

A FAMILY OF GENERALIZED LINEAR MODELS FOR REPEATED MEASURES WITH NORMAL AND CONJUGATE RANDOM EFFECTS

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RESUMO DE CONFERÊNCIA

Non-Gaussian outcomes are often modeled using members of the so-called exponential family. Notorious members are the Bernoulli model for binary data, leading to logistic regression, and the Poisson model for count data, leading to Poisson regression. Two of the main reasons for extending this family are (1) the occurrence of overdispersion, meaning that the variability in the data is not adequately described by the models, which often exhibit a prescribed mean-variance link (Hinde and Demétrio 1998, *Computational Statistics and Data Analysis* 27, 151-170), and (2) the accommodation of hierarchical structure in the data, stemming from clustering in the data which, in turn, may result from repeatedly measuring the outcome, for various members of the same family, etc. The first issue is dealt with through a variety of overdispersion models, such as, for example, the beta-binomial model for grouped binary data and the negative-binomial model for counts. Clustering is often accommodated through the inclusion of random subject-specific effects. Though not always, one conventionally assumes such random effects to be normally distributed. While both of these phenomena may occur simultaneously, models combining them are uncommon. This paper proposes a broad class of generalized linear models accommodating overdispersion and clustering through two separate sets of random effects (Molenberghs, Verbeke and Demétrio 2007, *LIDA*, 13, 513-531). We place particular emphasis on so-called conjugate random effects at the level of the mean for the first aspect and normal random effects embedded within the linear predictor for the second aspect, even though our family is more general. The binary, count, and time-to-event cases are given particular emphasis. Apart from model formulation, we present an overview of estimation methods, and then settle for maximum likelihood estimation with analytic-numerical integration. Implications for the derivation of marginal correlations functions are discussed. The methodology is applied to data from a study in epileptic seizures, a clinical trial in toenail infection named onychomycosis, and survival data in children with asthma (Molenberghs et al, 2010, *Statistical Science*, 25: 325-347).

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