Thesis project available

Prognostics and Health Management (PHM)

(duration: 8-10 months)

❖ Title of the research:

Development and implementation of diagnostic techniques for the classification of abnormal conditions in industrial plants using transparent rules.

❖ Context of the research

In plant management, control room operators are typically required to identify the causes of abnormal conditions considering the evolution of the monitoring signals. This task is often quite challenging, given the large number of monitoring signals in the Industry 4.0 era and the complex relationships among them. To aid the operators, various diagnostic techniques have been engineered, commonly based on artificial intelligence methods. An important requirement for their practical application is the physical interpretability of the relationship among the monitoring signals underpinning the functioning of the diagnostic technique. In this context, Association Rules (AR) extraction methods are gaining interest due to their capabilities of extracting knowledge from complex large-scale databases. The obtained "*if, then*" rules (e.g., ""*if the pressure in the Boiler-1 is greater than 345 kPa and the inlet steam temperature in Turbine-6 is lower than 350* ^{0}*C, then a malfunction in Generator-4 is expected*") are expected to be physically interpretable by the operators and allow building an accurate diagnostic system.

The present thesis project aims at developing and implementing methods for extracting association rules using artificial intelligence techniques such as Artificial Neural Networks (ANNs) and Deep Learning (DL) methods in the context of abnormal condition diagnostics of industrial plants.

❖ Objective of the research

Methodology investigation, development and pilot case examination, with software implementation of the method explored.

❖ Work Phases

- Analysis of the possible solution methods;
- Selection of the most promising solution method;
- Development of the selected solution method;
- Application to synthetic and industrial case studies
- Analysis of the obtained results.

❖ Required skills

- Interest in developing innovative algorithms to tackle real applications;

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