

Fuel FOT Energy Efficient Transport

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Analysis of factors influencing fuel consumption is a very important task both for automotive manufacturers, as well as for their clients. There is a lot of knowledge already available concerning this topic, but it is poorly organized and often more anecdotal than rigorously verified. Nowadays, however, enough rich datasets from actual vehicle usage are available and a data-mining based approach can be used to not only validate earlier hypotheses, but also to potentially discover unexpected influencing factors.

1. Background and Motivation

The number of embedded computers on-board modern vehicles is growing continuously, and the data exchanged among them contains a lot of information about the state of the system. It is now becoming possible to get access to numerous signals over data networks (such as CAN), coming from sensors, control units and fault codes. This kind of data is being collected within multiple projects, but it is important to recognise that the data itself is an additional asset and it can often be used for more than one purpose.

The continuous recording of driver behaviour data on the road have allowed researchers to conduct in-depth investigations on humans, machines, and their interaction in a way not possible just a few years ago. Statistical modelling and tools such as pattern recognition and data mining has the potential to become a key building block in this kind of investigations, but its full impact has yet to be explored.

2. Methodology

ATR at Volvo has collected large amounts of real-world data during the projects euroFOT and Customer Fuel Follow-up. The goal of fuelFEET is to use these rich datasets in order to better understand the factors that influence fuel consumption, with the special focus on impact of driver behaviour.

Fuel consumption depends on many different aspects of a vehicle, such as configuration, technical condition or cargo, as well as external conditions, including weather and terrain. This makes it difficult to isolate influence of those factors over which driver or fleet owner has control from the inescapable ones. This pilot study on using data mining methods over available data will assess which are the major driver-related factors affecting fuel consumption and quantify their impact, finding a way to abstract away or compensate over external conditions.

The first step is to model the fuel consumption process and develop an understanding of the main influencing factors behind it in terms of environment, vehicle and driver. This will provide a framework for analysing driver behaviour impact on fuel consumption in a way that takes relevant external factors into account.

Such a framework will allow ranking and clustering drivers from a fuel consumption performance perspective, as well as provide a list of driver behaviours that affect fuel consumption, and a quantitative estimation of their respective importance.

A wide range of systems and services could directly benefit from the results of the proposed project, for example Volvo could introduce efficient on-line and off-line driver coaching, which would target specific behaviours of individual drivers that mostly improve fuel consumption and safety on the road. Those results can also be used to dynamically adapt vehicle settings, targeting lower fuel consumption, as well as for better fuel consumption approximations in vehicle simulators.

3. Results

A literature review of past works in the field has been performed, resulting in fuel consumption models that are based on expert knowledge but tuned using on-board data. This resulted in high-accuracy fuel consumption predictions on a large percentage of typical road situations. One of the challenges still left to overcome is the incomplete or nonexistent data regarding factors such as cargo, weather and tire characteristics, to name just a few that prevent more global model generalization. Good predictions regarding fuel consumption we are able to obtain are only available under a number of constraints, some of which we would like to be able to lift.