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Methods for variable time-delay estimation in industrial data

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In many industrial applications, the goal is to predict (possibly in real-time) some target property based on a set of measured process variables. Process data always need some sort of preprocessing and restructuring before modelling. In continuous processes, an important step in the pipeline is to adjust for the time delay between target and input variables.

Time delay can generally be classified as either measurement/signal delay or process delay.

Measurement delay is a characteristic of the sensor setup and the measuring strategy, while process delay is an intrinsic characteristic of the Process and the way it is operated. This work is focused on process delay.

While it is possible to feed a machine learning algorithm all the process data and let it decide what to include in a complete black-box approach, it is often better from an industrial data scientist's perspective to have an increased degree of control over the process modelling pipeline and obtain better insights in the process. Variable time delay estimation becomes a valuable exercise in these cases, especially if the end goal of the analysis is fault detection or the building of a control system.

This topic is generally overlooked in the literature, but some methods have been proposed in the past years.

This contribution aims to give a comparative overview of the most common methods, comparing their performance on both simulated and real industrial data.

Keywords

Variable Time Delay, Mutual information, performance comparison

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