A New Approach to Model Longitudinal and Event-Time Data

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Abstract

It has become increasingly common to observe an event time of interest, usually referred to as a survival time, along with baseline and longitudinal covariates. Both the survival and covariate processes are of interest, so is the relationship between them. Due to several complications, traditional approaches, including the partial likelihood approach for the Cox proportional hazards model and rank based approaches for the accelerated failure time model, encounter difficulties when longitudinal covariates are involved in the modeling of survival times. Moreover, the longitudinal processes are often subject to informative dropout. Jointly modeling the survival and longitudinal data emerges as an effective way to overcome these difficulties. So far, attention has focused on Cox models for the survival data. 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 its longitudinal covariates. We illustrate how to implement the joint modeling approach for the AFT survival model, which 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 the unknown parameters, including the unknown baseline hazard function. Both the proportional hazards and AFT models are special cases of a broader class, termed "extended hazard survival model". We will extend the joint modeling approaches to this more general setting, which facilitates model checking and model selection.

The talk is based on joint work with Yi-Kuan Tseng (National Central University).