CO2 Emissions due to Fuel Consumption

1st NAVEEN C S
Dept of computer science Engineering
PES University,Bengaluru,India
SRN : PES1201801744
naveencs927@gmail.com

2nd ASHAY G
Dept of Computer Science Engineering
PES University,Bengaluru,India
SRN : PES1201801767
ashaygowda@gmail.com

3rd BHARGAV V
Dept of Computer Science Engineering
PES University,Bengaluru,India
SRN : PES1201801796
bhargavv1245@gmail.com

4th MANOJ KUMAR P
Dept of Computer Science Engineering
PPES University,Bengaluru,India
SRN : PES1201801923
manoj13812@gmail.com

***Abstract*—In recognition of the fundamental importance of understanding energy related environmental issues, CO2 Emissions from fuel combustion dataset provide a full analysis of emissions stemming from energy use and have become an essential tool for analysts and policy makers in many international fora. The publication is designed to assist in understanding the fuel specific and sectoral evolution of CO2 emissions associated with combustion of fuels in the year 2019.**

The reason why we have chosen this dataset is to find a way to minimize the CO2 emissions to the minimum possible rate. In this report we have done few of the ways in which we could achieve the above mentioned target.We have done few visualizations to better understand the data(exploring the data).

I. Introduction

The global energy usage is increasing day to day.Over one third of the global emissions come through transportation.This industry has a lot of fuel consumption.The amount of CO2 emissions is directly proportional to the amount of fuel used.Recent days the efficiency of the cars have increased and also electric cars have been introduced.But despite these efforts in our attempt to reduce our carbon footprint we have failed in achieving our goal.Low-carbon transportation solutions such as substitution of fossil oil by alternative fuels, enhancing vehicle technology, and developing public transport systems have been applied widely.In this paper we would like to address a small portion of this issue of CO2 Emissions due to Fuel Consumption.

We have chosen this data set fuel consumption.csv to analyze the CO2 emissions and to find the possible solutions to minimize to best possible rate.We have used data analytics tools to observe that here that most models emits CO2 in the rate of 250 which is likely to be eco friendly than higher rates.We should try to reduce to even better than this achieve Eco friendly nature by finding out the necessary correlations where CO2 emissions should be at a certain minimum rate.We aim to find the best technique methods configured to achieve the best precision levels reduce the fuel consumption in vehicles.Vehicle emission estimation models play a critical role for regional planning and development of emission control strategies

A number of papers related to the analysis of fuel consumption were studied and the following papers were considered.

Identify applicable funding agency here. If none, delete this.

II. Literature Survey

A. Fuel consumption models applied to automobiles using real time data : A comparison of statistical models

There are several methods including statistical methods re exploited in order to obtain prediction method for instantaneous fuel consumption The second largest CO2 emissions is the combustion of gasoline and diesel vehicles used in transportation. The amount of CO2 emissions from a vehicle is proportional to the fuel consumed by the engine. Fuel efficiency depends on the driving mode which in turn is dependable on several factors. There are many different ways to estimate emissions using the information on fuel consumption. To reduce environmental externalities, it is imperative that fuel efficiency of the vehicles is improved. The data are collected when drivers were in normal course In this paper three statistical methods namely Support vector machines,Artificial neural network and multiple linear regression is used in term of prediction of total and instant fuel consumption.SVM'S outperform both ann and mlr and can be applied to fuel consumption models efficiently. Support Vector Machine model of fuel consumption expose comparatively better correlation than the other statistical fuel consumption models.

Statistical models of fuel consumption:

a.Multiple linear regression

Linear Regression is the most widely used statistical model to construct a linear relationship between the variables. Linear regression models assume that response(dependent) variable is linear function of the model parameter(independent variable).

In multiple linear regression there are more than one model parameters in order to predict the response variable

b.Artificial Neural Networks:

Artificial neural network is the supervised learning technique that mimics the biological neural networks. Complex structure of neural networks allows ANN input vectors are propagated through layers of neurons in order to estimate corresponding output. ANN has been applied various disciplines including energy management, especially forecasting fuel consumption and CO2 emissions.

c.Support Vector Machines:

Support vector regression is a version of Support vector machine which was put forward in 1996. It basically aims in minimizing the width(perpendicular distance between support vectors).

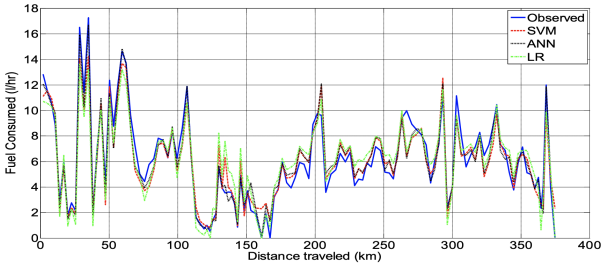


Fig. 5. Fuel consumption rate prediction of the three models

Results:

SVM provides better results for all automobile kinds comparing ANN and linear regression. SVM outperforms other models for both accuracy and consistency looking at average and standard deviation of R values. Even when we just use speed, acceleration and slope as input values SVM delivers better results than other statistical model.

B. Global Research on Carbon Emissions: A Scientometric Review

It emphasises to improve on the existing research on carbon emissions and bridge the gap in knowledge of carbon emissions. the data source and retrieval strategy adopted was based on the best techniques that will achieve the established aim, objectives and the identified methodology of this study. The source of data includes journal articles published from 1980 to June 2019.This paper was based only on the literature data obtained from the WoS core collection which might not cover all the available literature on the domain. Track the history of carbon emmision research through review.arbon capturing, predicting future carbon emissions through trend analysis, evaluating carbon performance, identifying carbon mitigation opportunities and ultimately achieving zero carbon emission goals are some of the most popular research areas in the carbon emission research domain. It offers an in-depth understanding and a valuable insight into the most significant authors, institutions, countries in the carbon emission research domain as well as the trends of publications. The findings of this study can be used to obtain the necessary support and guidance to formulate carbon emission control policies.

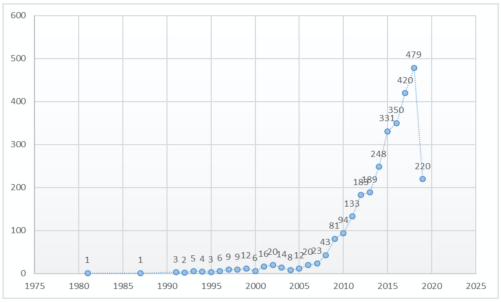


Figure 2. The trend in carbon emission publications from 1981 to June 2019.

Results:

a.Global Trends of Carbon Emission Research: The first research publication on carbon emission was in 1981, and since then carbon emission research has gained ground due to increased global warming. The highest number of publications on carbon emission research was reported in 2018—479 publications. There were 220 publications reported already by June 2019, implying a significant increase in publications on this domain in 2019. The carbon emission research domain remains to be a key theme of sustainability research and many researchers and institutions, therefore, tend to explore the domain extensively

b.Co-Word Scientometric Analysis Result The co-word scientometric analysis provides a scientific review of the keywords, and the association of words is often used in carbon emission research to understand the history and its relation to the global trends of carbon emission research. This section investigates and presents significant research keywords and co-words using CiteSpace software. The core contents of the research are presented by the keywords and indicate the development of research topics over a time period. Two types of major keywords are found in the WoS database: (i) keywords supplied by the authors and (ii) keywords identified by the journal which are also known as “keywords plus”.

c.Co-Citation Analysis Result Co-citation is another key measure of documents, which is defined as the frequency of two documents being cited together in other documents. Accordingly, a journal co-citation analysis, document co-citation analysis, and author co-citation analysis were conducted to identify the trends and patterns of carbon emission research.

C. Emissions and Fuel Consumption Modeling for Evaluating Environmental Effectiveness of ITS Strategies

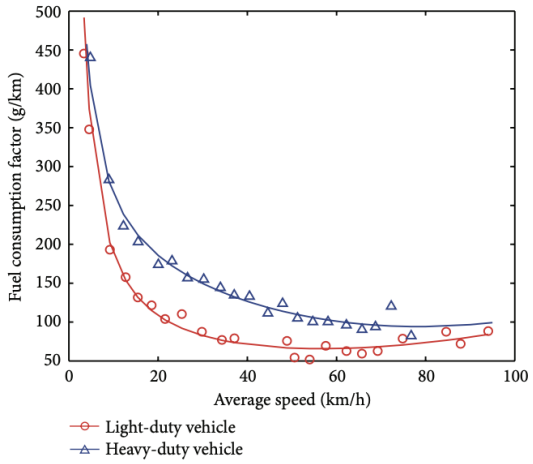
Based on the influence analysis of driving parameters on vehicle emissions, this paper establishes a set of mesoscopic vehicle emission and fuel consumption models using the real-world vehicle operation and emission data. The light duty vehicles and heavy duty vehicles are assumed to be of a similar kind and company and idealistic scenario is taken.Data is observed main chinese cities The proposed models in this paperare developed through considering the influence of the vehicle’s operating mode on vehicle emissions, which not only guarantees the accuracy of emissions and fuel consumption models, but also makes it possible to estimate the emission and fuel consumption based on most current traffic information

systems. The paper presents a methodology for establishing mesoscopic emission and fuel consumption models for assessing the environmental impacts of ITS strategies.It is verified that these models are well applied to evaluate the effect of ITS technologies on reducing vehicle emissions and fuel consumption.

Results:

The emission and fuel consumption rates typically increase with the increment of average speed. It should be noted that there is an apparent increase for emission and fuel consumption rates during the lower average speed range, while the rates rise relatively slowly when the speed increase to a specific value.

The emission and fuel consumption models have been established based on the proposed approach. As the traveling fragment by different time interval has effects on the model precision and estimation errors. It is valuable to explore the least estimation error and discuss the optimal time granularity. Successive 600-secong-long measurement trips for different time granularities were used for validation.



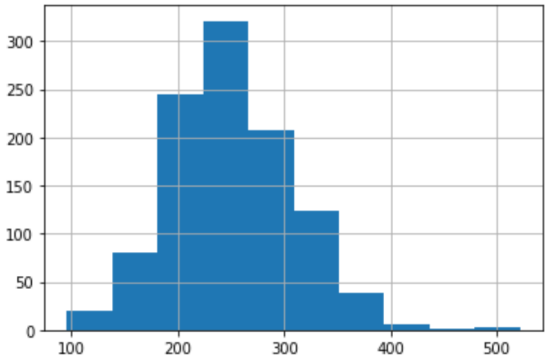
III. Problem Statement

Using this dataset we are interested in finding the solution to a problem, the better way to understand the dataset, the better way in which we could compare the fuel consumption and CO2 emissions with all other attributes like model, fuel type, engine size etc. factors affecting the increase in fuel consumption rate , the factors which influences the CO2 emissions rate. We are interested in predicting the best combination of the possible attributes in order to get optimized CO2 emission rate.

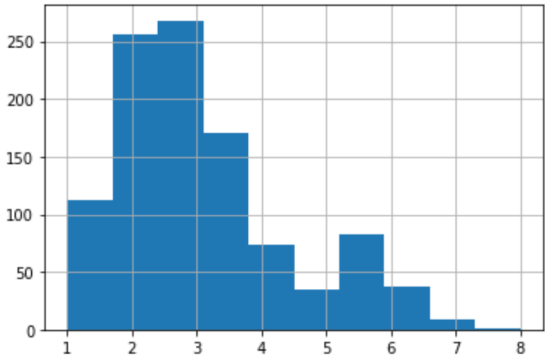
IV. Approach Used

We basically found out if there are any missing values in the dataset and fill it with the best statistical summary result based on what we would get in describe() function.We have found that there are no missing values in the dataset using isnull() function.

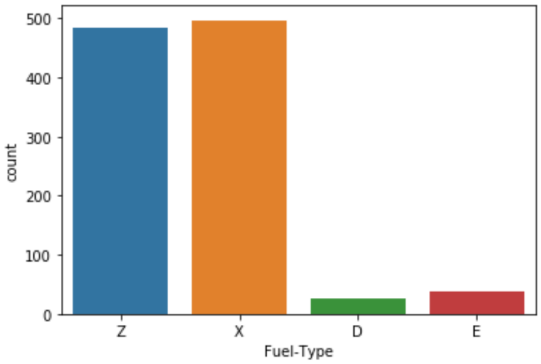
A. EDA and visualization



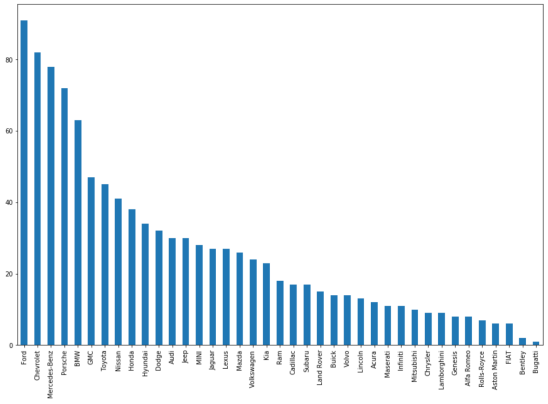
We have plotted histogram where we observe here that most models emits CO2 in the rate of 250 which is likely to be Eco friendly than higher rates. We should try to reduce to even better than this achieve Eco friendly nature by finding out the necessary correlations where CO2 emissions should be at a certain minimum rate.



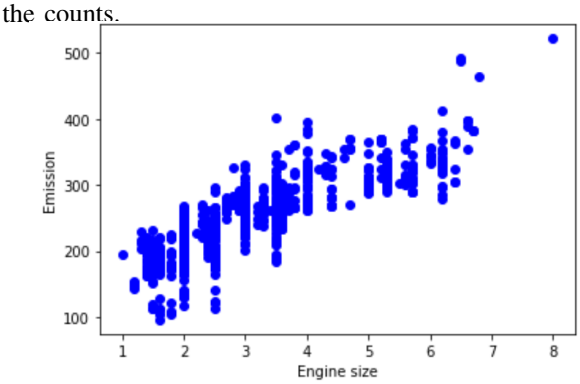
We can observe here that most of the models engine size lies between 2 and 3 units

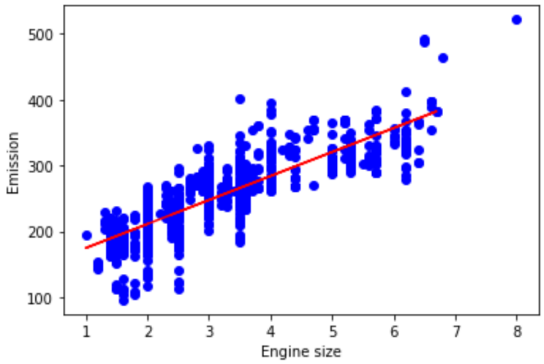


Most of fuel type is found to be X and Z.



Number of unique models in the decreasing order based on the counts.





This graph basically finds out the correlation between the engine size and CO2-emission ions using scatter plot. We can observe that the CO2-emissions is linearly depending on the engine size. Hence we have to look on an engine with least possible engine size considering all other aspects being efficient for a model(vehicle).

B. Plan for the weeks ahead:

We will use Machine learning concepts such as Simple Univariate Linear Regression and Simple Multivariate Linear Regression which involves evaluation metrics like Mean absolute error, Residual Sum of Squares, $R^2 score$.

Mean Absolute Error is the average of the absolute value of the errors. We have found the Mean Absolute Error for the engine size which is equal to 23.42. Similarly we can find the MAE of the other integer type attributes for further evaluation of the dataset.

R^2 represents the proportion of variance explained by your model. We have found the R pow 2 value(proportion of variance) for predicted engine size and CO2 emissions which is equal to 0.59, which tells us that engine-size is positively correlated with CO2 emissions with R pow 2 value 0.59.

The Simple Multivariate Linear Regression which will involve training of Machine learning model.This involves various predictions.It give the variance score and the Residual sum of squares.If the variance score is 1 it is perfect prediction.

REFERENCES

[1] Fuel Consumption Models Applied to Automobiles Using real time Ahmet Gurcan Caparaz,Pinar Ozel,Mehmet Sevkli,Omer Faruk Source-SEIT year-2016

[2] Global Research on Carbon Lebunu Hewage Udara Willhelm Abeydeera ,Jayantha Wadu Mesthrige 2 and Tharushi Imalka Samarasinghalage Source:Department of Building and Real Estate from hong kong polytechnic university Year:2019

[3] Emissions and Fuel Consumption Modeling for Evaluating Environment Effectiveness of ITS Startegies Yuan-yuan Song,En-jian Yao,Ting Zuo and Zhi-feng Lang1 Year-2014