IBM- NALAYA THIRAN

TRIP BASED MODELING OF FUEL CONSUMPTION IN MODERN FLEET VEHICLES USING MACHINE LEARNING

1. Based Modeling of Fuel Consumption in Modern Heavy-Duty Vehicles Using Artificial Intelligence

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https://www.mdpi.com/1413994

Heavy-duty trucks contribute approximately 20% 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 behaviour, 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 very few 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 Center 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.

2. A Machine Learning Model for Average Fuel Consumption in Heavy Vehicles

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https://www.researchgate.net/publication/333367045_A_Machine_Learning_Model_for_Average_Fuel_Consumption_in_Heavy_Vehicles

This paper advocates a data summarization approach based on distance rather than the traditional time period when developing individualized machine learning models for fuel consumption. This approach is used in conjunction with seven predictors derived from vehicle speed and road grade to produce a highly predictive neural network model for average fuel consumption in heavy vehicles. The proposed model can easily be developed and deployed for each individual vehicle in a fleet in order to optimize fuel consumption over the entire fleet. The predictors of the model are aggregated over fixed window sizes of distance travelled. Different window sizes are evaluated and the results show that a 1 km window is able to predict fuel consumption with a 0.91 coefficient of determination and mean absolute peak-to-peak percent error less than 4% for routes that include both city and highway duty cycle segments.

3.Average Fuel Consumption in Heavy Vehicles

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http://www.jctjournal.com/gallery/12-dec2021.pdf

We used vehicle travel distance rather than the traditional time period when developing individualized machine learning models for fuel consumption. This approach is used in conjunction with seven predictors derived from vehicle speed and road grade to produce a highly predictive neural network model for average fuel consumption in heavy vehicles. The proposed model can easily be developed and deployed for each individual vehicle in a fleet in order to optimize fuel consumption over the entire fleet. The predictors of the model are aggregated over fixed window sizes of distance travelled. Different window sizes are evaluated and the results show that a 1 km window is able to predict fuel consumption with a 0.91 coefficient of determination and mean absolute peak-to-peak percent error less than 4% for routes that include both city and highway duty cycle segments.

4.An Enhanced Fuel Consumption Machine Learning Model Used in Vehicles

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https://iopscience.iop.org/article/10.1088/1742-6596/1979/1/012068/pdf

In the present world, some of the people are not able to pay expenses for petrol/diesel. The model which we are generating will be useful for many people. The system which we are generating is a data summary approach will be based on distance rather than traditional conventional time period when developing personalized machine learning model for fuel consumption. This system is utilized within conjunction with vehicle pace Also seven predictors inferred starting with way review to prepare a neural system model utilizing machine Taking in that predicts Normal fuel utilization done vehicles. The proposed model can be easily developed for each individual vehicle and fitted into one fleet to optimize fuel consumption over entire fleet. The model's predictors are comprehensive on fixed window sizes and on the distance travelled. Different window sizes are evaluated and the results mean that the 1km window can estimate the fuel consumption with a coefficient of 0.91 and it also means less than 4% peak to peak percentage error for routes that include both city and highway duty cycling sections

5.Fuel-Efficient Driving Strategies for Heavy-Duty Vehicles: A Platooning Approach Based on Speed Profile Optimization

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https://www.hindawi.com/journals/jat/2018/4290763/

A method for reducing the fuel consumption of a platoon of heavy-duty vehicles (HDVs) is described and evaluated in simulations for homogeneous and heterogeneous platoons. The method, which is based on speed profile optimization and is referred to as P-SPO, was applied to a set of road profiles of 10 km length, resulting in fuel reduction of 15.8% for a homogeneous platoon and between 16.8% and 17.4% for heterogeneous platoons of different mass configurations, relative to the combination of standard cruise control (for the lead vehicle) and adaptive cruise control (for the follower vehicle). In a direct comparison with MPC-based approaches, it was found that P-SPO outperforms the fuel savings of such methods by around 3 percentage points for the entire platoon, in similar settings. In P-SPO, unlike most common platooning approaches, each vehicle within the platoon receives its own optimized speed profile, thus eliminating the intervehicle distance control problem. Moreover, the P-SPO approach requires only a simple vehicle controller, rather than the two-layer control architecture used in MPC-based approaches.