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Fuel Consumption using Machine Learning Approach

Tejashwini T S, Ms. Bhavya Shree H M

Student, Department of MCA, Visvesvaraya Technological University, The National Institute of Engineering, Mysuru, India

Assistant Professor, Department of MCA, Visvesvaraya Technological University, The National Institute of Engineering, Mysuru, India

ABSTRACT: Nowadays, as fuel is an important resource for the whole world, researchers are trying a variety machine learning models for fuel flow prediction in industry. Different machine learning models have been applied in different applications. This project will analyze these applications and many useful points have been found by comparison of those experimental results. This project presents the application of Machine Learning techniques to fuel consumption modelling of articulated vehicles for a large dataset. In particular, Support Vector Regression (SVR), Random Forest (RF), and Artificial Neural Network (ANN) models have been developed for the purpose and their performances are compared. 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 better understand the fuel consumption of road vehicles and the influence of road geometry. The study also shows that although all the three methods make it possible to develop models with good precision, the RF slightly outperforms SVR giving higher R^2, and lower error.

I. INTRODUCTION

Ability to understand the factors that influence fuel consumption and then being able to predict it, is vital in enhancing fuel economy of vehicles and preventing fraudulent activities. As fuel is limited and hard to regenerate, it is necessary to consider how to save fuel cost in many industries. Specifically, fuel is a significant expense in Vehicle manufacture companies. The vehicles cannot run without bringing fuel, meanwhile it will use more fuel than it really requires because it always occupies a large proportion of the total weight of the vehicle. 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 to optimize fuel consumption over the entire fleet.

II. OBJECTIVES

- Analyse Existing Applications: Review and analyse various machine learning models applied in fuel consumption prediction across different industries.
- Comparison of Experimental Results: Compare and contrast the performance of different machine learning models utilized in fuel consumption prediction.
- Evaluation of Useful Insights: Identify and evaluate key insights derived from the comparison of experimental results across different applications.
- Application to Articulated Vehicles: Apply machine learning techniques to fuel consumption modelling specifically for articulated vehicles, focusing on Support Vector Regression (SVR), Random Forest (RF), and Artificial Neural Network (ANN) models.

III. LITERATURE SURVEY

[1] “Application of Machine Learning for Fuel Consumption Modelling of Trucks” Authors: Federico Perrotta, Tony Parry et al., Published in: IEEE International Conference on Big Data, 2017

[2] " Impact of driver behavior on fuel consumption: classification, evaluation and prediction using machine learning " Authors: Ping, P., Qin, W., Xu, Y., Miyajima, C., & Takeda, K. Published in: IEEE Access, 2019

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[3] "Modeling of aircraft fuel consumption using machine learning algorithms." Authors: Baumann, S., & Klingauf, U. Published in: CEAS Aeronautical Journal, 2019
[4] "Machine learning approach to ship fuel consumption: A case of container vessel" Authors: Uyanık, T., Karatuğ, Ç., & Arslanoğlu, Y. Published in: Transportation Research Part D: Transport and Environment, 2020
[5] "Predicting fuel consumption for commercial buildings with machine learning algorithms." Authors: Rahman, A., & Smith, A. D. Published in: IEEE Access, 2017
[6] "Vehicular fuel consumption estimation using real-world measures through cascaded machine learning modeling." Authors: Moradi, E., & Miranda-Moreno, L. Published in: Transportation Research Part D: Transport and Environment, 2020
[7] "A Machine Learning Model for Average Fuel Consumption in Heavy Vehicles. " Authors: Schoen, A., Byerly, A., Hendrix, B., Bagwe, R. M., Santos, E. C. dos, & Miled, Z. B. Published in: IEEE Transactions on Vehicular Technology ,2019
[8] "Predicting Dynamic Fuel Oil Consumption on Ships with Automated Machine Learning." Authors: Ahlgren, F., Mondejar, M. E., & Thern, M. Published in: Energy Procedia, 2019
[9] "Utilization of a deep learning-based fuel consumption model in choosing a liner shipping route for container ships in Asia. " Authors: Bui-Duy, L., & Vu-Thi-Minh, N. Published in: The Asian Journal of Shipping and Logistics , 2020
[10] "Fuel Consumption Using OBD-II and Support Vector Machine Model. " Authors: Abukhalil, T., AlMahafzah, H., Alksasbeh, M., & Alqaralleh, B. A. Y. Published in: Journal of Robotics, 2020

IV. METHODOLOGY

The project's methodology encompasses the following key steps:

- **Data Collection:** Using the classic Auto MPG Datasets from UCI ML Repository.
- **Data Pre-processing:** Frame the problem based on the dataset description and initial exploration.
- **Data Analysis:** Carry our exploratory analysis to figure out the important features and creating new combination of features.
- **Data Preparation:** Create a pipeline of tasks to transform the data to be loaded into our ML models.
- **Selecting and Training ML models:** Training a few models to evaluate their predictions using cross-validation.
- **Hyperparameter Tuning:** Fine tune the hyperparameters for the models that showed promising results.
- **Deploy the Model using a web service:** Using Flask web framework

V. TOOLS AND TECHNOLOGIES REQUIRED

Hardware

- RAM (2 GB)
- Hard disk (100 GB)
- Process (32/64 Pentium)

Software

- IDE (FLASK)
- Language (Python)
- Tool (Jupyter Notebook)
- Software (Anaconda)
- Front End (HTML, CSS)
- Libraries (Tensorflow, keras, numpy, pandas)

VI. CONCLUSION

The report presented a comprehensive analysis of machine learning applications in fuel consumption modeling across diverse industries and various methodologies such as SVR, RF, and ANN were explored for predicting fuel consumption. The comparison of experimental results revealed valuable insights into the performance of different machine learning models.

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REFERENCES

1. Federico Perrotta, Tony Parry et al., "Application of Machine Learning for Fuel Consumption Modelling of Trucks", IEEE International Conference on Big Data, 2017.
2. Ping, P., Qin, W., Xu, Y., Miyajima, C., & Takeda, K. (2019). "Impact of driver behavior on fuel consumption: classification, evaluation and prediction using machine learning". IEEE Access, 1–1. doi:10.1109/access.2019.2920489
3. Baumann, S., & Klingauf, U. (2019). "Modeling of aircraft fuel consumption using machine learning algorithms". CEAS Aeronautical Journal. doi:10.1007/s13272-019-00422-0
4. Uyanık, T., Karatuğ, Ç., & Arslanoğlu, Y. (2020). Machine learning approach to ship fuel consumption: A case of container vessel. Transportation Research Part D: Transport and Environment, 84, 102389. doi:10.1016/j.trd.2020.102389
5. Rahman, A., & Smith, A. D. (2017). Predicting fuel consumption for commercial buildings with machine learning algorithms. Energy and Buildings, 152, 341–358. doi:10.1016/j.enbuild.2017.07.017
6. Moradi, E., & Miranda-Moreno, L. (2020). Vehicular fuel consumption estimation using real-world measures through cascaded machine learning modeling. Transportation Research Part D: Transport and Environment, 88, 102576. doi:10.1016/j.trd.2020.102576
7. Schoen, A., Byerly, A., Hendrix, B., Bagwe, R. M., Santos, E. C. dos, & Miled, Z. B. (2019). A Machine Learning Model for Average Fuel Consumption in Heavy Vehicles. IEEE Transactions on Vehicular Technology, 68(7), 6343–6351. doi:10.1109/tvt.2019.2916299.
8. Ahlgren, F., Mondejar, M. E., & Thern, M. (2019). Predicting Dynamic Fuel Oil Consumption on Ships with Automated Machine Learning. Energy Procedia, 158, 6126–6131. doi:10.1016/j.egypro.2019.01.499
9. Bui-Duy, L., & Vu-Thi-Minh, N. (2020). Utilization of a deep learning-based fuel consumption model in choosing a liner shipping route for container ships in Asia. The Asian Journal of Shipping and Logistics. doi:10.1016/j.ajsl.2020.04.003
10. Abukhalil, T., AlMahafzah, H., Alksasbeh, M., & Alqaralleh, B. A. Y. (2020). Fuel Consumption Using OBD-II and Support Vector Machine Model. Journal of Robotics, 2020, 1–9. doi:10.1155/2020/9450178

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