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Univariate Self-Starting Shiryaev (U3S): A Bayesian Online Change Point Model for Short Runs

Tuesday, 14 September 2021 12:40 (20 minutes)

In Statistical Process Control/Monitoring (SPC/M) our interest is in detecting when a process deteriorates from its "in control"state, typically established after a long phase I exercise. Detecting shifts in short horizon data of a process with unknown parameters, (i.e. without a phase I calibration) is quite challenging.
In this work, we propose a self-starting Bayesian change point scheme, which is based on the cumulative posterior probability that a change point has been occurred. We will focus our attention on univariate Normal data, aiming to detect persistent shifts for the mean or the variance. The proposed methodology is a generalization of Shiryaev's process, as it allows both the parameters and shift magnitude to be unknown. Furthermore, the Shiryaev's assumption that the prior probability on the location of the change point is constant will be relaxed. Posterior inference for the unknown parameters and the location of a (potential) change point will be provided.
Two real data sets will illustrate the Bayesian self-starting Shiryaev's scheme, while a simulation study will evaluate its performance against standard competitors in the cases of mean changes and variance inflations.

Keywords

Bayesian Statistical Process Control/Monitoring, Persistent Shifts, Change Point, Online Inference

Special/invited session

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