

Master's, Bachelor's and Project Theses in the Field of:

Alarm Flood Analysis in Automated Process Plants

Topic Description

Modern process plants continuously generate alarms, events and process measurements. During abnormal situations, many alarms may be triggered within minutes. Alarm floods hide the initiating disturbance, make it difficult to separate causes from consequential alarms, increase operator workload and may delay decisions.

This topic investigates data-driven and AI-based methods for detecting, representing, comparing and classifying alarm floods using historical alarm logs, process signals and simulated plant events. Besides accuracy, robustness, uncertainty, explainability and engineer-oriented interpretation are important.



Research Tasks

Possible theses include benchmark studies, systematic use of process simulators to generate new datasets, development and improvement of novel and existing alarm-flood classification and similarity analysis methods, and modern AI architectures such as sequence models, representation learning, Transformers or graph models.

Further directions include explainable AI (XAI) for alarm-pattern analysis, uncertainty quantification, open-set recognition of unknown disturbances and robustness analysis under missing, duplicate, delayed or swapped alarms. The specific scope will be adapted according to prior knowledge, data availability and planned duration of the thesis.

- 1) **Data and benchmarks:** prepare historical or simulated alarm data, define representations and compare evaluation metrics.
- 2) **Methods and evaluation:** develop detection, similarity analysis or classification and analyze robustness, uncertainty and explainability.

Requirements

- Interest in process automation, data analysis and industrial AI
- Python experience; basic knowledge of machine learning or time-series analysis is beneficial
- Experience with event data, process simulation, visualization or evaluation would be beneficial

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Start

by arrangement