Demo Case Update

From KWR – KWR WATER B.V.

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KWR Water Research Institute has been actively working with Waternet in **Demo Case #3 – i.e. intelligent control for wastewater treatment to reduce greenhouse gas emissions**, with focus on N_2O, and energy consumption while ensuring a good effluent quality. Specifically, the control algorithm is tested on a wastewater treatment lane equipped with sensors in the Amsterdam West Wastewater Treatment Plant (WWTP). **Intelligent control of the WWTP is being achieved through the deployment of additional sensors, development of data driven control strategies and Artificial Intelligence (AI) models.**

A key aspect that must be considered prior to the calibration and validation of data-driven strategies and AI models is data quality. Data quality can be impacted by sensor faults, (sensor) calibration issues, fouling or obstruction of the sensors and connectivity problems occurring during the transfer of data between the sensors and actuators and Process Information Management System (PIMS). As a result, data quality checks are needed. Especially when many values from a multitude of signals are required for AI models, manual detection and correction can be labor intensive, susceptible to human error and impractical in case of automated control.

Therefore, we are currently working on an automated Data Validation framework, which can be utilized as a data screening and correction layer between the PIMS and the smart applications developed. Additionally, the framework would be integrated within the F4W reference architecture. As a first step, detection techniques are developed which rely on data-driven, statistical methods (univariate or multivariate) as well as physically feasible and dynamic process (model) constraints.
The next step will be the development and testing of correction techniques in tandem with the development of virtual sensors to estimate key process variables. An example of what could be expected from anomaly detection is shown in the figure below.

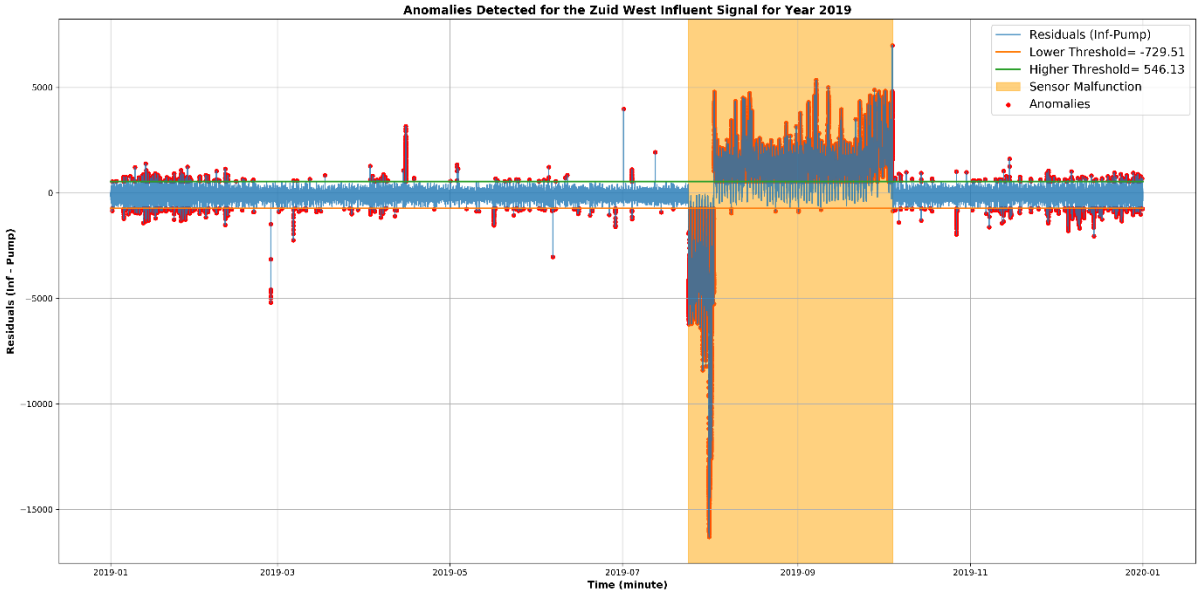

Figure 1: Preliminary results of anomaly detection of the flow signal (blue solid line) of one of the influent streams of WWTP Amsterdam West. The orange shaded area depicts an event-logged malfunctioning of the sensor, while the red dots show potential anomalies using a confidence threshold.

Additionally, the framework will provide (near) real-time data validation for new values that are measured in the treatment processes, thereby aiding the process of increasing the accuracy in the prediction and subsequently better control of key system processes, in order to achieve the goals of reducing N_2O emissions and energy consumption.

Author: KWR

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Project Consortium

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