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Plenary talk

Bridging Diagnosis from the Control and AI Perspectives

LOUISE TRAVÉ-MASSUYÈS
University of Toulouse, Toulouse, France
louise@laas.fr

dynamic systems supervision and diagnosis with special focus on qualitative, model-based reasoning methods and data mining

Abstract

Diagnosis is the process of identifying or determining the nature and root cause of a failure, problem, or disease from the symptoms arising from selected observations, checks or tests. The different facets of this problem and the wide spectrum of classes of systems and applications make it interesting to several communities and call for bridging several scientific fields. In particular, diagnosis must work from the signals that permit efficient fault detection towards the upper levels of supervision which call for qualitative interpretations. Proposing relevant abstractions to interpret the available signals in symbolic or event-based form is hence key to diagnosis. To do that, discrete formalisms borrowed from artificial intelligence find a natural link with continuous models from the control community. These two communities have their own model-based diagnosis track:

- the FDI (fault detection and isolation) track, whose foundations are based on engineering disciplines, such as control theory and statistical decision making, and
- the DX (diagnosis) track, whose foundations are rooted in the fields of logic and complexity analysis.

In the last ten years, there has been a growing number of researchers in both communities who tried to understand and incorporate approaches from their parallel research fields to build better and more effective diagnostic systems. Model-based approaches and data-driven approaches based on machine learning techniques are present in both communities and also complement synergically to provide solutions to a variety of diagnostic problems whose difficulty arises from the scarce nature of the instrumentation or, oppositely, from the massive amounts of data to be interpreted for the emergence of hidden knowledge. Other bridges can be found when considering that diagnosis is not a goal *per se* but a piece in fault management architectures. It takes part in the solutions produced for tasks such as on-board recovery, condition monitoring, maintenance and prognosis, repair and therapy planning. This talk will provide a comprehensive picture of the different facets of diagnosis, illustrated by real world problems, and exemplify how different techniques from control and from AI can be synergically integrated to provide better solutions for fault management problems.

Biography

Louise Travé-Massuyès is the research director at the National Center for Scientific Research (CNRS), working at the Laboratory for Analysis and Architecture of Systems (LAAS), Toulouse, France. She received a Ph.D. degree in control in 1984 and an engineering degree specializing in control, electronics and computer science in 1982, both from the National Institute of Applied Sciences (INSA) in Toulouse, France, and then the habilitation qualification (HDR) from Paul Sabatier University in 1998. Her main research interests are in dynamic systems supervision and diagnosis with special focus on qualitative, model- based reasoning methods and data mining. In CNRS-LAAS, she has been the head of the Diagnosis and Supervisory Control (DISCO) research team for several years. She has been particularly active in bridging AI and control model-based diagnosis methods, as the leader of the BRIDGE Task Group of the MONET European Network. She has been responsible for several industrial and European projects and published more than 200 papers in international conference proceedings and scientific journals as well as one patent. She is a member of the IFAC Safeprocess Technical Committee and a senior member of the IEEE Computer Society.