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Machine Learning based Vehicle Performance Analyzer

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ABSTRACT:

Vehicle performance analysis is an interesting project while we make it with the advanced machine learning models. Here we are making use of machine learning to analyze the performance of vehicles. Well what is the need of analyzing the performance of vehicles? There we get a solution, **Vehicle performance** is the study of the motion of a vehicle. The motion of any vehicle depends upon all the forces and moments that act upon it. These forces and moments, for the most part are caused by interaction of the vehicle with the surrounding medium(s) such as air or water (e.g. fluid static and dynamic forces), gravitational attraction (gravity forces), Earth's surface (support, ground, or landing gear forces), and on-board energy consuming devices such as rocket, turbojet, piston engine and propellers (propulsion forces). Consequently, in order to fully understand the performance problem, it is necessary to study and, in some way, characterize these interacting forces.

Generally speaking, **the performance of a vehicle can be evaluated using following indicators**: the maximal speed that can be reached, the accelerating time from zero to a certain speed, the maximal climbing angle, the mileage in a certain condition and the number of cylinders used in the vehicle.

INTRODUCTION:

In this project the main purpose is to analyze the performance of vehicles. Using machine learning techniques. The machine learning techniques we are using classification and regression techniques. Regression is used to analyze the continues and categorial values and variables. By analyzing the braking system and the count of cylinders of the engine types we can easily determine the mileage. For example let us consider a Engine horsepower is measured **using a dynamometer.** The data is collected from the dynamometer. The horse power produced by the engine the rpm max torque rate all things are put together. To determine the vehicle which is best in performance we have to access the data which we got. Sometimes it maybe a meta data which can be very unstructured data. Meta data can not be the actual data meta data is the data of the another data. First step is data collection. Although we collected the data processing the data maybe very hard, at the end of this process machine learning models are created to predict the data based on the vehicle specifications. For this we are creating a small UI for the customer comfort customer inserting the specifications of their data and the model trained using machine learning which is already dumped inside predict the performance and generates a csv file based on the performance. These are the methods included in this project to analyze the vehicle performance using machine learning.

LITERATURE REVIEW:

In this paper, we depict the vehicle performance analysis using machine learning for this we are implementing machine learning regression models to analyze the continues data. As the population increases the number of consuming of vehicles also increases. To improve the vehicles performance we need to analyze the statistics. By analyzing the vehicle performance we can build and implement the new advanced improvements to increase the performance of vehicles. The main purpose of analyzing the vehicle performance is to get a or we could say to build an optimized model. Well to analyze we need bunch of time to collect the data and it takes more time to clean the data for starting the analysis. What is the need of machine learning to use here is, nowadays AI is being implemented everywhere. The models trained by humans give more accuracy for complex problem solving. To implement this project we have used regression model. By doing this project and implementing this can be very helpful and useful to analyze the performance of the vehicles.

The user can give input of the data to the web page that we have implemented using python and HTML. For **UI** we are using **HTML** and for a creating web page we are using a popular python web framework known as flask. These type of techniques can really help to use and access the web page easily. A vehicle based on it's characteristics can be classified whether the vehicle is functioning good or bad. Also, we can analyze the efficiency of the vehicle which could be very helpful. This project could be very helpful and easy to access. Overall we can say that this particular project is based on a machine learning which the model is pre-trained early to analyze the new data that the pre-trained model should predict the output accurately. The pre-trained machine learning model should be dumped into the web page which is designed using simple **HTML** and flask python web framework. This project accepts the input from the user and predict the output which is already trained with a bunch of data. That's the overall and overview of this modern world project.

MATERIALS AND METHODS:

The design and development of this project are divided into two main parts which are data collection & data preparation and implementation of the machine learning model. For this we have to collect a bunch of data to get more accuracy. The data collection can be done from various resources and various file formats like json, xlsx, csv and other file formats. The collected data must be processed properly to get the higher accuracy. Data processing can take more time. It could be the biggest time consuming task. Then, the next step the machine learning model (Suitable machine learning model) is selected. The model selection is done by considering the target variable. Model is trained and evaluated if the model gives the desired accuracy then the next step is create a web page and to dump the model into the web page. These are the overall methods followed in this project.

1 DATA COLLECTION:

To train a model which gives us the desired accuracy we have collect more amount of data to train a best model. To do that we have collected some data with a shape of 399X9 . This dataset is used to train our linear regression model. This dataset contains a the popular vehicle manufacturers and their best manufactured models. This dataset also contains an amount of NaN values and other missing values. The step after collecting the data is to process the data. The next step is to process the data. To do this we have to go through each and every columns sharply. By analyzing the columns we can come to an idea about what is the data about and how to handle the data.

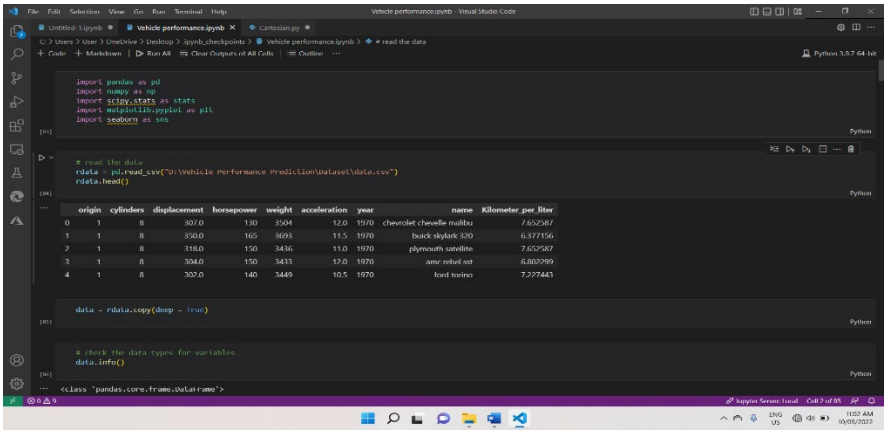

Figure 1: Reading the data from the csv file

DATA PRE-PROCESSING:

Data preprocessing involves in cleaning the data. Which is more important in data analysis. These process comes under the **EDA**(Exploratory Data Analysis). In this EDA process we can do many simple and basic things like analyzing the correlation between the variables and plotting graphs and charts for understanding the data which we are going to process. Exploratory Data Analysis helps to understand the matching patterns between the variables. The data is removed NaN values and removed empty cells.

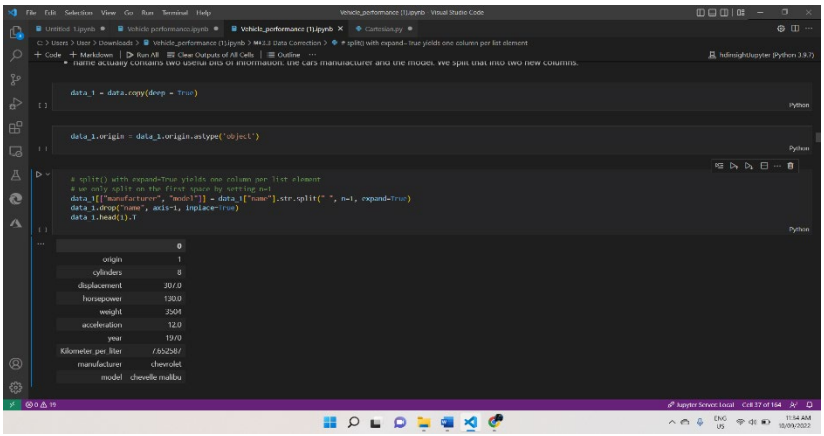

Figure 2: Exploratory Data Analysis.

Statistical Summary:

The overall summary of the data is identified to understand the correlation between the variables. The statistical summary gives us all the details about the data including the mean, Standard Deviation and so on. By doing this we can know the data is whether perfect or not. Understanding the correlation between the variables we can use them to create alter the data perfectly. This perfectly altered data is now ready to train the machine learning model.

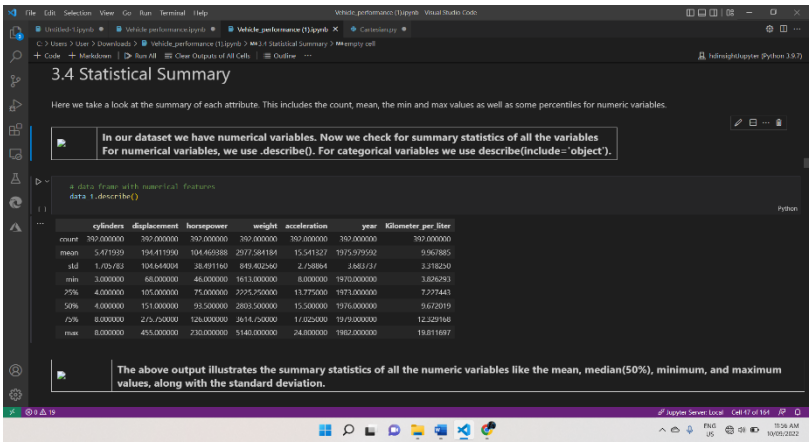

Figure 3: Statistical summary of the data

Model Training:

Model training is done after the data is well and deeply pre-processed. The well defined data without any missing values, NaN values and also duplicate values. The well pre-processed data is split into test and train values. Always the train size is bigger than the test values. The splitting is done. For this whole process we do with the **Scikit-learn**. This module is inbuilt in python. Using scikit learn we import the linear regression and train the model. This is how the data is processed and trained.

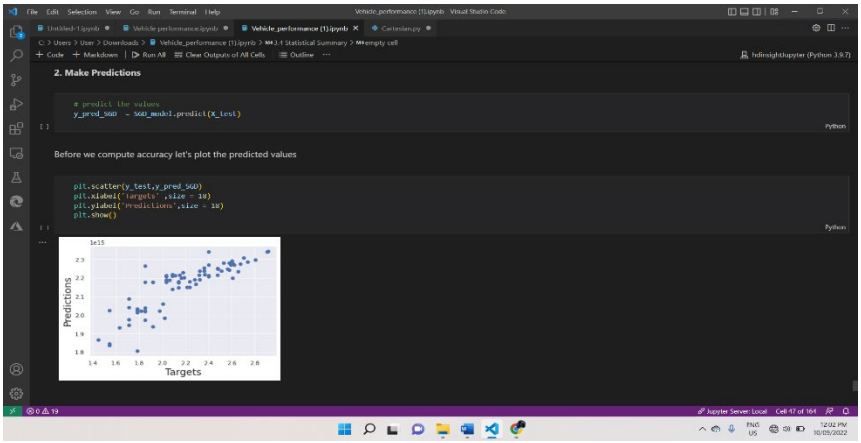

Figure 4: The LCD Display.

PREDICTIONS:

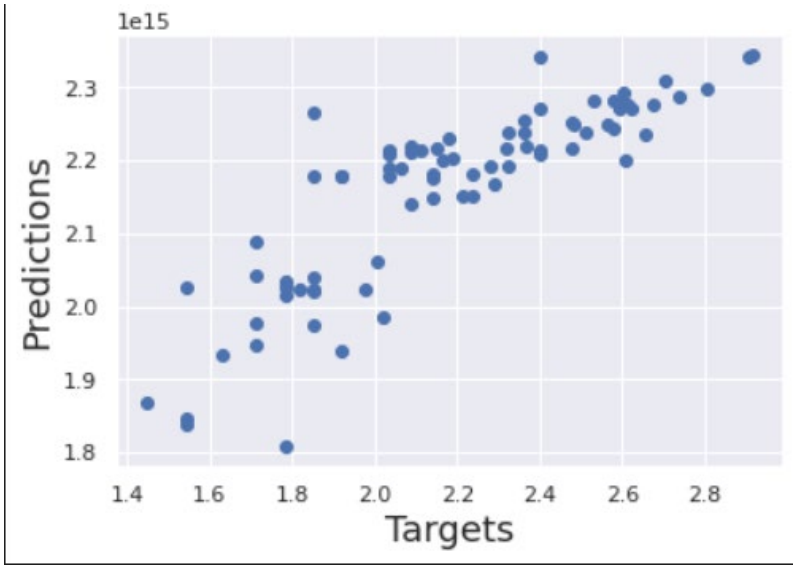

Figure 5: Predictions made by the Machine Learning model.

WEB PAGE DEVELOPMENT:

As we finished our first phase of our project we are now in second phase the web page development phase. This phase involves in developing a simple **UI** with simple **HTML** and a python web framework. In this web page the user need to give some inputs. Those inputs would be like the manufacturer name, engine type, mileage, and number of cylinders. By taking inputs from the user we need to analyze the vehicle performance. In the backend the machine learning model which we trained would be running. The machine learning model takes input from the user and predicts the output accurately. Since the model is trained and evaluated already, now the machine learning model can predict the actual and real time data. The input from the user is given to the machine learning model and the output would get downloaded as in a **CSV** format in the user's local storage. This would be the final format of the output. The actual predicted output gets stored in the user's local disk.

CONCLUSIONS:

This project has been made to Real-time vehicle performance analyzing system based on a machine learning model. This project is an amazing real-time project which is easy to create idea and implementation. This project is created with machine learning model and also created with simple **UI** for the user's convenience. Ultimately this project could be very helpful for analyzing the performance of the vehicle. It has a simple **UI** design and running on python web framework. This project is containing trained **ML** model running in the backend. It could buy the real-time data as input from the user and could analyze it. This is the overview of this project.

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