Statistical Process Control for batch processes using a Bayesian VAR model-based control chart.

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In the field of Statistical Process Control (SPC) there are several different approaches to deal with monitoring of batch processes. Such processes present a three-way data structure (batches × variables × time-instants), so that for each batch a multivariate time series is available. Traditional approaches do not take into account the time series nature of the data. The main reason is that the time series inference theory is not based on replications of time series, as it is in batch process data. Recent developments in SPC have proposed the use of the time series models; among that, we highlight the work of D. Marcondes Filho & M. Valk (2020), that proposes an approach to deal with batch data focusing on the Vector Autoregressive (VAR) model. In short, we estimate VAR coefficients from historical in-control reference batch samples and build the multivariate control chart based on the modified Hotelling statistic to monitoring new batches. However, the performance of this SPC approach is limited to a suficiente number of reference batches available. In order to overcome this issue, we propose an alternative control approach by using a bayesian version of the VAR (BVAR) model based on the Minnesota prior and the Normal posterior distribution. The decision rule based on the Bayes Factor is proposed and tested through the batch simulated data with a different level of disturbances imposed. That approach seems to be promissor for detecting changes in the batch trajectories even with a very few number of historical reference batches.