EXTENDING THE PROPORTIONAL HAZARDS AND THE ACCELERATED FAILURE TIME PARADIGMS: RANDOM EFFECTS MODELS FOR SURVIVAL DATA

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A general proportional hazards model with random effects for handling clustered survival data is proposed. This generalizes the usual frailty model by allowing a multivariate random effect with arbitrary design matrix in the log-relative risk, in a way similar to the modeling of random effects in linear, generalized linear and non-linear moxed models. The distribution of the random effects is generally assumed to be multivariate normal, but other (preferably symmetrical) distributions are also possible. Maximum likelihood estimates of the regression parameters, the variance components and the baseline hazard function are obtained via the EM algorithm. The E-step of the algorithm involves computation of the conditional expectations of functions of the random effects, for which we use Markov chain Monte Carlo methods. Approximate variances of the estimates are computed by Louis' formula, and posterior expectations and variances of the individual random effects can be obtained as a by-product of the estimation. The inference procedure is exemplified on two data sets.

Secondly, we present a framework for extending the accelerated failure time model to accomodate random effects, using an estimating equation version of the EM algorithm. While the computational issues are not fully resolved, we discuss several challenges and recent efforts.

This is joint work with Ronghui Xu, Dept of Biostatistics, Harvard School of Public Health.

Reference: Vaida F and Xu R, "Proportional Hazards Model with Random Effects", Statistics in Medicine (2000), pp 3309-3324.

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