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Linear Profile Monitoring of Functional Data

Linear profile monitoring assesses the stability of a process described by a linear relationship between a scalar response variable and multiple explanatory variables. When both the response and explanatory variables are functions, this translates into tracking the stability of the underlying functional linear model (FLM). However, unlike the scalar setting, where batches of data points are collected at each sampling stage to construct a profile, this setting provides only a single paired functional observation at each stage, making stagewise estimation of the regression coefficient functions at each sampling stage ill-posed.
To address this challenge, this article proposes a framework for the online monitoring of the relationship between a functional response and multiple functional covariates. An extensive Monte Carlo simulation study compares the performance of the proposed method with a state-of-the-art method, and a case study on monitoring the relationship between lambda-signals and engine state values illustrates its practical applicability.

Special/ Invited session

Classification

Both methodology and application

Keywords

Profile Monitoring, Functional Data Analysis, Statistical Process Control

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