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Statistical Process Monitoring Based on Functional Data Analysis

In modern industrial settings, advanced acquisition systems allow for the collection of data in the form of profiles, that is, functional relationships linking responses to explanatory variables. In this context, statistical process monitoring (SPM) aims to assess the stability of profiles over time in order to detect unexpected behavior. This talk focuses on SPM methods that model profiles as functional data, that is, smooth functions defined over a continuous domain, and apply functional data analysis (FDA) tools to address limitations of traditional monitoring techniques. A reference framework for monitoring multivariate functional data is first presented. The talk then offers a focused survey of several recent FDA-based profile monitoring methods that extend this framework to address common challenges encountered in real-world applications. These include approaches that integrate additional functional covariates to enhance detection power, a robust method designed to accommodate outlying observations, a real-time monitoring technique for partially observed profiles, and adaptive strategies that target the characteristics of the out-of-control distribution. These methods are implemented in the R package funcharts, available on CRAN.

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Special/ Invited session

Classification

Both methodology and application

Keywords

Anomaly detection; Control charts; Profile Monitoring

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