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Anomaly Forecast of Sensor Data in Energy Intensive Industries

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Energy intensive industries are considered to account for about half of all industrial sector delivered energy use. Beer production is an energy intensive industry requiring heating or cooling large volumes of mixtures. Thermal energy from burning natural gas or co-generation is used to produce hot water and steam. In turn, steam water is used in the brewing and packaging process. Our analysis focuses on the brewing room (brewhouse) where steam vapor is supplied by boilers and delivered to the mash tun, lauter tun and kettle in the process line. Early detection of anomalous behavior of sensor data allows for convenient scheduling of corrective actions to prevent loss of production when the pressure drops below certain threshold for a specified period of time. The actions originating from the early detection of such anomalies guarantees cost savings since corrective tasks are performed only when warranted to prevent unwanted downtime and/or loss of production due to the low quality of the product. The discovery of the anomaly does not prevent the possibility of material loss or equipment failure [1], and therefore a prediction of future occurrence of an anomaly is needed and this is the main focus of this work.

Bucket-based representations from a time-series and regularized logistic regression have been used for failure prediction in an industrial setting [2]. For this particular industrial process, we found that an adequate averaging time-interval for the construction of a regular time-series and a proper selection of a classification algorithm is all we need to accurately predict abnormal behavior, i.e. pressure drop in the main line for a specified period of time. The overall goal from implementing this solution is to reduce loss in production capacity, generation of greenhouse gases, amount of raw material, labor cost, infrastructure, and contribution to global warming caused by excessive steam vapor demand.

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