

Nonparametric Profile Monitoring with Error-Prone Auxiliary Variables

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Abstract

Profile monitoring has been one of the important topics in statistical process control. Unlike the usual settings that monitor a variable, profile monitoring aims to incorporate an auxiliary variable to characterize the primarily interested variable. To efficiently adopt an auxiliary variable to connect the main variable under the unknown relationship, nonparametric regression is a possible strategy. However, in applications, variables are possibly subject to measurement errors, which may lead to unreliable results if ignored in the analysis. In this paper, we investigate nonparametric profile monitoring when an auxiliary variable is contaminated with measurement error. We consider the regression calibration correction on the Nadaraya-Watson estimator. To monitor the variable and to detect the out-of-control samples, we adopt the asymptotic normality of the corrected Nadaraya-Watson estimator to derive the confidence band and treat it as the control limits. A series of numerical settings are considered to assess the performance of the proposed method, and the results verify the importance of taking measurement error effects into account.

Keywords : Nadaraya-Watson regression; nonparametric regression; regression calibration; statistical process control.