Joint Modelling of Accelerated Failure Time and Longitudinal Data

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Abstract

The accelerated failure time (AFT) model is an attractive alternative to the Cox model when the proportionality assumption fails to capture the relation between the survival time and longitudinal covariates. Several complications arise when the covariates are measured intermittently at different time points for different subjects, possibly with measurement errors, or measurements are not available after the failure time. Joint modelling of the failure time and longitudinal data offers a solution to such complications. We explore the joint modeling approach under the AFT assumption when covariates are assumed to follow a linear mixed effects model with measurement errors. The procedure is based on maximizing the joint likelihood function where random effects are treated as missing data. A Monte Carlo EM algorithm is employed to estimate all the unknown parameters, including the unknown baseline hazard function. The performance of the proposed procedure is checked in simulation studies. A case study of reproductive egg-laying data for female Mediterranean fruit flies and their relation to longevity demonstrate the effectiveness of the new procedure.

Key words: EM algorithm; measurement errors; method of sieves; missing data; Monte Carlo integration; random effects; survival data.