Tembryo

New analysis techniques from machine learning and dynamical systems theory have the potential to radically improve the detection of faults in industrial process equipment and enable predictive maintenance. Tembryo is interested in the discovery of target applications for this technology within the food manufacturing industry and seeks validation with an industrial partner.

Problem

Machine failure is an ever-present problem in food production that prevents plants from operating at full capacity. Disturbances of various magnitudes interrupt the production line, requiring factories to keep backup-capacity and causing a significant amount of downtime. Sensors installed throughout the production line collect information on the processing conditions, but without appropriate analysis tools this data is difficult to interpret and oftentimes left unused. If automated techniques are applied, the analysis is typically very rudimentary and ignores important information in the data that could signal impending failure.

Solution

We propose to leverage cutting edge research from machine learning and dynamical systems modeling to detect faults earlier and more robustly than the current fault detection methods used in the industry. These techniques use existing sensor data to learn nonlinear models of the fault-free operating behaviour of the process, and then detect deviations from these models that could indicate malfunction. By presenting this information to plant operators and managers in a visual and intuitive way, our solution will help reduce costly unscheduled down-time. A significant advantage of this approach is that it makes use of existing sensor data and so does not require any additional sensors to be installed.

Team

Richard Mason holds a PhD in Optimisation and Control Theory from the University of Oxford. His PhD research considered methods of exploiting sparsity in a number of analysis and synthesis problems found in control theory. He has attended international conferences on Control Systems and Fault Detection, and one of his papers was awarded the O. Hugo Schuck prize in 2015.

Quirin Fischer studied computer science at the Technical University of Munich. Starting on an early-study programme for high school students, he completed his Bachelor's degree in 2013 with a thesis on artificial intelligence in robotics and worked on computer vision for his Master's thesis. He has ten years of programming experience, competed on a university team at an international programming contest and spent two years developing and implementing new techniques for geometry processing at the Fortiss institute.

Tembryo is supported by Entrepreneur First, a pre-seed incubator based in London that works with Europe's top technical talent to develop deep-tech startups.

Proposed Plan of Action

The first step would be to conduct meetings with relevant stakeholders at interested companies in order to identify an application target within their organisation and decide on steps required to carry out an effective pilot project.

The second step would be a proof of concept study of the performance of the developed algorithms on standard benchmark models for industrial systems. One suggested testbed would be the DAMADICS benchmark, a simulation based on the Lublin sugar factory in Poland that is a well established tool for evaluating fault detection methods.

The third step would be a paid pilot study of the performance of the analysis technology on historical data from a production plant provided by the industry partner. Subject to satisfactory performance, the aim would be to set up a follow-up project to develop an online predictive maintenance system.