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Abstract Title: Fault Detection and Diagnosis in Chemical Processes Using Big Data Analytics

Authors: Dr. Mohamed Bin Shams, University of Bahrain

Modern industries today deal with different automated systems that can generate a huge amount of data and store it in a historical database. As these big data continues to accumulate, there has been a significant focus on finding and obtaining actionable insight from it. These massive amounts of industrial data are characterized by being correlated (most likely in a nonlinear manner), of low signal to noise ratio and usually with many missing measurements in all measured variables. Yet, this data is capable to reveal many useful information e.g. for detecting and identifying process faults. In this project, a big data analytics tool called Kernel Principal Component Analysis (KPCA) was used for fault detection. A new fault identification strategy based on the power series approximation of the kernel functions was investigated and tested. The speed of computation was also studied and enhanced especially with regard to the calculation of the principal components and the contribution plots. KPCA was applied and tested using a simple case study as well as a subset of the faults in the Tennessee Eastman Process (TEP). The kernel principal component analysis shows a superior proficiency compared to its linear counterpart.