

Hypothesis Testing: Test hypotheses formulated at the beginning of the investigation.
Real-World Validation: Validate predictions with real-world data and scenarios.

12. Documentation and Reporting

Detailed Report: Document methodologies, results, and conclusions in a comprehensive report.
Visualization: Use charts and graphs to present findings clearly.
Recommendations: Provide recommendations based on the findings.

Hypotheses:

1. Larger engine size leads to lower MPG.
2. Heavier vehicles have lower MPG.
3. Better aerodynamics (lower drag coefficient) results in higher MPG.

Experimental Design:

Independent Variables: Engine size (L), vehicle weight (kg), drag coefficient (Cd).
Dependent Variable: Fuel efficiency (MPG).
Control Variables: Tire pressure, driving speed, and route.

Data Collection:

1.Select a diverse sample of vehicles with varying engine sizes, weights, and aerodynamics.

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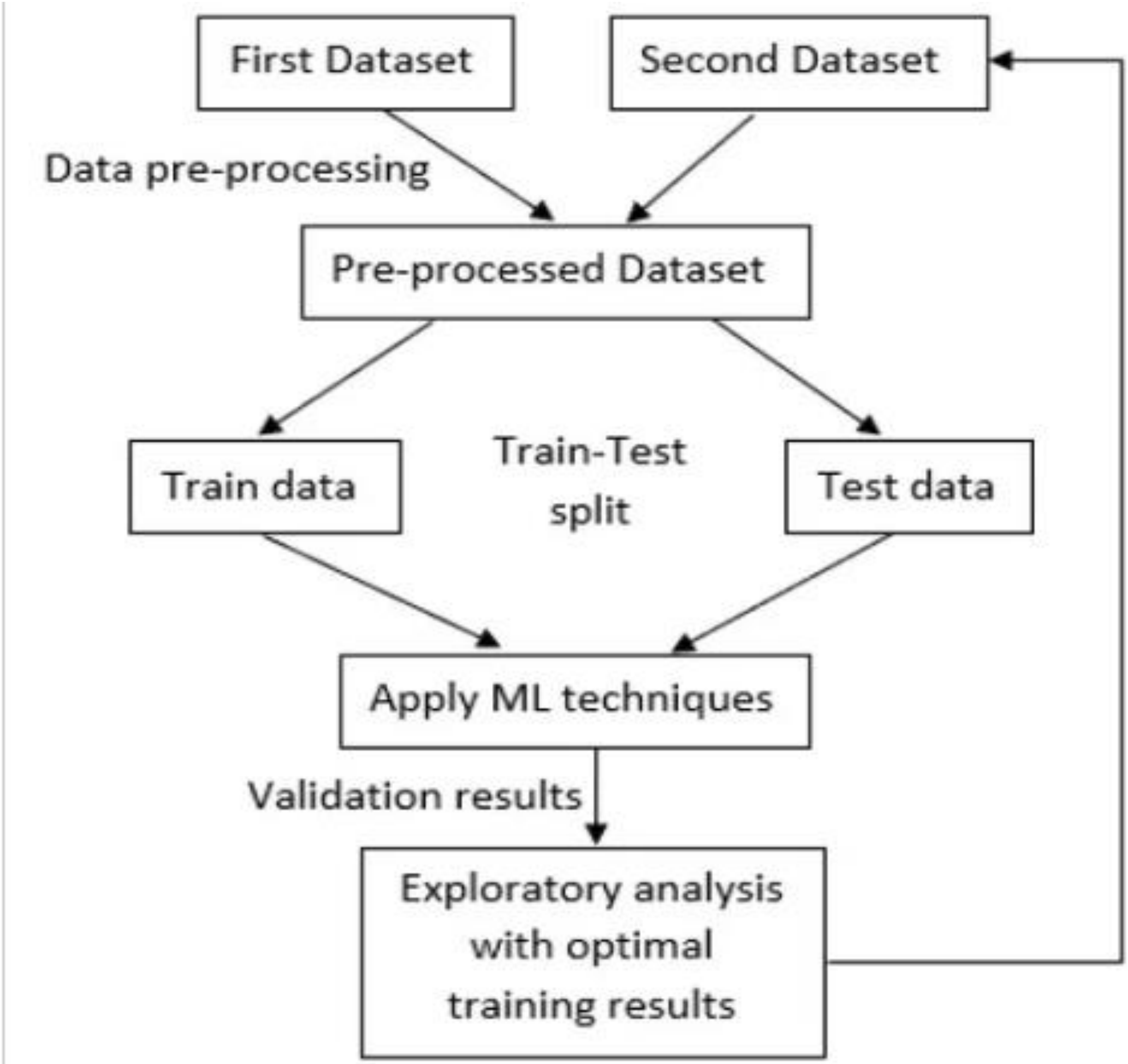
2.Conduct controlled driving tests on a test track.
3.Collect data on fuel consumption, distance traveled, and environmental conditions.

Data Analysis:

EDA: Plot fuel efficiency against engine size, weight, and drag coefficient.
Regression Analysis: Build a multiple linear regression model to predict MPG.
Model Evaluation: Assess model performance using R-squared and residual analysis.

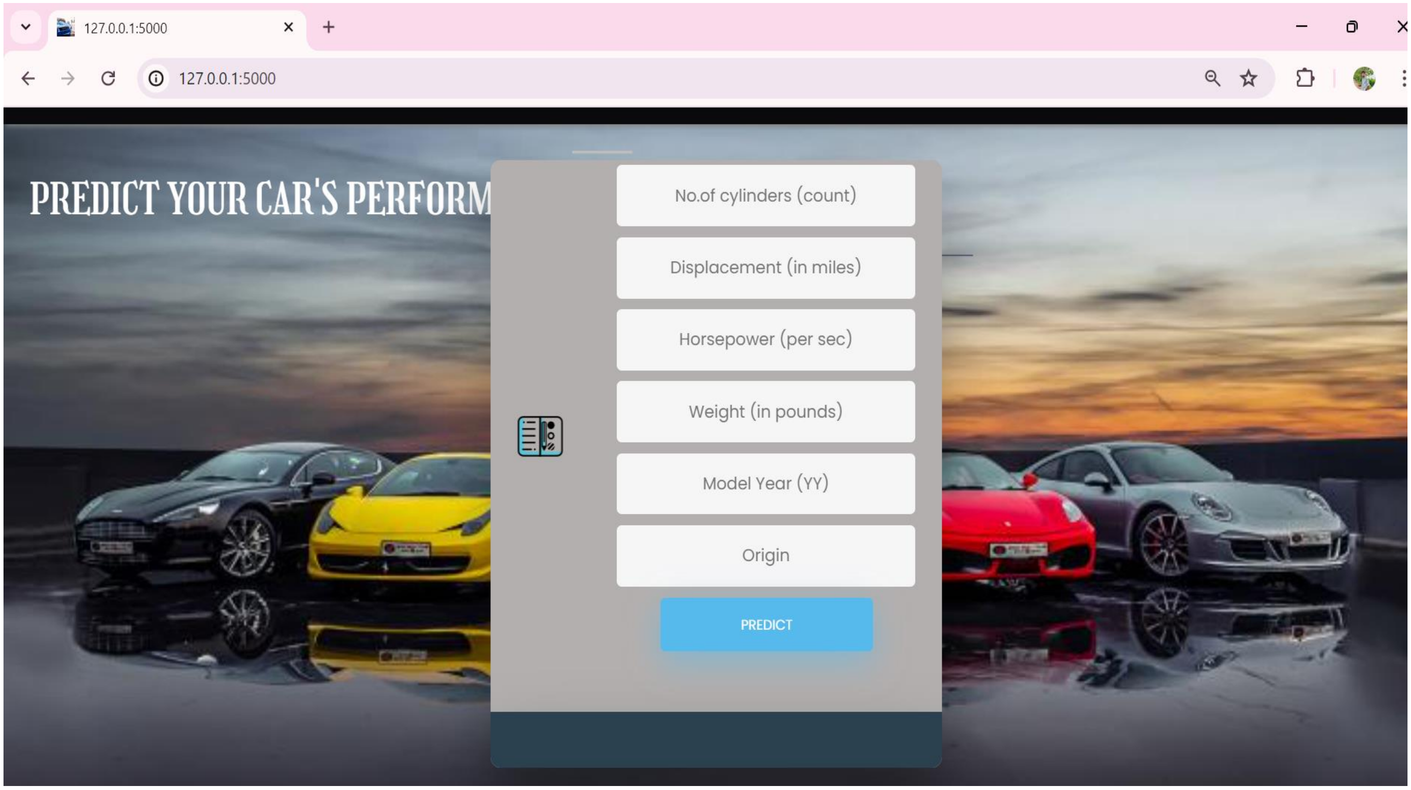
5 .FLOW CHART


First Dataset
Second Dataset
Data pre-processing
Pre-processed Dataset
Train data
Train-Test
split
Test data
Apply ML techniques
Validation results
Exploratory analysis
with optimal
training results

S

6.RESULT

HOME PAGE



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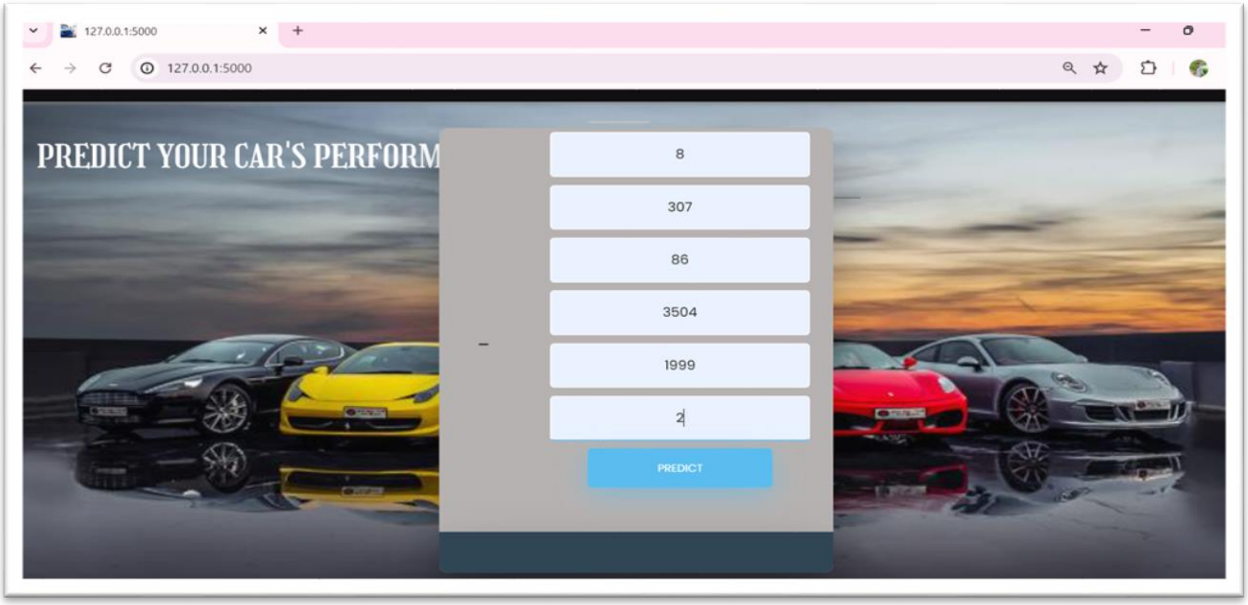
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1999
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PREDICT

7.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

Car performance prediction offers several advantages across various aspects of the automotive industry, including manufacturing, marketing, maintenance, and customer satisfaction. Here are some key benefits:

1. Improved Vehicle Design and Engineering

Enhanced Performance: Engineers can design vehicles with better performance metrics by predicting and optimizing for speed, acceleration, fuel efficiency, and handling.

Safety: Predictive models can help design safer vehicles by anticipating and mitigating potential issues during the design phase.

Cost Efficiency: Identifying and addressing potential design flaws early can save significant costs associated with recalls and redesigns.

2. Predictive Maintenance

Reduced Downtime: Predicting when parts are likely to fail allows for timely maintenance, reducing the likelihood of unexpected breakdowns.

Cost Savings: Preventive maintenance based on predictions can be more cost-effective than reactive maintenance, reducing repair costs and extending vehicle lifespan.

Improved Reliability: Regular, predictive maintenance enhances vehicle reliability and customer trust.

3. Enhanced Customer Experience

Personalized Services: Predictive analytics can offer tailored

DISADVANTAGES:

While car performance prediction offers many advantages, it also comes with several potential disadvantages and challenges

1. Data Dependency and Quality;

Data Requirements: Accurate predictions require large amounts of high-quality data, which can be difficult to collect and manage.Data Privacy: Collecting data from vehicles can raise privacy concerns among users, particularly regarding how data is stored, used, and shared.

2. Complexity and Costs;

Implementation Costs: Developing and maintaining predictive models can be expensive, requiring significant investment in technology and skilled personnel.Complexity: Creating accurate models involves complex algorithms and computational methods, which can be challenging to develop and validate.

3. Model Accuracy and Reliability

Prediction Errors: Predictive models are not infallible and can sometimes produce inaccurate predictions, leading to incorrect decisions and actions. Overfitting: Models may become too tailored to historical data and fail to generalize well to new, unseen data, reducing their effectiveness in real-world applications.

4. Technological Limitations

Sensor Limitations: The accuracy of predictions depends on the quality and reliability of sensors used to collect data. Faulty or imprecise sensors can lead to incorrect predictions.Software Issues: Software bugs or glitches in the predictive systems can cause malfunctions or incorrect predictions.

5. User Acceptance and Trust

Resistance to Change: Users and industry stakeholders may be resistant to adopting new predictive technologies, especially if they perceive them as complex or unreliable.Trust Issues: Building trust in predictive systems can be challenging, particularly if users have experienced incorrect predictions or system failures.

6. Legal and Ethical Considerations

Liability: Determining liability in case of failures or accidents caused by incorrect predictions can be legally complex.

Ethical Issues: The use of predictive models must be carefully managed to avoid ethical issues, such as discrimination based on biased data.

7. Integration Challenges

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Compatibility: Integrating predictive systems with existing vehicle systems and infrastructure can be difficult, requiring significant changes and

adaptations.Interoperability: Ensuring that predictive models work seamlessly with various makes and models of vehicles can be challenging, especially in a diverse market.

Overall, while car performance prediction holds significant promise, addressing these disadvantages is crucial for the effective and ethical implementation of these technologies.

8.APPLICATIONS

Car performance prediction has a wide range of applications across various domains within the automotive industry. Here are some key areas where these predictions can be particularly useful:

1. Vehicle Design and Development

Optimization of Design Parameters: Engineers can use predictive models to optimize various design parameters for better performance, efficiency, and safety.

Virtual Testing: Simulating vehicle performance under different conditions reduces the need for physical prototypes and extensive field testing.

2. Manufacturing

Quality Control: Predictive analytics can identify potential defects or variations in the manufacturing process, leading to improved quality control and fewer recalls.

Supply Chain Management: Predictions about future performance issues can help manage the supply chain more effectively, ensuring that necessary parts are available when needed.

3. Predictive Maintenance

Component Lifespan Estimation: Predictive models can estimate the remaining lifespan of various components, allowing for timely maintenance and replacements.

Failure Prediction: Identifying components that are likely to fail soon helps in scheduling proactive maintenance, reducing downtime and costs.

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4. Customer Experience

Personalized Service Plans: Using predictive data, service centers can offer customized maintenance plans tailored to individual driving habits and vehicle usage.

Enhanced Reliability: Vehicles with predictive maintenance features can offer a more reliable and satisfactory driving experience.

5. Fleet Management

Operational Efficiency: Fleet operators can use performance predictions to optimize routes, schedules, and maintenance, improving overall operational efficiency.

Cost Reduction: Predictive maintenance and performance optimization can lead to significant cost savings in fuel, repairs, and downtime for fleet operators.

6. Safety Enhancements

Accident Prevention: Predictive models can identify potential safety hazards and alert drivers or autonomous systems to take preventive measures.

Driver Behavior Analysis: Monitoring and predicting driver behavior can help in developing advanced driver-assistance systems (ADAS) that enhance safety.

7. Autonomous Vehicles

Path Planning: Predictive models help autonomous vehicles in planning the most efficient and safest routes.

Real-Time Decision Making: Continuous performance prediction allows autonomous systems to make real-time decisions to adapt to changing road conditions and traffic.

8. Environmental Impact:

Fuel Efficiency: Predictions about fuel consumption can lead to designs and driving practices that optimize fuel efficiency, reducing environmental impact.

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Emission Control: Predictive maintenance ensures that vehicle components like exhaust systems are functioning optimally, reducing harmful emissions.

9. Insurance

Risk Assessment: Insurers can use performance prediction models to assess risk more accurately and offer personalized insurance premiums based on predicted driving behavior and vehicle performance.

Claims Management: Predictive analytics can streamline the claims process by accurately identifying the causes and extents of accidents.

10. Marketing and Sales

Customer Insights: Understanding predicted performance and maintenance needs helps manufacturers and dealers offer targeted marketing and sales strategies.

Product Development: Insights from performance predictions can guide the development of new products and features that meet customer demands and market trends.

Overall, car performance prediction is a powerful tool that can lead to significant improvements in vehicle design, manufacturing, maintenance, safety, and customer satisfaction across the automotive industry.

9.CONCLUSION

Car performance prediction represents a significant advancement in the automotive industry, offering a range of benefits that enhance vehicle design, maintenance, safety, and customer satisfaction. By leveraging advanced analytical techniques and vast amounts of data, stakeholders in the automotive sector can make more informed decisions, leading to better outcomes across the board.

Key Benefits:

- **Enhanced Vehicle Design:** Predictive models enable engineers to optimize various aspects of vehicle design, improving performance, efficiency, and safety.
- **Predictive Maintenance:** Anticipating component failures and maintenance needs reduces downtime, lowers costs, and extends the lifespan of vehicles.
- **Improved Customer Experience:** Personalized maintenance plans and increased vehicle reliability contribute to higher customer satisfaction.

- **Operational Efficiency:** Fleet operators benefit from optimized maintenance schedules and route planning, leading to significant cost savings and improved operational efficiency.
- **Safety Improvements:** Predictive models help identify potential safety issues and enhance driver assistance systems, contributing to safer driving experiences.

Challenges:

- **Data Quality and Privacy:** Ensuring the availability of high-quality data and addressing privacy concerns are critical for effective performance prediction.
- **Implementation Costs:** Developing and maintaining predictive systems require substantial investment in technology and skilled personnel.
- **Model Accuracy:** Continuous validation and refinement of predictive models are necessary to maintain their accuracy and reliability.

In summary, car performance prediction offers transformative potential for the automotive industry. By addressing challenges related to data quality, implementation costs, and model accuracy, the industry can fully harness the benefits of predictive analytics. As technology continues to evolve, the widespread adoption of performance prediction is expected to drive further innovation, leading to safer, more efficient, and more reliable vehicles.

10.FUTURE SCOPE.

The future scope of car performance prediction is broad and promising, with numerous opportunities for innovation and enhancement in the automotive industry. As technology advances, the capabilities of predictive models will expand, leading to new applications and improvements in various aspects of vehicle performance, safety, and efficiency. Here are some key areas where car performance prediction is likely to evolve in the future.

1. Integration with Autonomous Vehicles

Real-Time Decision Making: Advanced predictive models will be crucial for autonomous vehicles, enabling real-time decisions based on current and anticipated driving conditions.

Enhanced Safety: Predictive analytics will help autonomous systems foresee potential hazards and take preventive measures to avoid accidents.

2.Advancements in Machine Learning and AI :

Improved Algorithms: The development of more sophisticated machine learning algorithms will lead to more accurate and reliable performance predictions.

Deep Learning Applications: Deep learning techniques can analyze vast amounts of data from various sources, improving predictions related to vehicle performance and driver behavior.

3. IoT and Connected Vehicles

Enhanced Data Collection: The proliferation of Internet of Things (IoT) devices and connected vehicle technologies will provide richer data sets for more precise predictions.

Predictive Maintenance: Real-time monitoring and data analysis will enable even more accurate predictions of maintenance needs and component failures.

4.Personalized User Experience

Customized Driving Assistance: Predictive models can tailor driving assistance features to individual driver habits and preferences,enhancing the overall driving experience.
Smart Infotainment Systems: Future vehicles may use predictive analytics to offer personalized entertainment and navigation options based on driver preferences.

5. Sustainability and Environmental Impact

Optimized Fuel Consumption: Predictive models will continue to advance in optimizing fuel efficiency, leading to reduced fuel consumption and lower emissions.

Electric Vehicle Performance: As electric vehicles (EVs) become more prevalent, predictive analytics will play a key role in optimizing battery performance and extending range.

6. Enhanced Safety Features:

Accident Prediction and Prevention: Future predictive systems will be able to better anticipate and prevent accidents by analyzing driving patterns, road conditions, and vehicle performance data.
Advanced Driver Assistance Systems (ADAS): Predictive models will enhance ADAS by providing more accurate and timely assistance tO drivers.

7. Integration with Smart CitiesTraffic Management:

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Predictive analytics can be integrated with smart city infrastructure to improve traffic flow, reduce congestion, and enhance overall transportation efficiency. V2X Communication: Vehicle-to-everything (V2X) communication will leverage predictive models to improve interactions between vehicles and infrastructure, enhancing safety and efficiency.

8. Augmented Reality (AR) and Virtual Reality (VR) :

Driver Training: AR and VR technologies combined with predictive analytics can create realistic training environments for drivers, improving their skills and safety awareness. Enhanced Navigation: AR-based navigation systems can use predictive models to provide more accurate and context-aware directions.

9. Regulatory and Policy Support:

Standardization: As predictive technologies become more widespread, there will be a need for standardized protocols and regulations to ensure safety and interoperability. Incentives for Adoption: Governments may offer incentives for adopting predictive maintenance and performance technologies, promoting wider use and further innovation.

10. Consumer Applications Insurance:

Predictive models will allow for more personalized and dynamic insurance policies based on real-time driving behavior and vehicle performance. Market Insights: Manufacturers and dealers can use predictive analytics to gain insights into consumer preferences and market trends, leading to better product offerings and marketing strategies.In conclusion, the future scope of car performance prediction is vast, with significant potential to revolutionize the automotive industry. As technology continues to advance, the integration of predictive analytics with various aspects of vehicle design, maintenance, and operation will lead to safer, more efficient, and more personalized driving experiences

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12.APPENDIX

<u>Model building :</u>

1)Dataset
2)Google colab and Application Building
  1. HTML file (Index file, Predict file)
  1. CSS file
  2. Models in pickle format

SOURCE CODE:

<u>INDEX.HTML</u>

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<script src="//maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<script src="//cdnjs.cloudflare.com/ajax/libs/jquery/3.2.1/jquery.min.js"></script>
<link rel="stylesheet" href="{{ url_for('static', filename='css/style.css') }}">
<link rel="shortcut icon" href="{{ url_for('static', filename='css/favicon.ico') }}">
<div class="navbar">
    <section class="title">
    <h1><p style="font-family: 'Girassol', cursive ;">PREDICT YOUR CAR'S
PERFORMANCE</p></h1>
      <lottie-player

src="https://assets9.lottiefiles.com/datafiles/HN7OcWNnoqje6iXIiZdWzKxvLIbfeCGTmvXmEm1h/dat
a.json"
      background="transparent"
      speed="1"
      style="width:300px; height: 300px;"
      loop
      autoplay
     ></lottie-player>
    </section>
</div>

<div class="wrapper fadeInDown">
  <div id="formContent">
   <!-- Tabs Titles -->
  <section class="date">
   <!-- Icon -->
   <div class="fadeIn first">
```

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```
      <script src="https://unpkg.com/@lottiefiles/lottie-player@latest/dist/lottie-player.js"></script>
       <lottie-player
         src="https://assets6.lottiefiles.com/packages/lf20_TkGfat.json"
         background="transparent"
         speed="1"
         loop
         style="width: 100px; height: 100px;"
         autoplay
       ></lottie-player>
    </div>
    <div class="fadeInDown">
    <form action="{{ url_for('y_predict')}}"method="post">
      <input type="text" name="Cylinders" placeholder="No.of cylinders (count)" required="required" />
       <input type="text" name="Displacement" placeholder="Displacement (in miles)"
required="required" />
  <input type="text" name="Horsepower" placeholder="Horsepower (per sec)" required="required" />
       <input type="text" name="Weight" placeholder="Weight (in pounds)" required="required" />
       <input type="text" name="Model Year" placeholder="Model Year (YYYY)" required="required" />
       <input type="text" name="Origin" placeholder="Origin" required="required" />
       <br>
      <input type="submit" class="fadeIn fourth" value="Predict">
    </form>
    </section>

    <div id="formFooter">
      <a class="underlineHover" href="#">
        <strong>{{ prediction_text }}</strong></a>
    </div>
   </div>
  </div>
</div>
```

APP.PY

```
import numpy as np
from flask import Flask, request, jsonify, render_template
import pickle
#from joblib import load
app = Flask(__name__)
model = pickle.load(open('decision_model.pkl', 'rb'))

@app.route('/')
def home():
```

```
    return render_template('index.html')

@app.route('/y_predict',methods=['POST'])
def y_predict():
    '''
    For rendering results on HTML GUI
    '''
    x_test = [[int(x) for x in request.form.values()]]
    print(x_test)
    #sc = load('scalar.save')
    prediction = model.predict(x_test)
    print(prediction)
    output=prediction[0]
    if(output<=9):
        pred="Worst performance with mileage " + str(prediction[0]) +". Carry extra fuel"
    if(output>9 and output<=17.5):
        pred="Low performance with mileage " +str(prediction[0]) +". Don't go to long distance"
    if(output>17.5 and output<=29):
        pred="Medium performance with mileage " +str(prediction[0]) +". Go for a ride nearby."
    if(output>29 and output<=46):
        pred="High performance with mileage " +str(prediction[0]) +". Go for a healthy ride"
    if(output>46):
        pred="Very high performance with mileage " +str(prediction[0])+". You can plan for a Tour"


    return render_template('index.html', prediction_text='{}'.format(pred))

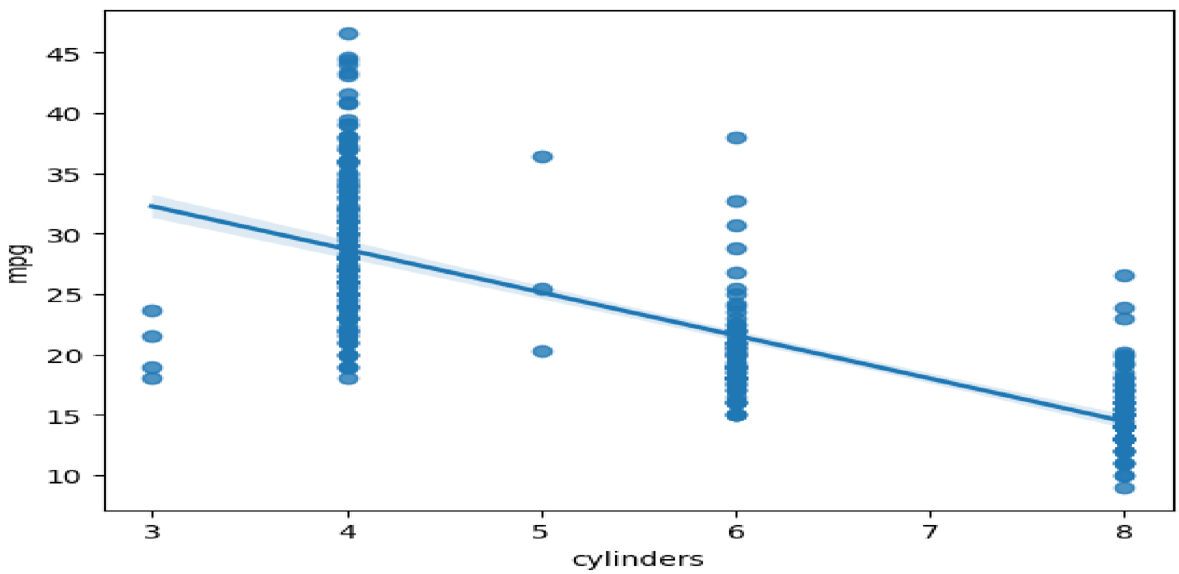
@app.route('/predict_api',methods=['POST'])
def predict_api():
    '''
    For direct API calls trought request
    '''
    data = request.get_json(force=True)
    prediction = model.y_predict([np.array(list(data.values()))])

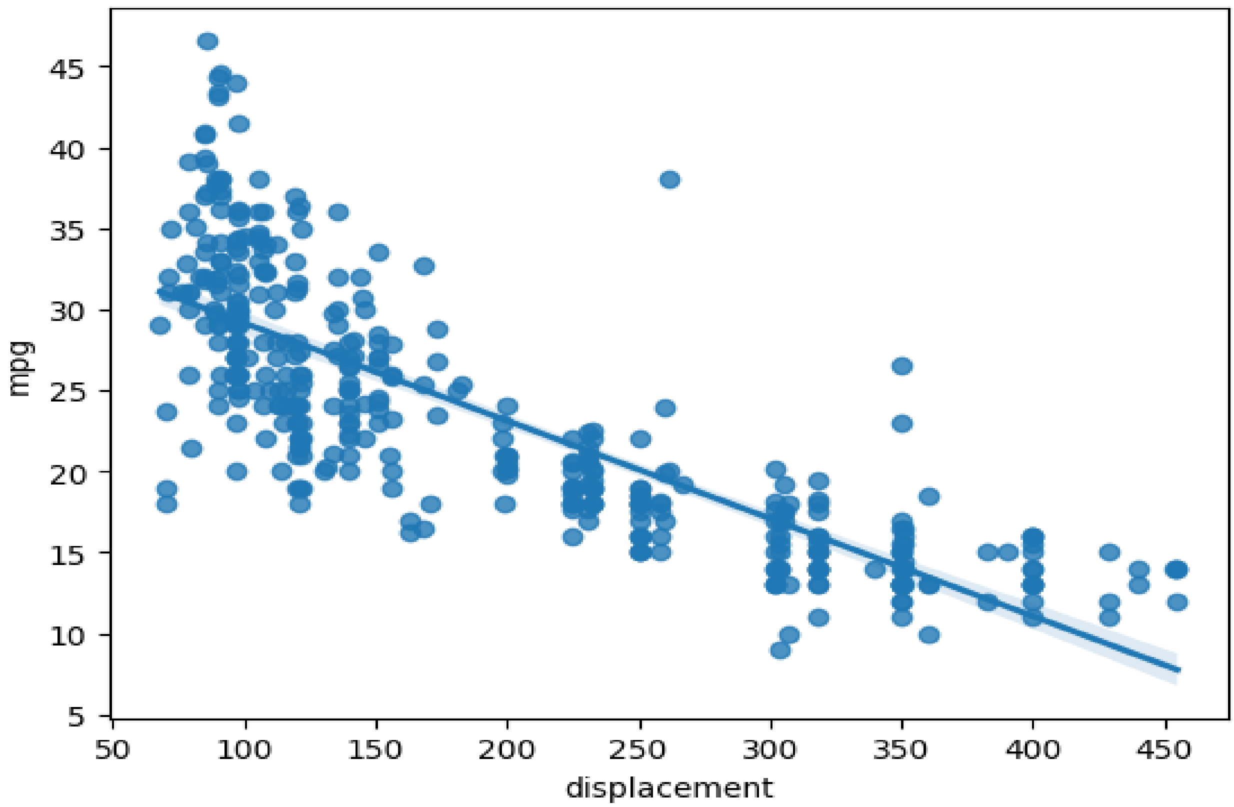
    output = prediction[0]
    return jsonify(output)

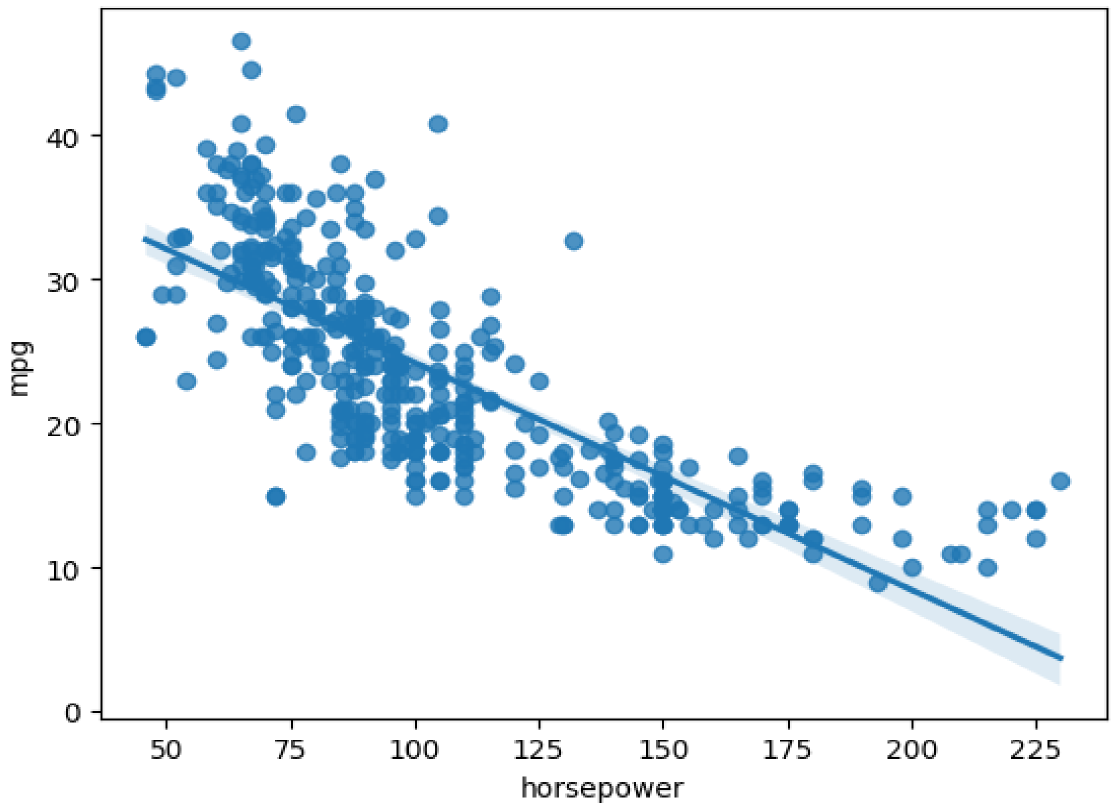
if __name__ == "__main__":
    app.run(debug=True)
```

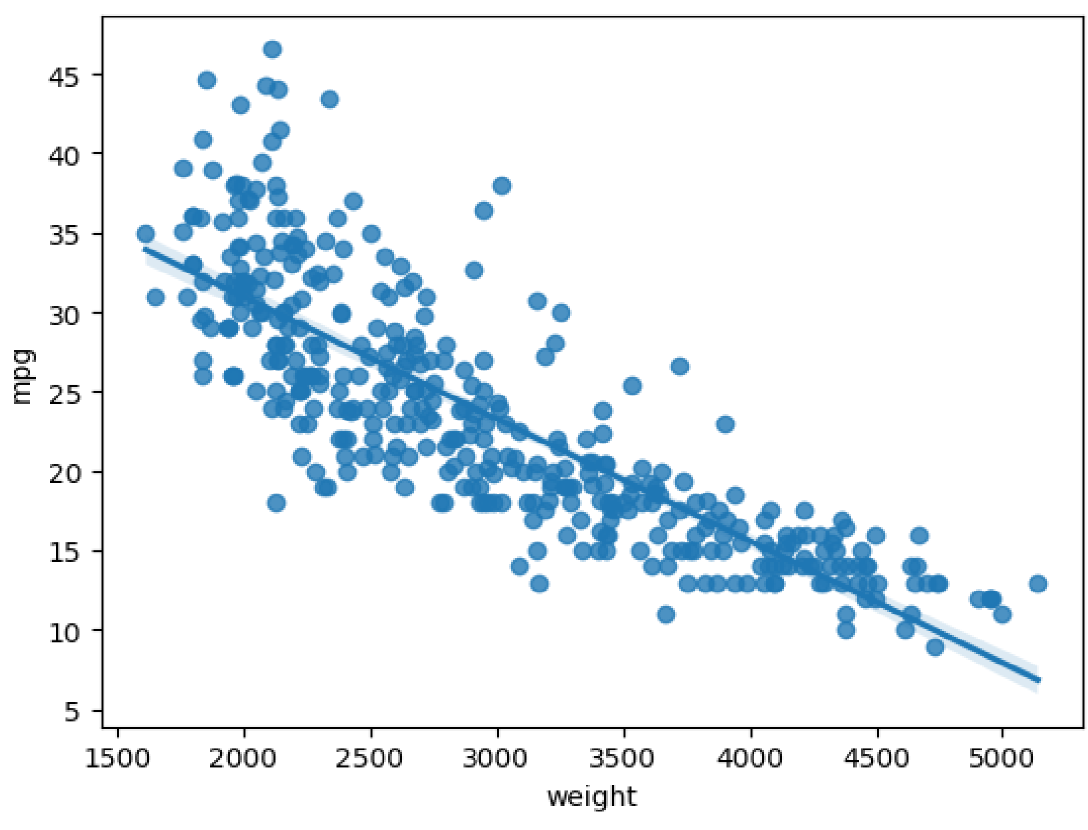
CODE SNIPPETS

MODEL BUILDING

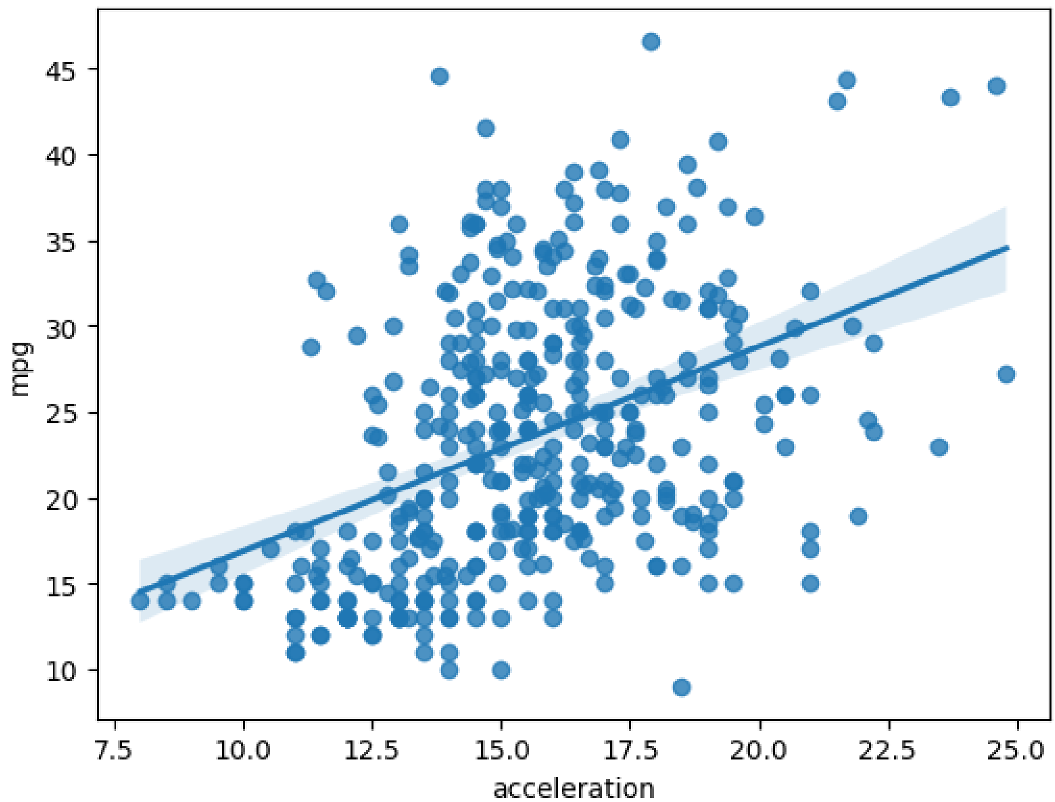



45
40
35
30
25
20
15
10
5
mpg
50
100
150
200
250
300
350
400
450
displacement

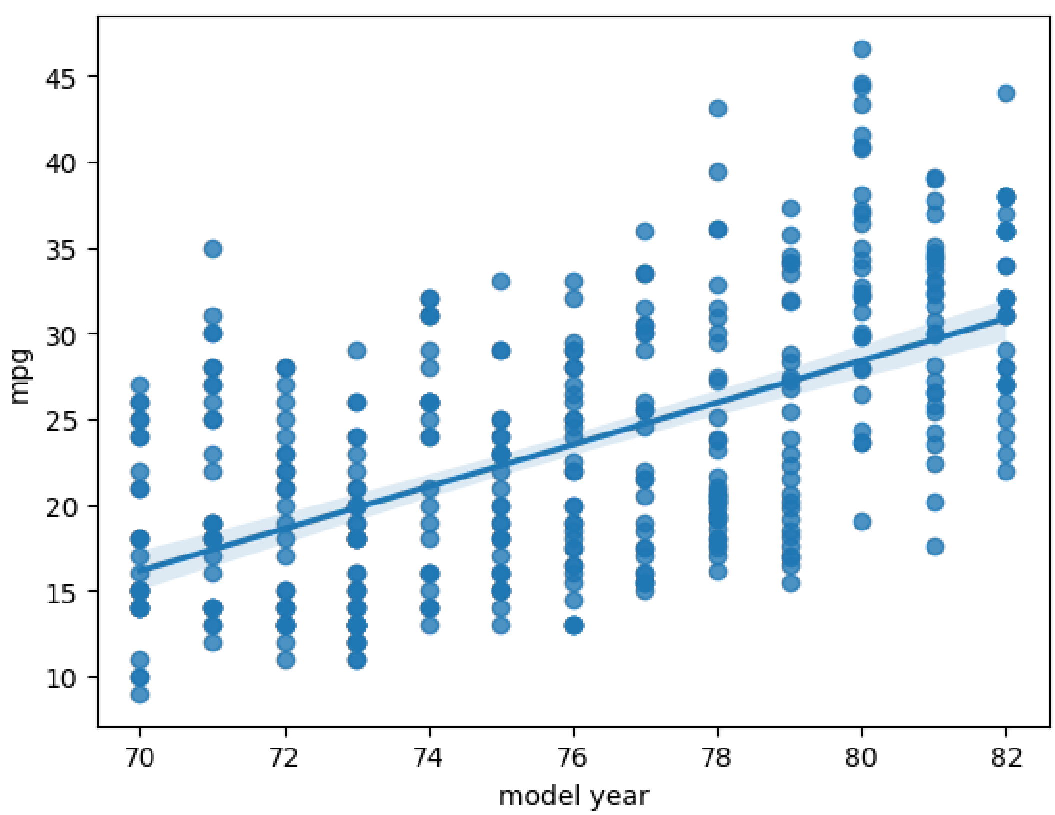

mpg
horsepower
0
10
20
30
40
50
75
100
125
150
175
200
225


mpg
weight
5
10
15
20
25
30
35
40
45
1500
2000
2500
3000
3500
4000
4500
5000

32

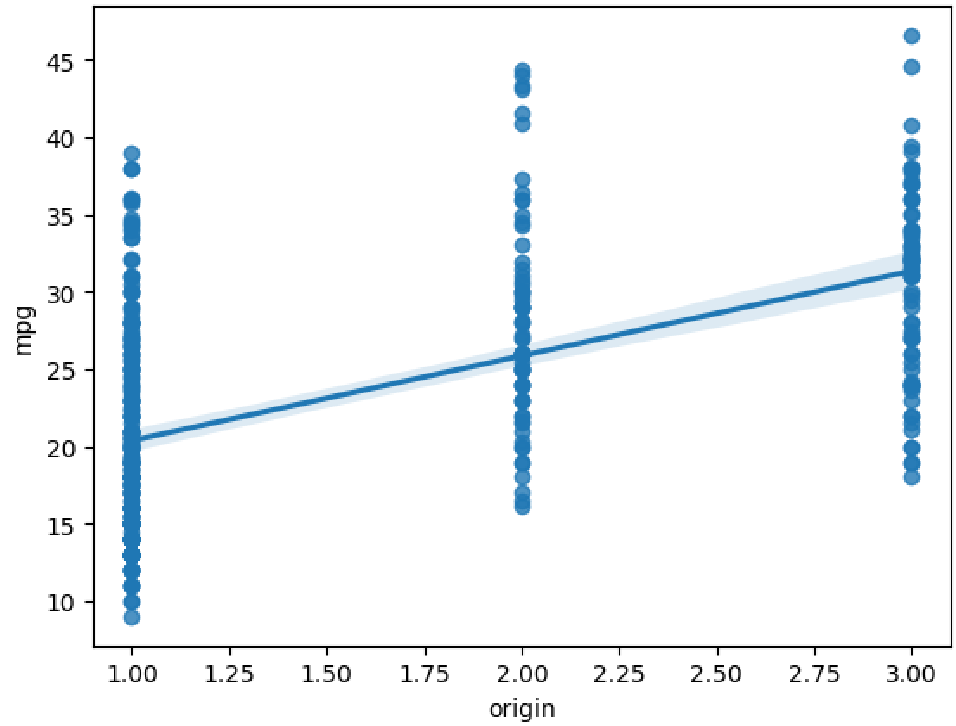


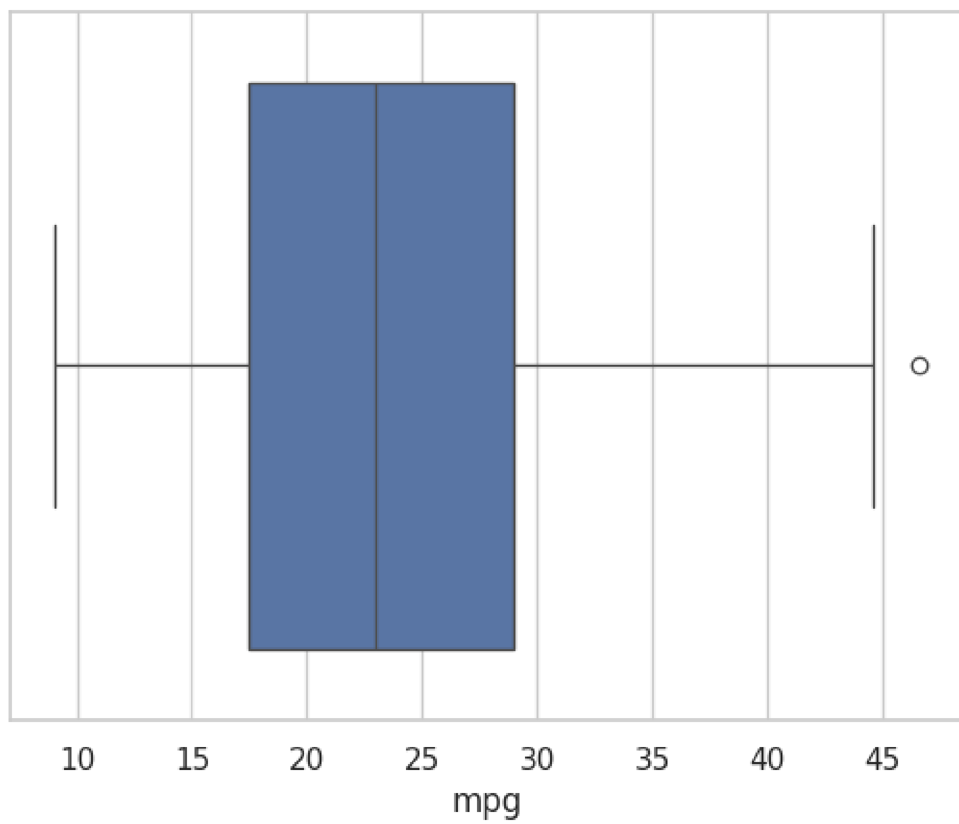
45
40
35
30
25
20
15
10
mpg
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
acceleration



45
40
35
30
25
20
15
10
mpg
70
72
74
76
78
80
82
model year

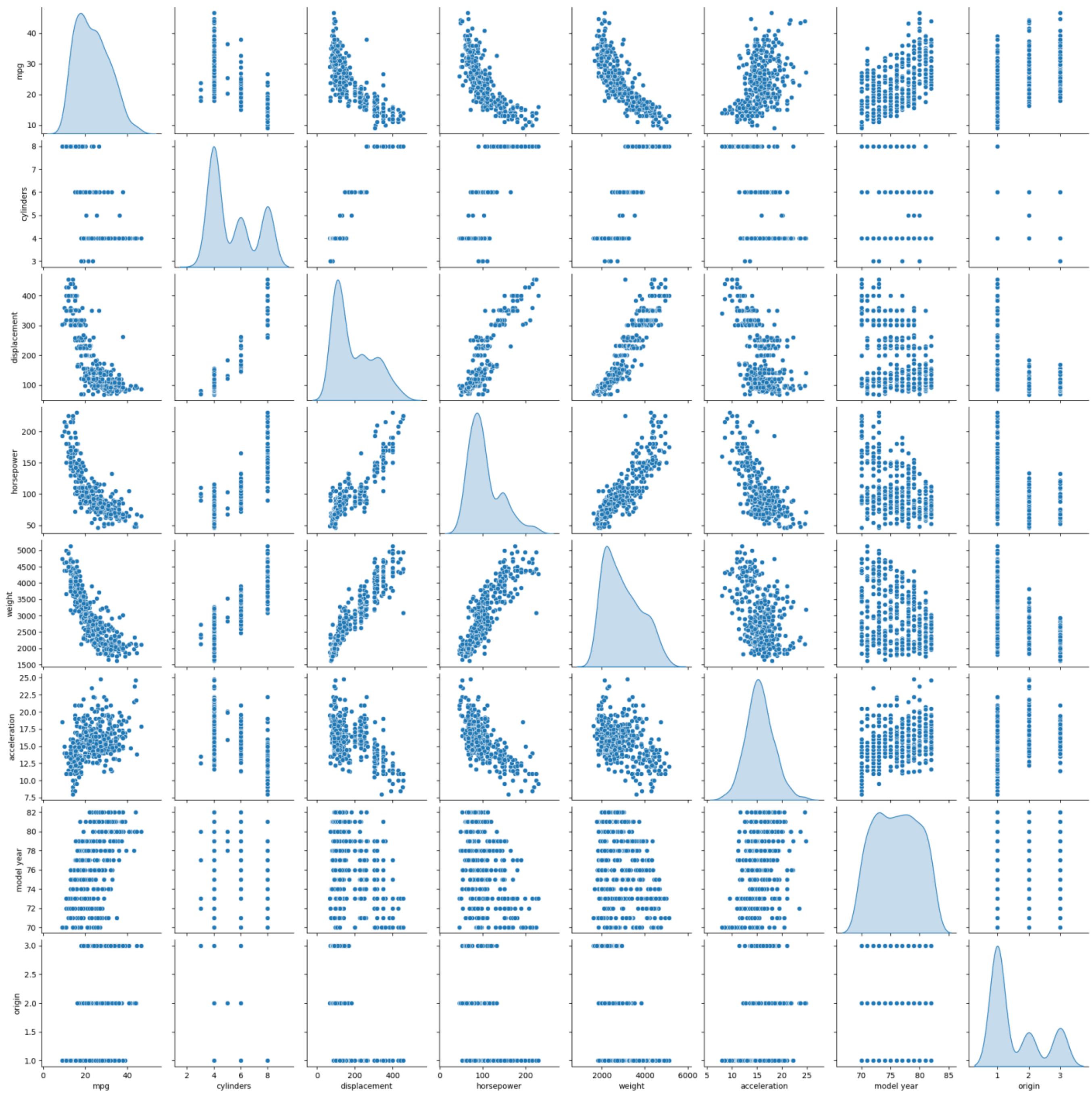
33


mpg
45
40
35
30
25
20
15
10
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
origin


10
15
20
25
30
35
40
45
mpg

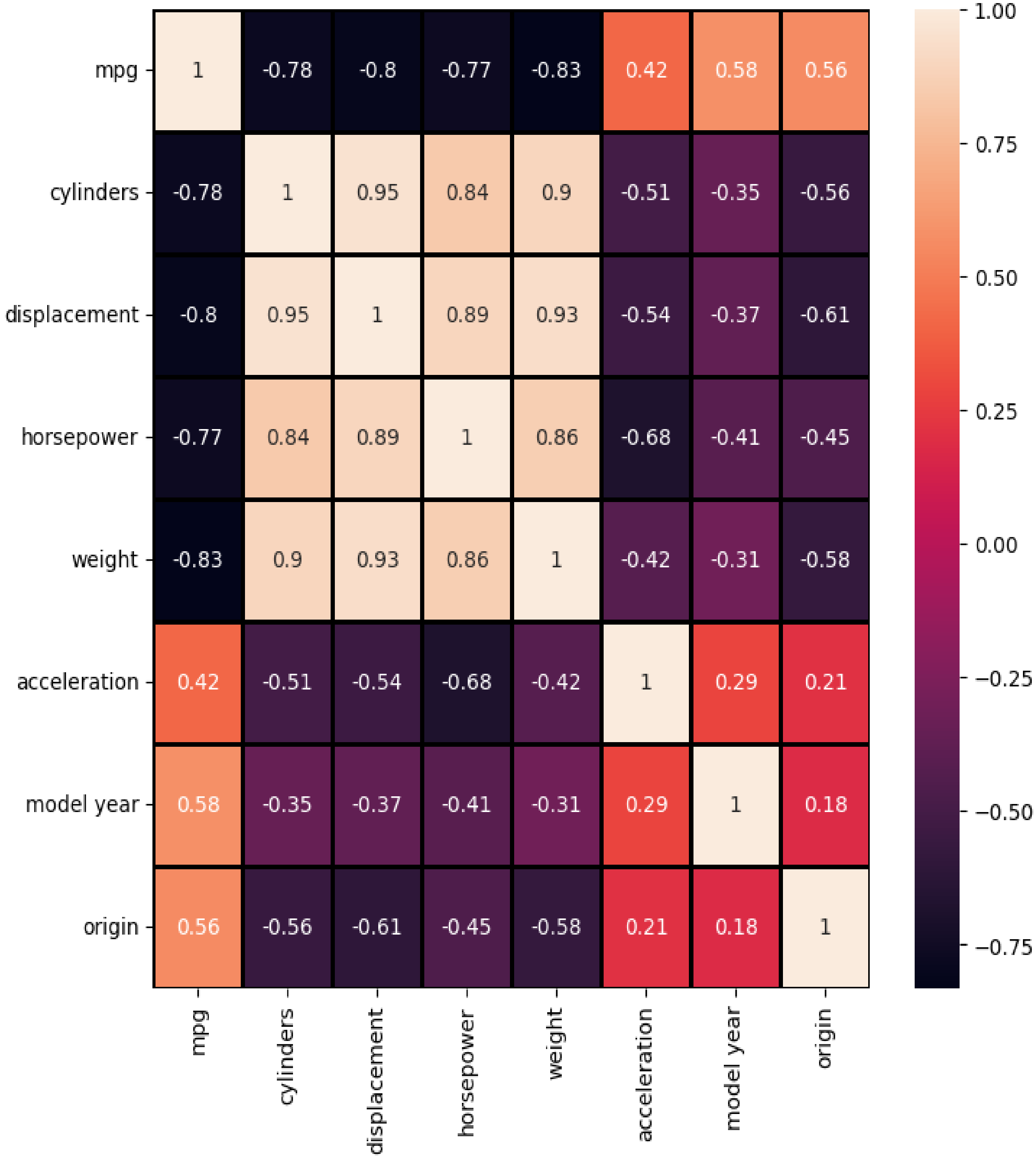
34

PAIRPLOT


mpg
cylinders
displacement
horsepower
weight
acceleration
model year
origin

35

HEATMAP


mpg
cylinders
displacement
horsepower
weight
acceleration
model year
origin
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
1 -0.78 -0.8 -0.77 -0.83 0.42 0.58 0.56
-0.78 1 0.95 0.84 0.9 -0.51 -0.35 -0.56
-0.8 0.95 1 0.89 0.93 -0.54 -0.37 -0.61
-0.77 0.84 0.89 1 0.86 -0.68 -0.41 -0.45
-0.83 0.9 0.93 0.86 1 -0.42 -0.31 -0.58
0.42 -0.51 -0.54 -0.68 -0.42 1 0.29 0.21
0.58 -0.35 -0.37 -0.41 -0.31 0.29 1 0.18
0.56 -0.56 -0.61 -0.45 -0.58 0.21 0.18 1

36

37