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SEMIPARAMETRIC REVERSED MEAN MODEL FOR RECURRENT EVENT PROCESS WITH INFORMATIVE TERMINAL EVENT

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Abstract: We study semiparametric regression for a recurrent event process with an informative terminal event, where observations are taken only at discrete time points, rather than continuously over time. To account for the effect of a terminal event on the recurrent event process, we propose a semiparametric reversed mean model, for which we develop a two-stage sieve likelihood-based method to estimate the baseline mean function and the covariate effects. Our approach overcomes the computational difficulties arising from the nuisance functional parameter in the assumption that the likelihood is based on a Poisson process. We establish the consistency, convergence rate, and asymptotic normality of the proposed two-stage estimator, which is robust against the assumption of an underlying Poisson process. The proposed method is evaluated using extensive simulation studies, and demonstrated using panel count data from a longitudinal healthy longevity study and data from a bladder tumor study.

Key words and phrases: Counting process, expected log-likelihood, reversed mean model, semiparametric M-estimator, terminal event.

1. Introduction

Panel count data often arise in biomedical research, economics, social sciences, and reliability studies (Thall (1988); Sun and Wei (2000); Hu, Sun and Wei (2003); Wellner and Zhang (2007); Lu, Zhang and Huang (2009); Zhao, Li and Sun (2013)). During the follow-up, observations are taken at finite distinct time points, with researchers collecting the number of recurrent events that occurred between observation times, without information on the exact timing of the events. While both the observation and the follow-up times may vary between subjects, observations may be terminated by a terminal event. Examples of studies based on panel count data include the bladder cancer study conducted by the Veterans Administration Cooperative Urological Research Group (Andrews and Herzberg (1985)) and the Chinese Longitudinal Healthy Longevity Study (CLHLS) (Zeng et al. (2017)). We aim to estimate the mean function of the underlying counting process and make inferences about the factors that affect the event occurrence

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