Survival Analysis of Phase-Type Regression Models

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Abstract

Aalen (1995) has effectively argued for the introduction of phase-type distributions into survival analysis, or equivalently, for the picture of a survival time as the absorption time of a latent Markov chain. We develop new parameterizations of statistical survival-time models obtained as a special class of phase-type distributions, by placing restrictions on the numbers of states, the sets of allowed transitions, and the specification of shared parameters for transition rates. Examples are given, motivated by the multi-hit and multi-stage models for incidence and mortality of cancer and other diseases. Natural formulations of survival regression models are introduced, based on our new models. Parameters in such models can be estimated from right-censored survival data using an EM algorithm approach developed by Asmussen et al. (1996) and Olsson (1996). The analysis of survival data and associated tests of fit using the new models are illustrated on a real dataset.

Keywords: Multi-hit models; Discrete-state Markov chain; Survival regression; Censored data; Goodness of fit.

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