Early failure detection of paper manufacturing machinery using nearest neighbor based feature extraction

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May 4, 2020

Abstract

In a paper manufacturing system, it can be substantially important to detect machine failure before it occurs and take necessary maintenance actions to prevent a detrimental breakdown of the system. Multiple sensor data collected from a machine provides useful information on the system's health condition. However, it is hard to predict the system condition ahead of time due to the lack of clear ominous signs for future failures, a rare occurrence of failure events, and a wide range of sensor signals which might be correlated with each other. In this paper, we present two versions of feature extraction techniques based on the nearest neighbor combined with machine learning algorithms to detect a failure of the paper manufacturing machinery earlier than its occurrence from the multi-stream system monitoring data. First, for each sensor stream, the time series data is transformed into the binary form by extracting the class label of the nearest neighbor. We feed these transformed features into the decision tree classifier for the failure classification. Second, expanding the idea, the relative distance to the local nearest neighbor has been measured, results in the real-valued feature, and the support vector machine is used as a classifier. Our proposed algorithms are applied to the dataset provided by IISE 2019 data competition, and the results show the better performance than the given baseline.

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