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Anomaly detection for complex equipment monitoring

Anomaly detection is a key issue in many fields of application. In condition-based maintenance, we are navigating between two key issues: the health status assessment and the identification of the default (diagnosis itself). The first can be answered by an “unsupervised” approach, which seeks to detect changes in the behavior of complex industrial equipment, in order to detect faults or measurement problems as early as possible. The latter, on the other hand, implies supervised methods that are rarely applicable to complex equipment due to a lack of labeled data. The aim of this paper is to present a methodology for setting up a more suitable monitoring system than the simple detection of threshold exceedances usually used in maintenance. Due to the multiplicity of equipment to be monitored, the automatic anomaly detection process needs to prioritize the equipment to be analyzed and provide key indications to help experts for diagnosis. The main constraint is that the number of false alarms must not overload the control room, while at the same time not tolerating any missed detections. The method we have developed consists in learning and running a behavioral model based on an analysis of the distances between a new measurement and measurements from a reference period, which makes it close to k-NN type methodologies. This methodology, which meets the needs defined above, incorporates a process for automatically determining the end of the reference period, a definition of the adaptive distance metric, and the ability to reduce false alarms over time by taking continuous human analysts feedback into account.

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