Robust estimation in joint mean–covariance regression model for longitudinal data

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Abstract   In this paper, we develop robust estimation for the mean and covariance jointly for the regression model of longitudinal data within the framework of generalized estimating equations (GEE). The proposed approach integrates the robust method and joint mean–covariance regression modeling. Robust generalized estimating equations using bounded scores and leverage-based weights are employed for the mean and covariance to achieve robustness against outliers. The resulting estimators are shown to be consistent and asymptotically normally distributed. Simulation studies are conducted to investigate the effectiveness of the proposed method. As expected, the robust method outperforms its non-robust version under contaminations. Finally, we illustrate by analyzing a hormone data set. By downweighing the potential outliers, the proposed method not only shifts the estimation in the mean model, but also shrinks the range of the innovation variance, leading to a more reliable estimation in the covariance matrix.

Keywords   Covariance matrix · Generalized estimating equation · Longitudinal data · Modified Cholesky decomposition · Robustness