Support Vector Machine for automatic failure detection and time evolution tracking
Application to wind-nuclear-hydroelectric energy production plants -

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Whatever its source, the energy production and safety relies on the availability of the equipment. Planning a maintenance based on a reliable estimate of its health state is called condition monitoring and is a critical challenge for the future of all types of energy. The proposed internship is within this context, and particularly in the context of AStrion project, which has been part of two recently completed European projects KAStríon and SUPREME.

In order to monitor a running system and characterize its health, sensors are installed close to the different critical components and signals are continuously collected over time. From these measures, the method AStrion, a data-driven signal processing approach, generates new high-dimensional feature vectors that are characteristics of the health or condition of the components. The generated features are made of a mix of discrete and continuous features, so inhomogeneous and with different statistical properties. The processing of these features is a complex task to handle in classification algorithms. Moreover, signals of interest being composed of several hundreds of components, such a « big data » context makes the problem more complex.

The final objective is to design and add a decision-making process in the AStrion methodology. A first study has shown promising results when applying a parallel one-class Support Vector Machine (SVM) algorithm in order to extract automatically the evolving features that can then be associated to a faulty component. Moreover, in order to be able to track the time evolution of these features and then a damage evolution, anomaly alarms are updated thanks to an automatically data-driven update of the training data set.

The objective of the internship is to further this first study in order to confirm its interest by validating or modifying the current algorithm, evaluating the sensitivity of the chosen kernel and of the size of the data training set, and by quantifying the performances.

In support of this study, substantial real-world data bases are available, in particular, from GOTIX platform of GIPSA-lab for a test bench wear monitoring, from some of our partners, the SME VALEMO for onshore wind turbine monitoring, the startup BLADETIPS for monitoring the small rotors of flying blade tips in smart wind turbines, EDF-DTG for nuclear and hydroelectric plant monitoring,

This internship can result in a thesis subject.

***Skill requirements**: signal processing, machine learning, classification*

***Location**: GIPSA-lab, SAIGA team, in Grenoble in collaboration with IRIT, SC team, in Toulouse.*