Mixed Effects Models

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Testing Variance Components in Linear Mixed Effects Models

Testing variance components with zero is a well-known and non-standard hypothesis testing problem in linear mixed effects models with many applications. We introduce a test statistic using the variance least square estimator and propose to approximate its finite sample distribution using a permutation procedure. The procedure covers test of multiple variance components and any subset of them which is barely feasible using the existing methodologies. An application of the proposed method is demonstrated on real data.

YAN YAN WU, Samuel Lunenfeld Research Institute

Third-Order Method For the Test of Variance Components in Linear Mixed Model

We consider the problem of testing for variance components in linear mixed models. The likelihood based on third-order asymptotic method is proposed for approximating the p-values for testing a scalar parameter, such as a random intercept or a random slope. The third-order p-values use a simple modification of the familiar first-order method, likelihood ratio test and Wald statistics. Extensive simulations show that the proposed approximations outperform the existing likelihood based methods with both maximum likelihood and restricted maximum likelihood.

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Methodology for Scoring the EQ-5D

The EQ-5D yields a quality weight used to calculate quality adjusted life years. The new EQ-5D consists of five questions, each offering five possible responses, yielding 3125 health states. These health states must be converted into quality weights through a scoring algorithm. Methodology for creating the algorithm is lacking. The input data to the algorithm will consist of discrete choice experiments, with some time-trade-off tasks. This suggests using Generalised Linear Mixed Models to construct latent utilities, and regression to map onto utilities. The performance of these methods under varying inter-rater agreement and sample sizes is explored through simulation.

WEIQIANG WANG, University of Guelph

Modeling the Uncertainty of Susceptible and Non-susceptible Multiple Outcomes

Many diseases progress with multiple outcomes after the onset of the disease. With some potential factors, patients may or may not be susceptible to the event of interest. The objectives of the study are: (1) to identify and measure the effect of risk factors on the distribution of event time and the odds of susceptibility; (2) to model and predict the disease progression. We propose a mixed effect model nested within a mixture model to account for the susceptible and non-susceptible uncertainty and the correlations among the events. Simulation studies are conducted to assess the performance of our method.

HAOCHENG LI, University of Waterloo

A Variable Selection Method for Random Effects Models

Random effects models are commonly used for the analysis of longitudinal data. Including irrelevant covariates and random effects in the model may considerably degrade the quality of the results. To address this problem, we explore a variable selection method that can simultaneously select both fixed and random effects. Our method is developed based on penalizing a composite likelihood function. Empirical studies will be presented to assess the performance of the proposed method.

JESSE D. RAFFA, University of Waterloo
Multivariate Longitudinal Data Analysis Using Hidden Markov Models

Extending hidden Markov models (HMMs) to include random effects to describe subject-specific differences between HMM processes have allowed for effective modeling of longitudinal data in several disease areas. We propose further extensions to such models to accommodate multivariate longitudinal data of mixed data types. This approach was motivated by a smoking cessation clinical trial where subjects are monitored longitudinally using several distinct measures of smoking status. Under such models, the inclusion of hidden states describes heterogeneity due to changes in disease state (e.g. abstinence, smoking). The advantages and consequences of using such models will also be discussed.