Model Robust Profile Monitoring for the Generalized Linear Mixed Model for Phase I Analysis

There are so many applications for detecting the changes in the relationship between the response variable and explanatory variable (s) may be the most important consideration rather than detecting the changes in univariate or multivariate quality characteristics. This relationship between the response variable and one or more explanatory variables is called a profile. The act of using various techniques to statistically monitor the process or product profiles is known as profile monitoring.

The study introduces two mixed model methods to monitor profiles from the exponential family: a nonparametric (NP) regression method based on the penalized spline regression technique and a semi-parametric (SP) method (Model Robust Profile Monitoring for the Generalized Linear Mixed Model (MRGLMM)) which combines the advantages of both the parametric and nonparametric methods. A correctly specified parametric (P) model will have the most power in detecting the profile shift (Abdel-Salam *et al*.,2013), while a NP method can give improved performance for any type of profile. The MRGLMM method gives results similar to the P method when P model is correctly specified and it gives results similar to the NP method if the proposed P model is badly misspecified. The MRGLMM method gives results that are superior to either the P method or the NP method if the P model provides some useful information regarding profile behavior. Thus, the MRGLMM method is robust to model misspecification. The performances of P, NP and MRGLMM methods are compared through a simulation study using binary data.