

# Inference for Multivariate $t$ Linear Mixed Models with Damped Exponential Correlation Errors

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## Abstract

Irregularly observed multivariate longitudinal data with possibly missing values have received increasing emphasis in applications of biomedical, psychological and clinical studies. The multivariate  $t$  linear mixed model (MtLMM) has been proposed to robustly modeling multi-outcome continuous repeated measures especially in the presence of potential outliers or heavy-tailed noises. In this study, I present a flexible framework for fitting the MtLMM with an arbitrary missing pattern across outcome variables and scheduled occasions. Moreover, I employ a damped exponential correlation structure to address the autocorrelation among the within-subject errors. Under the missing at random (MAR) mechanism, an efficient alternating expectation-conditional maximization (AECM) algorithm is developed for carrying out maximum likelihood estimation of parameters and retrieving each missing outcome with a single-valued imputation. The issues for the estimation of random effects and the prediction of further values given past observed responses are also explored. The usefulness of the proposed methodology is demonstrated by using real and simulated examples.

*Keywords:* AECM algorithm, Multivariate longitudinal data, Missing values, Imputation, Prediction