Machine Learning Dashboard for Aviation Fuel Optimization

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Abstract

The aviation industry is the one of the fastest-growing travel industry in the world. This industry is growing 7% per year and is giving its facilities for more than 1.5 billion passengers. The International Air Transport Association (IATA) indicates that this number will pass in the next 20 years by 7.3 billion of passengers. Due to this large growing passenger count, airplane manufacturing companies such as Boeing & Airbus are making more efficient planes to handle this amount.

Aviation fuel is the biggest cost in air transport. IATA (The International Air Transport Association) figures show that everyone dollar increase in the cost of oil per barrel increases the airline industry's costs by about $1 billion. So that airline companies do their best to optimize the fuel usage managing many types of maintenance, weight flowing management to reduce the plane taxi fuel. Airplane manufacturing companies are also gearing up to make more fuel-efficient planes. This research project built finding suitable variables and providing a solution to overcome the high fuel usage by using a neural network model to predict the fuel usage, CO_2 emission dashboard to get necessary steps to reduce CO_2.

Finding the suitable variables are the most challenging part in this research. To find them, correlation coefficient method was used. Before using this method need to normalize the dataset using the statistical normalization method after that used this method to find the linear combinations of the fuel usage & other dependent variables. If the value is next to -1 then it gives a perfect negative relation or if +1 then it is a perfect positive relation. For this analysis, the best fit regression model was created based on the variables Actual passenger count, Flight wing size, Flight length, Flight height, Distance between airports, zero fueling weight identified are those variables. For a prediction model, it is more practical to use simple model than a complex model.

Before developing this model, data need to be clean (without empty data sets) and eliminate the outlier data from the data set after the normalization process which was done by using the statistical quartile method. For this model 2 types of training, functions were used to create the models 'Bayesian regularization back-propagation' and 'scaled conjugate gradient back-propagation'. 'Bayesian regularization' method is the best training to train noisy data sets. After training these 5 layers (4-hidden layer) 5-10-5-10 hidden neuron model, then it was selected as the minimal error rate. There were 26, 834 data points & 70% were used to train this model and the rest 30% was used for testing. For this research, there are lots of future works could be done adding weather data, giving a recommendation in flight scheduling process.

Keywords: *Aviation industry, Fuel Optimization, Bayesian regularization*