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Constructing nonparametric control charts for correlated and independent data using resampling techniques

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Non-parametric control charts based on data depth and resampling techniques are designed to monitor multivariate independent and dependent data.

Phase I

Dependent and independent case

- 1. The depths $D_F(X_i)$ ordered in ascending order are obtained.
- 2. The lower control limit (LCI) is calculated as the quantile at the α level of the observations under null hypothesis such that the percentage of false alarms are approximately equal to α .
- 3. If $D(X_i) \leq LCI$ then the process is out of control.

For the estimation of the quantile, smoothing bootstrap, stationary bootstrap have been applied for independent and dependent case.

Phase II

- 1. From the reference sample $\{X_1, ..., X_n\}$ the depth of the data $D(X_i)$ is calculated with i = 1, ..., nand based on this the depths of the monitoring sample $D(Y_j)$ are obtained with j = n+1, ..., m based on the calibration sample
- 2. Monitor the process, if you have observations $D(Y_j) \leq LCL$ then the process is out of control.
- 3. Calculate the percentage of rejection as the average of observations under the lower control limit.

The simplicial depth in general has a better performance for all sample sizes. It is noted that as the sample size increases, the Tukey and Simplicial measures yield better results.

Keywords

Control Chart Depth Bootstrap

Special/invited session

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