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Title

An Adaptive Sampling Strategy for Online Monitoring and Diagnosis of High-dimensional Streaming Data

Abstract

Statistical process control techniques have been widely used for online process monitoring and diagnosis of streaming data in various applications, including manufacturing, healthcare, and environmental engineering. In some applications, the sensing system that collects online data can only provide partial information from the process due to resource constraints. In such cases, an adaptive sampling strategy is needed to decide where to collect data while maximizing the change detection capability. This paper proposes an adaptive sampling strategy for online monitoring and diagnosis with partially observed data. The proposed methodology integrates two novel ideas: (i) the recursive projection of the high-dimensional streaming data onto a low-dimensional subspace to capture the spatio-temporal structure of the data while performing missing data imputation; and (ii) the development of an adaptive sampling scheme, balancing exploration and exploitation, to decide where to collect data at each acquisition time. Through simulations and two case studies, the proposed framework's performance is evaluated and compared with benchmark methods.

Short Biography

Kamran Paynabar is the Fouts Family Early Career Professor and Associate Professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Tech. He received his B.Sc. and M.Sc. in Industrial Engineering from Iran and his Ph.D. in Industrial and Operations Engineering from The University of Michigan in 2012. He also holds an M.A. in Statistics from The University of Michigan. His research interests comprise both applied and methodological aspects of machine-learning and statistical modeling integrated with engineering principles for predictive modeling, system monitoring, diagnosis and prognosis. He is a recipient of the INFORMS Data Mining Best Paper Award, the Best Application Paper Award from IIE Transactions, the Best QSR Refereed Paper from INFORMS, and the Best Paper Award from POMS. He has been recognized with the CETL/BP Junior Faculty Teaching Excellence Award and the Provost Teaching and Learning Fellowship. He served as the chair of Quality, Statistics, and Reliability of INFORMS, and the president of Quality Control and Reliability of IISE. He is Associate Editor for Technometrics, IEEE-TASE, INFORMS Journal of Computing, and INFORMS Journal of Data Science, a Department Editor for IISE-Transactions and a member of editorial board for Journal of Quality Technology. He is a co-founder of ProcessMiner an AI/ML startup company for manufacturing improvement.