

Comparing the Inertial Effect of MEWMA and Multivariate Sliding Window Schemes with Confidence Control Charts

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Abstract

In practical applications of multivariate sliding window (SW) control charts, a considerable amount of difficulty lies in selecting parameters related to the window size and to the disposal of past observations. Although widely used for pattern recognition problems, to the best of the authors' knowledge, there have been no comparative analyses of the efficiencies of multivariate SW schemes and more traditional and easy-to-apply control charts, such as Hotelling's T^2 and the multivariate exponentially weighted moving average (MEWMA) control charts. The present work applies a transformed statistic called confidence control chart (CCC), which standardizes all the control charts in the 0-1 interval to improve visualization, and comparisons are made in terms of the average run length (ARL). Therefore, the purpose of this paper is to present a simulation study to compare the inertial effect of estimating the actual mean vector through the SW and the MEWMA schemes. Three types of SW schemes were tested, including uniform, linear, and exponential weights. In addition to providing equivalences between the smoothing parameter of the MEWMA method and the window sizes for the bivariate case, the results show that multivariate SW schemes suffer from the inertial effect more than MEWMA charts. In this sense, the user is encouraged to apply both control charts to avoid detection delay.

Keywords: Process control, mean vectors, sliding window, simulation, average run length