Univariate Self-Starting Shiryaev (3S): A Bayesian Change Point Model for Online Monitoring of Short Runs

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ABSTRACT

The Shiryaev's change point methodology is a powerful Bayesian tool in detecting persistent parameter shifts. It has certain optimality properties when we have pre/post-change known parameter setups. In this work we will introduce a self-starting version of the Shiryaev's framework that could be employed in performing online change point detection in short production runs. Our proposal will utilize available prior information regarding the unknown parameters, breaking free from the phase I requirement and will introduce a more flexible prior for change-point parameter, compared to what standard Shiryaev employs. Apart from the on-line monitoring, our proposal will provide posterior inference for all the unknown parameters, including the change point. The modeling will guard in detecting persistent parameter shifts. A real data set will illustrate its use, while a simulation study will evaluate its performance against standard competitors.

Keywords: Bayesian Statistical Process Control and Monitoring, At Most Once Change (AMOC), Persistent Shifts, Phase I

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Adaptive Sampling in Profile Monitoring Through Bandits

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ABSTRACT

Profile monitoring has found many applications in industrial problems. In this research, we consider the adaptive sampling strategies in profile monitoring. Instead of uniformly sample the profiles, we can adaptively choose the number and locations of the samples to increase the chance of anomaly detection. We use online learning approach to balance the trade off between exploration and exploitation in sampling to achieve good performance in detecting changes in different forms. Numerical studies have demonstrated the superior performance over conventional approach with uniform samplings.

Keywords: Profile monitoring, adaptive sampling, upper confidence bound

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Multivariate Control Charts for Correlated Quality Variables of Different Types

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ABSTRACT

The two major challenges, monitoring/detection and diagnostics, for multivariate control chart developments and applications have become more front and center in modern era, especially for non-manufacturing processes, as these processes often involve correlated variables of different types, continuous, count and categorical. Little attention has been paid to develop multivariate control charts for monitoring correlated variables of different types. Even fewer efforts have been devoted to developing diagnostic mechanisms for identifying out-of-control parameters under such a premise. In this talk, we will discuss how these two challenges present a unique opportunity to develop multivariate control charts which can not only monitor correlated variables of different types, but also provide instantaneous diagnostics of out-of-control parameters when an out-of-control signal is detected. The discussions focus on some recent works which tackle these challenges by adopting multiple testing procedures in developing multivariate control charts. Future research directions along the same line will also be discussed.

Keywords: Diagnostic mechanism; Multiple testing procedure; Multivariate control chart; Variables of different types

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