CHILLER DIAGNOSTICS USING MACHINE LEARNING

How to use data from a complex machine to detect faults

Chillers are large and complex machines, used for cooling in buildings and industrial plants. When a fault occurs, it can make the chiller less efficient, causing it to be more expensive to run and have a bigger impact on the environment. Although there are many controllers and sensors in the system, the detection of these faults usually takes a long time. It is not uncommon that the faults are detected when they have become severe, which can cause damage to the machine. To provide safe and stable operation, it is important to detect faults early and several fault detection methods can be applied to solve this problem. One of them is a machine learning approach, which learns from historical data to separate a faulty operation from normal. Carrier, as one of the leading manufacturers and distributors of the chillers, sees machine learning as one of the tools that can ultimately enhance existing fault diagnostic methods.

In this thesis, a fault detection algorithm was implemented using three simple and rather popular machine learning methods: decision tree, support vector machine, and logistic regression. Each model was trained on simulated data, generated by a Carrier chiller model. The dataset consisted of many signals representing normal operation as well as operation during three separate faults. The simulated data was provided by the company and had no noise or bias from the sensors.

The fault detection algorithm, using the support vector machine model, managed to predict these faults with high accuracy scores. Another two models performed slightly worse and one of the faults (leakage) was the most challenging to detect. Finally, the number of signals needed for the algorithm was reduced to just 4. The results from the thesis may serve as a good foundation for future studies in this field and the company can use the models on more complex data, that are closer to real data.

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