Mukherjee, Amitava; Li, Qi; Song, Zhi
An assessment of the effect of using different mappings and Minkowski distances in joint monitoring of the time-between-event processes. (English) Zbl 07444630

Summary: Monitoring multiple parameters of a process using a single integrated charting scheme is an attractive research area in statistical process monitoring and control. The Max-type combining function based on Chebyshev’s distance and the Distance-type combining function, essentially based on Euclidean distance, are widely used to construct various schemes for simultaneously monitoring the location and scale parameters. In most of these schemes, normalising the suitable function of maximum likelihood estimators (MLE) of individual parameters is commonly used. While monitoring two-parameter exponential distributions, we show that mapping the pivots based on the maximum likelihood estimators to standard normal variables is not optimal. This paper investigates four different mappings to analyse the transformation effect on the joint monitoring schemes for a two-parameter exponentially distributed process. The Chebyshev’s and Euclidean distances are particular cases of Minkowski distance. We additionally investigate the effect of Manhattan and minimum-type Minkowski distances via Monte Carlo in terms of the run-length properties. The overall chart performance is assessed using the expected weighted run length (EWRL). It is observed that the use of Manhattan distance and mapping into the standard Laplace model is more appropriate. A real example of monitoring a high-voltage current in a P-type high-voltage metal oxide semiconductor transistor (HPM) data is given to show the excellent performance of the suggested control chart.

MSC:
62Fxx Parametric inference
62Nxx Survival analysis and censored data
62Pxx Applications of statistics

Keywords:
variable transformations; Minkowski distance; joint monitoring; shifted exponential distribution; efficient charting plan

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References:

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