Fall Colloquium

October 17, 3:30-4:30pm
Seitz 313

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Fault Detection and Isolation for a Complex Decentralized Wastewater Treatment Facility

Decentralized wastewater treatment (WWT) facilities monitor many features that are complexly related. The ability to detect faults quickly and accurately identify the variables that are affected by a fault are vital to maintaining proper system operation and high quality produced water. Various multivariate methods have been proposed to perform fault detection and isolation, but most methods require the data to be independent and identically distributed when the process is in control (IC) as well as a distributional assumption. We propose a distribution-free fault isolation method for nonstationary and dependent multivariate processes. We detrend the data using observations from an IC time period to account for expected changes due external or user-controlled factors. Next, we perform fused lasso, which penalizes differences in consecutive observations, to detect faults and identify affected variables. To account for autocorrelation, the regularization parameter is chosen using an estimated effective sample size in the Extended Bayesian Information Criterion. We demonstrate the performance of our method compared to a state-of-the-art competitor in a simulation study. Finally, we apply our method to WWT facility data with a known fault, and the affected variables identified by our proposed method are consistent with the operators' diagnosis of the cause of the fault.

Bio: Professor Hering obtained her Ph.D. from Texas A&M University in Statistics in 2009. She joined the Department of Applied Mathematics and Statistics at Colorado School of Mines in Golden, Colorado in 2009 as an Assistant Professor. In 2016, she joined the Department of Statistical Science at Baylor University as an Associate Professor. She is an associate editor for Environmetrics, Technometrics, and Stat. In 2017, she was awarded the ASA's Section on Statistics and the Environment's Early Investigator Award and in 2019 was selected as the TIES recipient of the Abel El-Shaawari Early Investigator Award.. Her interests are in modeling big, multivariate, spatial datasets; developing methods for categorical spatial data; and detecting outliers and faults for process monitoring.