MACHINE LEARNING BASED VEHICLE PERFORMANCE ANALYZER

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LITERATURE SERVEY

TITLE: Performance of Motor Vehicle based on Driving and Vehicle Data using Machine Learning

AUTHOR:

1. Punith Kumar Nagaraje Gowda

Abstract:

With the increasing population demographics and the dependency of man on motor vehicles as the primary source of transportation, the number of motor vehicles being registered for commercial as well as non-commercial activities on a daily basis is massive and yet continues to increase at an alarming rate. This has a direct and an unambiguous effect on the amount of fossil fuels being utilized globally and its subsequent environmental effects, which is of great concern in the present situation. Several attempts from various research sectors are ongoing in order to overcome this global issue and promising results are expected. This project is one such attempt at identifying the performance of small passenger cars in terms of fuel efficiency and map them with factors affecting it using machine learning techniques. The commencing activity while carrying out any such research activity will be the identification of the problem and all its possible sources. In this case, two potential

sources can be identified and they are; the vehicle characteristics and the driver/driving behaviour. The relevant data for this analysis was taken from the public source, Kaggle which is the data collected from the OBD of the car and models are built using techniques like Multiple Linear Regression, XGBoost, Support Vector Machine and Artificial Neural Network and their performance is compared to discover the first-rate technique in predicting the fuel efficiency and to propose the optimum driving behaviour in terms of throttle position to achieve better fuel efficiency. The results reveal that XGBoost model outperforms all other models developed in predicting the fuel efficiency for the different split ratios evaluated and comparing the throttle position with the predicted fuel efficiency explains that to achieve better fuel efficiency the throttle position must be around 70 to 80 on a scale of 100, referred to as full throttle position. The knowledge discovered from the research could be used by car manufacturers to design cars in future to mitigate the fuel consumption.

TITLE: Simulation for prediction of vehicle efficiency, performance, range and lifetime: a review of current techniques and their applicability to current and future testing standards

AUTHORS:

1. A Fotouhi, D J Auger
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Abstract:

Computer simulation tools can give early indicators of key vehicle characteristics. In traditional hybrid vehicles, this is important in designing for optimal fuel consumption; in plug-in hybrids and pure electric vehicles, it is critical for accurate prediction of range, a key market qualifier. There are a variety of techniques, typically operating at different levels of fidelity and employing different modelling philosophies. This paper develops on earlier work, exploring conventional and ‘backward’ techniques in the context of current NEDC-based UNECE vehicle testing standards and the proposed replacements based on the World Light Test Procedure. Model sensitivities for A, C and D-segment vehicles are quantified and this is used to explore aspects where accurate models are key and where lower-fidelity representative models are appropriate. The paper also explores the sensitivity of predictions to ‘PID control’ driver models, and discusses the effect of cycle-following

tolerance on predictions. Finally, the paper proposes new standards suitable for simulation or real-world testing – for a common quantification of in-use battery lifetime. The use of these techniques and the sensitivity analysis methods on a representative simulation model is demonstrated as a case study, and the impacts on battery management strategy design are explored.

TITLE: Machine Learning-Based Vehicle Model Construction and Validation Toward Optimal Control Strategy Development for Plug-In Hybrid Electric Vehicles

AUTHORS:

1. Yuanjian Zhang
2. Zheng Chen
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Abstract:

Advances in machine learning inspire novel solutions for the validation of complex vehicle models and spur an easy manner to promote energy management performance of complexly configured vehicles, such as plug-in hybrid electric vehicles (PHEVs). A constructed PHEV model, based on the four-wheel-drive passenger vehicle configuration, is validated through an efficient virtual test controller (VTC) developed in this article. The VTC is designed via a novel approach based on the least-square support vector machine and random forest with the inner-interim data filtered by the ReliefF algorithm to validate the vehicle model as necessary. This article discusses the process and highlights the accuracy improvements of the PHEV model that is achieved by implementing the VTC. The validity of the VTC is addressed by examining the PHEV model to mimic the characteristics of internal combustion engine, motor, and generator behaviors observed through the benchmark test. Sufficient simulations and hardware-in-loop test are employed to demonstrate the capability of the novel VTC-based model validation method in practical applications. The major novelty of this article lies in the development of a VTC, by which the

vehicle model can be efficiently developed, providing solid framework and enormous convenience for control strategy design.

TITLE: A Machine Learning Approach Based on Automotive Engine Data Clustering for Driver Usage Profiling Classification

AUTHORS:

1. Cephas Alves da Silveira Barreto
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Abstract:

The potential for processing car sensing data has increased in recent years due to the development of new technologies. Having this type of data is important, for instance, to analyse the way drivers behave when sitting behind steering wheel. Many studies have addressed the drive behaviour by developing smartphone-based telematics systems. However, very little has been done to analyse car usage patterns based on car engine sensor data, and, therefore, it has not been explored its full potential by considering all sensors within a car engine. Aiming to bridge this gap, this paper proposes the use of Machine Learning techniques (supervised and unsupervised) on automotive engine sensor data to discover drivers' usage patterns, and to perform classification through a distributed online sensing platform. We believe that such platform can be useful used in different domains, such as fleet management, insurance market, fuel consumption optimization, CO2 emission reduction, among others.

TITLE: Machine-Learning Analysis for Automobile Dataset

AUTHOR:

1. Ahmed Ali

Abstract:

The automobile data analysis includes a dataset introduced from the University of California Irvine Machine Learning Repository UCI and refined from Kaggle. According to UCI (1985), the attributes consist of three different types of entities: (a) the model and specification of an auto, which includes the characteristics, (b) the personal insurance, (c) its normalized losses in use as compared to other cars. The data set source for this model collected from Insurance collision reports, personal insurance, and car models. According to Kaggle, There are 26 data attributes in this model descript the data set model from different angles. The objective of this report is to perform exploratory data analysis to find the primary relationships between features, which include univariate analysis, which includes finding the maximum and minimum, such as the weight, engine size, horsepower, and price.

TITLE: Machine-Learning-Based Data Processing Techniques for Vehicle-to-Vehicle Channel Modeling

AUTHORS:

1. Chen Huang
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Abstract:

Machine learning has recently drawn much attention for a variety of applications, thanks to its good performance in identification, recognition, and regression problems. One such important application is V2V communication propagation channel research. In this article, the challenges and opportunities of machine-learning-based data processing techniques for evaluation of V2V channel measurements are presented. This article reviews some state-of-the-art applications including identification of channel line-of-sight situations, tracking of MPCs, and

MPC clustering. The data obtained with these methods form, inter alia, the basis for accurate channel models. Furthermore, some challenges of machine-learning-based data processing for V2V channel research are discussed as basis for future studies.

TITLE: Machine learning methods for vehicle predictive maintenance using off-board and on-board data

AUTHOR:

1. Rune Prytz

Abstract:

Vehicle uptime is getting increasingly important as the transport solutions become more complex and the transport industry seeks new ways of being competitive. Traditional Fleet Management Systems are gradually extended with new features to improve reliability, such as better maintenance planning. Typical diagnostic and predictive maintenance methods require extensive experimentation and modelling during development. This is unfeasible if the complete vehicle is addressed as it would require too much engineering resources. This thesis investigates unsupervised and supervised methods for predicting vehicle maintenance. The methods are data driven and use extensive amounts of data, either streamed, on-board data or historic and aggregated data from off-board databases. The methods rely on a telematics gateway that enables vehicles to communicate with a back-office system. Data representations, either aggregations or models, are sent wirelessly to an off-board system which analyses the data for deviations. These are later associated to the repair history and form a knowledge base that can be used to predict upcoming failures on other vehicles that show the same deviations. The thesis further investigates different ways of doing data representations and deviation detection. The first one presented, COSMO, is an unsupervised and self-organized approach demonstrated on a fleet of city buses. It automatically comes up with the most interesting on-board data representations and uses a consensus based approach to isolate the deviating vehicle. The second approach outlined is a supervised classification based on earlier collected and aggregated vehicle statistics in which the repair history is used to label the usage statistics. A classifier is trained to learn patterns in the usage data that precede specific repairs and thus can be used to predict vehicle maintenance. This method is demonstrated for failures of the vehicle air compressor and based on AB Volvo's database of vehicle usage statistics.