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A Bayesian Self-starting Hotelling (BSSH) T2 for Online Multivariate Outlier Detection

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Online outlier detection in multivariate settings is a topic of high interest in several scientific fields, with the Hotelling's T2 control chart being probably the most widely used method in practice to treat it. The problem becomes challenging though when we lack the ability to perform a proper phase I calibration, like in short runs or in cases where online inference is requested from the start of the process, as in biomedical applications. In this work, we propose a Bayesian self-starting version of the Hotelling's T2 control chart, for multivariate normal data when all parameters are unknown. A conjugate power prior will allow to incorporate different sources of information (when available), providing closed form expressions that are straightforward to be used in practice and most importantly, will allow online inference, breaking free from the phase I calibration stage. From a theoretic perspective, we determine the power of the proposed scheme in detecting a fixed size outlier in the mean vector and we discuss its properties. Apart from monitoring, we deal also with the post-alarm inference aiming to provide the likely source(s) of an alarm, enriching the practitioners root-cause analysis toolbox. A simulation study evaluates the performance of the proposed control chart against its competitors, while topics regarding its robustness are also covered. An application to real data will illustrate its practical use.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

Statistical process control and monitoring, power prior, post alarm inference

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