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Statistical process control of multivariate functional data in R

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In many statistical process control applications data acquired from multiple sensors are provided as profiles, also known as functional data. Building control charts to quickly report shifts in the process parameters or to identify single anomalous observations is one of the key aims in these circumstances. In this work, the R package funcharts is introduced, which implements new methodologies on statistical process control for multivariate functional data developed in the recent literature, in both unsupervised and supervised learning scenarios. In the unsupervised setting, multivariate functional data are the quality characteristic of interest to be monitored. In the supervised setting, the quality characteristic a scalar or functional quantity, influenced by multivariate functional covariates, then functional regression is used to model the relationship between the quality characteristic and the variables to increase the capacity to assess anomalies in the process. The major focus of funcharts is on Phase II monitoring, in which one wants to monitor a data set of new observations to signal anomalous observations, given a reference data set of in-control data used to estimate the model and control chart limits. Furthermore, in all the considered scenarios, the R package offers functions for real-time monitoring for functional data with a temporal domain, i.e. for monitoring the section of profiles partially observed only up to an intermediate domain point.

Keywords

functional data analysis, statistical process control, R

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