

Executive Summary

It is well known that Shewhart chart is good at detecting large mean shifts while EWMA chart is effective in identifying small mean shifts. To take the advantages of both charts, the combined Shewhart-EWMA chart has been proposed to jointly monitor both statistics. The basic idea of it is to take a maximum function of both Shewhart and EWMA statistics. Note that the Shewhart and EWMA statistics are correlated; however, the Max-type combination of the Shewhart and EWMA statistics cannot take the correlation structure into consideration.

The correlation between the Shewhart and EWMA statistics may be useful for charting. To make use of it, this dissertation proposes a different combination method, the U chart, which originates from the multivariate monitoring techniques. The average run length (ARL) performance is compared with the conventional Shewhart-EWMA chart through Monte Carlo simulation under three different scenarios: (i) the case with step mean shifts; (ii) the case with dynamic mean shifts; and (iii) the case with linear drifts.

The comparison results show that the U chart has competitive performance to the Shewhart-EWMA chart for i.i.d. case. However, the U chart demonstrates prominent advantages over the latter in cases when the mean shift exhibits a decreasing pattern and when there is a linear drift in the process mean. Moreover, the U chart can gain some simplicity in its implementation in the sense that it involves the design of a single chart, compared to the conventional Shewhart-EWMA chart.