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Discrete time-to-event data with longitudinal covariates

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Abstract

Survival analysis has been conventionally performed on a continuous time scale. In practice, the survival time is often recorded or handled on a discrete scale; when this is the case, the discrete-time survival analysis would provide analysis results more relevant to the actual data scale. Besides, data on time-dependent covariates in the survival analysis are usually collected through intermittent follow-ups, resulting in the missing and mis-measured covariate data. In this work, we propose the sufficient discrete hazard (SDH) approach to discrete-time survival analysis with longitudinal covariates that are subject to missingness and mismeasurement. The SDH method employs the conditional score idea available for dealing with mis-measured covariates, and the penalized least squares for estimating the missing covariate value using the regression spline basis. The SDH method is developed for the single event analysis with the logistic discrete hazard model, and for the competing risks analysis with the multinomial logit model. Simulation results revel good finite-sample performances of the proposed estimator and the associated asymptotic theory. The proposed SDH method is applied to the scleroderma lung study data, where the time to medication withdrawal and time to death were recorded discretely in months, for illustration

Keyword: Competing risks, Measurement error, Right censored data, Survival analysis