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Predict the Failure of Hydraulic Pumps by Different Machine Learning Algorithms

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ABSTRACT

Pump failure is a general concerned problem in the hydraulic field. Once happening, it will cause a huge property loss and even the life loss. The common methods to prevent the occurrence of pump failure is by preventative maintenance and breakdown maintenance, however, both of them have significant drawbacks. This research focuses on the axial piston pump and provides a new solution by the prognostic of pump failure using the classification of machine learning. Different kinds of sensors (temperature, acceleration and etc.) were installed into a good condition pump and three different kinds of damaged pumps to measure 10 of their parameters. Then, several classification models were trained by different machine learning algorithms including Decision Tree, K-Nearest Neighbor, and Neural Network. These classification models can detect the “unhealthy” state of the pump and locate the damaged parts from real-time data. Finally, the performances of these models were evaluated by different metrics including Training Time, Accuracy and etc. According to the results, for the prognostic of axial piston pump failure, the algorithm with the highest accuracy is Fine KNN; while the algorithm that has a good balance of training time and accuracy is Fine Tree; finally, the Deep Neural Network has a good accuracy and can be designed with different hidden layer structures, in addition, the trained net of the Deep Neural Network can also be reserved and retrained with new data.

KEYWORDS

Fluid Power, Pump failure, Prognostic, Machine Learning, Classification, Neural Network