Contribution ID: **132** Type: **not specified**

Tensor-Based Temporal Control for Partially Observed High-Dimensional Streaming Data

Monday, 16 September 2024 12:00 (30 minutes)

In advanced manufacturing processes, high-dimensional (HD) streaming data (e.g., sequential images or videos) are commonly used to provide online measurements of product quality. Although there exist numerous research studies for monitoring and anomaly detection using HD streaming data, little research is conducted on feedback control based on HD streaming data to improve product quality, especially in the presence of incomplete responses. To address this challenge, this article proposes a novel tensor-based automatic control method for partially observed HD streaming data, which consists of two stages: offline modeling and online control. In the offline modeling stage, we propose a one-step approach integrating parameter estimation of the system model with missing value imputation for the response data. This approach (i) improves the accuracy of parameter estimation, and (ii) maintains a stable and superior imputation performance in a wider range of the rank or missing ratio for the data to be completed, compared to the existing data completion methods. In the online control stage, for each incoming sample, missing observations are imputed by balancing its low-rank information and the one-step-ahead prediction result based on the control action from the last time step. Then, the optimal control action is computed by minimizing a quadratic loss function on the sum of squared deviations from the target. Furthermore, we conduct two sets of simulations and one case study on semiconductor manufacturing to validate the superiority of the proposed framework.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

quality, streaming data, tensor

Primary author: PAYNABAR, Kamran (Georgia Tech Atlanta)

Presenter: PAYNABAR, Kamran (Georgia Tech Atlanta)

Session Classification: INFORMS invited session: Quality Statistics Reliability (QSR)