Title: Use of Machine learning methods for vehicle predictive maintenance

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Diagnostic Trouble Codes or Fault codes are codes that a vehicle's On-Board Diagnostics (OBD) system uses, to notify you about an issue. Each code corresponds to a fault detected in a vehicle, which may mean a vehicle needs to be serviced. Large trucking-based freight companies spend millions of dollars per year, repairing broken down tractor trailers. These breakdowns are expensive to fix and lead to revenue loss if not quickly resolved. How can we combine the historical overview of a tractor trailers diagnostic code data, to prevent these breakdowns from even occurring? Implementations of predictive maintenance may be the answer to this problem. According to Rune, "Predictive maintenance employs monitoring and prediction modelling to determine the condition of the machine and to predict what is likely to fail and when it is going to happen". We hypothesized that a tractor trailers diagnostic trouble codes can predetermine when a truck will breakdown. Certain combinations of these codes are more likely to cause this to happen. We argue that there may be a data-driven trend between the fault codes a truck gives, and if it is likely to break down. This trend would enable companies to be more cost-effective in their maintenance strategies. In this study, we used real data from a leading trucking-based freight company. We analyzed large sets of trucks and their relative fault codes in correlation with the truck's breakdown history, to determine a relationship amongst the data. For each truck we analyzed multiple fault codes provided over a historical period which gives a better understanding of how the diagnostic trouble codes combine to play a part in the overall health of a truck. Through building a predictive model, we gained meaningful understanding of the relationships in this data and validated our hypothesis. This study specifically focuses on one of the leading trucking-based freight companies, but our findings can be applied to any company in the industry. We used multiple traditional machine learning algorithms such as Random Forest, K Nearest Neighbor, Support Vector Machine, Naïve Bayes etc. to build our predictive models and compared their performances. Future approaches include replacing predictive models derived from traditional machine learning with deep learning techniques. Our hopes are to provide insightful and helpful information to companies regarding their maintenance approaches. We hope that our research will lead to a more cost-efficient approach in overall maintenance of trucks and in everyday use of automobiles.

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