The semiparametric mark-specific proportional hazards model for multivariate marks via a single-index

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Abstract

Competing risk analysis is commonly applied to time-to-event data with finitely many causes of failure. It alters the probability of the occurrence of an event of interest broken down by a specific cause. Motivated by the HIV vaccine efficacy trials, continuous causes-of-failure (marks) have been discussed in the literature. Methodologies have been developed to model for a continuous univariate mark or to study a parametric structure to relate multiple marks with covariates. In this dissertation, we extend the scope of the previous research and explore a semiparametric mark-specific proportional hazards model accommodating a multivariate continuum of marks via a single-index.

In our model, we allow flexible nonlinear interactions between covariates and multiple marks. To avoid the curse of dimensionality, we incorporated multiple marks into a single-index. A profile estimation procedure is introduced. We adopt the local linear smoothing technique for approximating the unknown functions and then utilize the maximum partial likelihood to estimate the unknown parameters. A detailed computational algorithm is derived. The uniform consistency and asymptotically normality of the proposed estimators are established. Furthermore, we evaluate the proposed model and methods in simulations and two HIV vaccine efficacy trials.

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