

## Comparing Machine Learning Estimation of Fuel Consumption of Heavy-Duty Vehicles

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**Abstract :** Fuel consumption (FC) is one of the key factors in determining expenses of operating a heavy-duty vehicle. A customer may therefore request an estimate of the FC of a desired vehicle. The modular design of heavy-duty vehicles allows their construction by specifying the building blocks, such as gear box, engine and chassis type. If the combination of building blocks is unprecedented, it is unfeasible to measure the FC, since this would first require the construction of the vehicle. This paper proposes a machine learning approach to predict FC. This study uses around 40,000 vehicles specific and operational environmental conditions information, such as road slopes and driver profiles. All vehicles have diesel engines and a mileage of more than 20,000 km. The data is used to investigate the accuracy of machine learning algorithms Linear regression (LR), K-nearest neighbor (KNN) and Artificial neural networks (ANN) in predicting fuel consumption for heavy-duty vehicles. Performance of the algorithms is evaluated by reporting the prediction error on both simulated data and operational measurements. The performance of the algorithms is compared using nested cross-validation and statistical hypothesis testing. The statistical evaluation procedure finds that ANNs have the lowest prediction error compared to LR and KNN in estimating fuel consumption on both simulated and operational data. The models have a mean relative prediction error of 0.3% on simulated data, and 4.2% on operational data.

**Keywords :** artificial neural networks, fuel consumption, friedman test, machine learning, statistical hypothesis testing

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