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Implementation of self-starting monitoring schemes based on online parameter learning

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Self-starting control charts have been proposed as alternative methods for testing process stability when the in-control (IC) process parameters are unknown and their prospective monitoring has to start with few initial observations. Self-starting schemes use consecutive observations to simultaneously update the parameter estimates and check for out-of-control (OC) conditions. Although such control charts offer a viable solution, it is well-documented that their OC performance deteriorates when sustained shifts in process parameters go undetected within a short time window after the fault occurrence. This undesired drawback is partially due to the inclusion of OC observations in the process parameter estimates, with an unavoidable loss in terms of detection power. The inability to detect changes during such "*window of opportunity*"is even worse when the parameter shift is small in magnitude and/or occurs early in the prospective monitoring. To face this critical issue, a proposal for online parameter learning is here introduced to complement the key-idea of "cautious learning"introduced by Capizzi and Masarotto (2019). The main goal of the proposed procedure is to find a suitable "trade-off"between a bias reduction of parameter estimates in the OC setting and the increase in variance under the IC scenario. The proposal is illustrated using a self-starting EWMA control chart for Poisson data introduced by Shen et al. (2016), and already with a moderate number of historical observations, results show a promising OC performance for early and/or small shifts while containing the loss in the attained IC performance.

References

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