Master Project

Multivariable Anomaly Detection Framework for Multi-sensor Network

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Context

The built environment is responsible for one-third of the energy consumption. Ambitious goals for the reduction of this energy consumption are set by the Dutch 'Klimaatakkoord'. A promising way of reaching those goals is by operating the HVAC systems in buildings more efficiently by making the buildings smart through the use of sensors, allowing for data-driven operation. At the moment, the number of building monitoring sensors is rapidly growing.

One of the key challenges in a large amount of data processing is the detection of anomalies resulting from the sensor or the data acquisition. Moreover, the diagnosis of the anomalies is essential. The data collected by the multi-sensor network in DWA buildings have high dimensionality. Processing multidimensional signals are more complicated. And the feature of the anomaly is more unapparent in multidimensional data compares to the unidimensional data. In addition, anomaly detection and diagnosis need to be applied on unlabeled or partially labelled data due to the insufficient labelled data. These three challenges are faced by most smart building companies.

Project tasks

The task is to develop and test a new framework for anomaly detection and diagnosis that tackles the challenges above. To achieve the requirement, the following tasks are proposed:

1. Determine a feature extraction method for preprocessing the multi-dimensional signal in preparation for the learning process
2. Determine a decent and efficient machine learning algorithm, design labeling strategies, classify the signals.
3. Analyze the resulting anomaly detection framework. Experimental testing and evaluation of the designed solution. Investigate the influences of different parameters for the algorithms and how multiple algorithms can be combined for improved performance.

This master thesis project is done in cooperation with DWA. The data that is used for validating the performance of the developed framework is provided by DWA, the department of Bright Building.