LITERATURE SURVEY

1. Fuel Consumption and Traffic Emissions Evaluation of Mixed Traffic Flow with Connected Automated Vehicles at Multiple Traffic Scenarios

Bin Zhao et al. presented a paper which intends to analyses the impact of different proportions of connected automated vehicles (CAVs) on fuel consumption and traffic emissions. This paper studies fuel consumption and traffic emissions of mixed traffic flow with CAVs at different traffic scenarios. The car following modes and proportional relationship of vehicles in the mixed traffic flow are analyzed. On this basis, different car-following models are applied to capture the corresponding car-following modes. Then, Virginia Tech microscopic (VT-micro) model is adopted to calculate the instantaneous fuel consumption and traffic emissions. Finally, based on three typical traffic scenarios, a basic segment with bottleneck zone, ramp of the freeway, and signalized intersection, a simulation platform is built based on Python and SUMO to obtain vehicle trajectory data, and the fuel consumption and traffic emissions in different scenarios are obtained. The results show that in different traffic scenarios, the application of CAVs can reduce fuel consumption and traffic emissions. The higher the penetration rate, the more significant the reduction in fuel consumption and traffic emissions. In the three typical traffic scenarios, the advantages of CAVs are more evident in the signalized intersection. When the penetration rate of CAVs is 100%, the fuel consumption and traffic emissions reduction ratio is as high as 32%. It is noteworthy that the application of CAVs in urban transportation will significantly reduce fuel consumption and traffic emissions.

2. Fuel Consumption Prediction Model Using Machine Learning

Mohamed A. HAMED et al. team proposed the idea of enhancing the accuracy of the fuel consumption prediction of a model with Machine Learning to minimize fuel consumption. This will lead to an economic improvement for the business and satisfy the domain needs. We propose a machine learning model to predict vehicle fuel consumption. The proposed model is based on the support Vector Machine algorithm. The Fuel Consumption estimation is given as a function of mass air flow, vehicle speed, revolutions per minute, and throttle position sensor features. The proposed model is applied and tested on a vehicle's Onboard diagnostics dataset. The observations were conducted on 18 features. Results achieved a higher accuracy with an R-squared metric value of 0.97 than other related work using the same support vector machine regression algorithm. In this study, they tried to enhance fuel consumption prediction using machine learning using the Support Vector Machine Algorithm to predict fuel consumption based on a legacy dataset containing onboard diagnostics data. Their aim is to achieve a good value for the R-squared metric using the SVM. The proposed model aims to predict fuel consumption using SVM. the proposed model consists of four phases: data preprocessing, feature weighting, feature selection, and SVM prediction model the proposed prediction model has been applied to a dataset with 8262 records, the dataset includes 18 fields, the fuel consumption dataset was gathered from 19 drivers using OBD scanner in vehicles, which was used for a previous dissertation for profiling automotive data in 2019. The Dataset gathered from 19 drivers had been collected depending on a vehicle model of the well-known Brazilian vehicle, A 2015 Chevrolet S10, which has a 2.5-liter flex-fuel engine of 206 hp. This Dataset is gathered on an urban road in the city of Natal (Brazil). It was gathered at a distance of 18.8 kilometers for 34 minutes for each driver.

3. Development of a Fuel Consumption Prediction Model Based on Machine Learning Using Ship In-Service Data

Young-Long Kim et al. prepared a paper as interest in eco-friendly ships increases, methods for status monitoring and forecasting using in-service data from ships are being developed. Models for predicting the energy efficiency of a ship in real time need to process the operational data effectively and be optimized for such an application. This paper presents models that can predict fuel consumption using in-service data collected from a 13,000 TEU class container ship, along with statistical and domain-knowledge methods to select the proper input variables for the models. These methods prevent over fitting and multicollinearity while providing practical applicability. To implement the prediction model, either an artificial neural network (ANN) or multiple linear regression (MLR) was applied, where the ANN-based models showed the best prediction accuracy for both variable selection methods. The goodness of fit of the models based on ANN ranged 0.9709 to 0.9936. Furthermore, sensitivity analysis of the draught under normal operating conditions indicated an optimal draught of 14.79 m, which was very close to the design draught of the target ship, and provides the optimal fuel consumption efficiency. These models could provide valuable information for ship operators to support decision making to maintain efficient operating conditions.

4. Vehicle Fuel Consumption Prediction Method Based on Driving Behavior Data Collected from Smartphones

Ying Yao et al. proposed this paper as vehicle energy consumption and pollutant emissions are key problems for the healthy and sustainable development of urban transportation. With the continuous growth of car ownership in China, the energy consumption of its private cars increased 4.2 times, from 13.12 to 68.34 million tons of standard coal, from 2005 to 2015. Based on the growth of the population, GDP, and the proportion of secondary and tertiary industries of China, the trend of future transportation energy consumption can be predicted. -e energy consumption of private cars will continue to increase before 2020 when it is expected to reach 117.38 million tons of standard coal. -therefore, reducing energy consumption has become one of the most important challenges in the transportation field.

Among many factors that affect the energy consumption of vehicles, driving behavior plays an important role. Research conducted by Ford Motor Company shows that improvement in driving behavior could improve fuel economy by 25% in the short term. Providing drivers with continuous eco-driving feedback in the long term could lead to a 10 percent reduction in fuel consumption. studied the influence of ecological driving behavior on fuel consumption and found that giving feedback on fuel consumption information to drivers could improve fuel economy by 10%. In addition, the eco-driving instructions given to drivers could improve fuel economy by approximately 15%. Zhao and Chang analyzed the influence of drivers' route choices on vehicle fuel consumption, and the results indicated that energy consumption and exhaust emissions are significantly reduced by minimizing high-emission driving behavior.

This study proposes a vehicle fuel consumption prediction method based on Global Positioning System (GPS) data collected from a smartphone. Taxi drivers participated in this experiment.

By matching the driving behavior data of the mobile phone and the fuel consumption data of the OBD terminal, the driving behavior indexes that affect fuel consumption were screened, and the fuel consumption prediction models were constructed using machine learning algorithms. E-prediction model of drivers individual fuel consumption based on mobile phone data could not only further improve the real-time monitoring database of fuel consumption with strong error tolerance but also provide technical support for macro control of urban transportation energy consumption and effectiveness evaluation of the transportation energy policy.

5. Influence of road and traffic conditions on fuel consumption and fuel cost for different bus technologies

Ivković Ivan S.et al. presented paper on the influences of road and traffic conditions on fuel consumption and fuel costs of conventional diesel, parallel hybrid, and stoichiometric compressed natural gas buses in intercity bus service are analyzed. Calculation of fuel consumption and fuel costs for these three different bus technologies was conducted for road network of the Republic of Serbia. Three scenarios were considered. The first scenario includes bus traffic volume carried out on the road network in 2014. The other two scenarios are characterized by the decrease i. e. increase of traffic volume by 20% with unchanged state of road infrastructure in comparison to the year 2014. Obtained results show that in intercity bus service the greatest influence on the fuel consumption of buses has operating speed of the bus, followed by terrain type on which buses operate. The impact of other factors (international roughness index, fluctuation of traffic volume by 20%, and correction factors of fuel consumption) is less pronounced. This is cost saving for hybrid buses compared to diesel buses that are in the range of €3.33-7.27.

6. Application of Machine Learning for Fuel Consumption Modelling of Trucks

Federico Perrotta et al. presented this paper which explains about the application of three Machine Learning techniques to fuel consumption modelling of articulated trucks for a large dataset. In particular, Support Vector Machine (SVM), Random Forest (RF), and Artificial Neural Network (ANN) models have been developed for the purpose and their performance compared. Fleet managers use telematics data to monitor the performance of their fleets and take decisions regarding the maintenance of the vehicles and the training of their drivers.

The data, which include fuel consumption, are collected by standard sensors (SAE J1939) for modern vehicles. Data regarding the characteristics of the road come from the Highways Agency Pavement Management System (HAPMS) of Highways England, the manager of the strategic road network in the UK. Together, these data can be used to develop a new fuel consumption model, which may help fleet managers in reviewing the existing vehicle routing decisions, based on road geometry.

The model would also be useful for road managers to understand the fuel consumption of road vehicles better and the influence of road geometry. Ten-fold cross-validation has been performed to train the SVM, RF, and ANN models. Results of the study show the feasibility of using telematics data together with the information in HAPMS for the purpose of modelling fuel consumption. The study also shows that although all three methods make it possible to develop models with good precision, the RF slightly outperforms

SVM and ANN giving higher R2, and lower error.

Smart routing is used by fleet managers to direct their vehicles and minimize costs. Usually, the shortest path or the least congested route is chosen, however, some studies showed that the road geometry and the condition of the road infrastructure can significantly affect fuel economy. A new fuel consumption model that takes into account these two factors would, therefore, help fleet managers in reviewing their routing decisions. Furthermore, the model would be useful for pavement engineers and road managers to estimate the life-cycle costs of new and existing roads.

The aims of this paper is to show an application of machine learning to Big Data for fuel consumption modelling of a large fleet of trucks, to test the use of telematics and road condition data, from fleet managers and road agency databases, for fuel consumption modelling, and to compare the performance of SVM, RF, and ANN in modelling the fuel consumption of large truck fleets using the available data.

7. Fuel Consumption Models Applied to Automobiles Using Real-Time Data

Ahmet Gurcan et al. projected studies on the validation using real-life data is not only limited but also does not fit well the real time data. In this paper, three statistical models namely Support Vector Machine(SVM), Artificial Neural Network and Multiple Linear Regression are used in term of prediction of total and instant fuel consumption.

The models are compared against data collected in real-time from three different passenger vehicles on three routes by casual drive, using a mobile phone application. Our outcomes reveal that, the results obtained by the models exposed comparatively better correlation than the other statistical fuels consumption models. Over one third of global energy usage is due to transportation, the majority of which is obtained through petroleum products. Consumption of fuel by vehicle engines result in greenhouse gases (GHG) emissions, the most prominent of which is co2, all of which have determined effects on the environment. The second largest source of co2 emission is the combustion of gasoline and diesel in vehicles used in transportation. To reduce environmental externalities, it is imperative that fuel efficiency of vehicles is improved. To this end, whilst renewable fuel and alternative fuel vehicle might be a solution in the long-term reducing emission and fuel consumption of vehicles operating under existing technologies should be the goal in the short to medium term.

The amount of co2 emission from a vehicle is proportional to the amount of the fuel consumed by the engine. Fuel efficiency depends on the driving mode, which in turn is dependent on several factors. There are many different ways to estimate emission using the information on fuel consumption. However, the choice of the nature of emission function becomes crucial for when accurate estimates are needed in planning for transportation, be it at operational, tactical or strategic levels. The literature is relatively rich in describing models to estimate fuel consumption of vehicles, but also to be able to provide comparison result across the various models. They adopted concepts such as Artificial Neural Networks, Support Vector Machine, Multiple Linear Regression.

8. Trip Based Modelling of Fuel Consumption in Modern Heavy-Duty Vehicles Using Artificial Intelligence (Sasanka Katreddi and Arvind Thiruvengadam)

Heavy-duty trucks contribute approximately 20 percent of fuel consumption in the United States of America (USA). The fuel economy of heavy-duty vehicles (HDV) is affected by several real-world parameters like road parameters, driver behavior, weather conditions, and vehicle parameters, etc. Although modern vehicles comply with emissions regulations, potential malfunction of the engine, regular wear and tear, or other factors could affect vehicle performance. Predicting fuel consumption per trip based on dynamic on-road data can help the automotive industry to reduce the cost and time for on-road testing. Data modelling can easily help to diagnose the reason behind fuel consumption with a knowledge of input parameters. In this paper, an artificial neural network (ANN) was implemented to model fuel consumption in modern heavy-duty trucks for predicting the total and instantaneous fuel consumption of a trip based on minimal key parameters, such as engine load (%), engine speed (rpm), and vehicle speed (km/h). Instantaneous fuel consumption data can help to predict patterns in fuel consumption for optimized fleet operations. In this work, the data used for modelling was collected at a frequency of 1Hz during on-road testing of modern heavy-duty vehicles (HDV) at the West Virginia University Centre for Alternative Fuels Engines and Emissions (WVU CAFEE) using the portable emissions monitoring system (PEMS). The performance of the artificial neural network was evaluated using mean absolute error (MAE) and root mean square error (RMSE). The model was further evaluated with data collected from a vehicle on-road trip. The study shows that artificial neural networks performed slightly better than other machine learning techniques such as linear regression (LR), and random forest (RF), with high R-squared (R^2) and lower root mean square error.