

Multivariate Contaminated Normal Linear Mixed Models with Censored and Missing Outcomes Applied to Alzheimer's Disease Data

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Abstract

The paper proposes a robust approach to jointly modeling multiple repeated clinical measures with intricate features. More specifically, we aim to expand the scope of the multivariate linear mixed model by using the multivariate contaminated normal distribution. The proposed model, called the MCNLMM-CM, is designed to handle minor outliers effectively while simultaneously accommodating censored measurements and intermittent missing responses. An expectation conditional maximization either (ECME) algorithm is developed to estimate the parameters of the proposed model in situations involving missing at random responses. We also provide techniques for approximating the asymptotic standard errors of model parameters, recovering censored data, imputing missing values, and identifying outliers. The proposed methodology is inspired by and applied to data from the Alzheimer's Disease Neuroimaging Initiative cohort study, which involves longitudinal clinical measurements of patients with mild cognitive impairment. A simulation study is conducted to evaluate the finite-sample properties of the parameter estimators.

Keyword: Censored data; EM algorithm; Longitudinal data; Missing data; Outliers