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In this study, we consider recurrent events of the same type, which are frequently occurring in longitudinal studies and are collected from a group of independent subjects experiencing recurrent events, with the information of time-independent covariates. For the ith subject, $i = 1, \cdots, n$, let $N_i(t)$, $\mathbf{X}_i = (X_{i1}, \cdots, X_{ip})^T$, Y_i and $\{T_{ij}\}_{j=1}^{m_i}$ separately denote the recurrent event process, the $p \times 1$ covariate vector, the minimum value of the censoring time (i.e., the time to the end of follow-up) and the end of study time T_0, and the ordered event times in the time interval $[0, Y_i]$ with m_i being the number of the recurrent events occurring at or prior to Y_i. Generally, the main interest in this type of data is to estimate the occurrence rate function in the target population and to evaluate the effects of possible risk factors on the recurrent event process. In some applications, it is unreasonable to assume the censoring time to be independent of the recurrent event process because each subject's recurrent events could be terminated before or at the end of study by loss to follow-up or informative drop-out. Motivated by an epidemiological example from the AIDS Link to Intravenous Experiences cohort study, Wang, Qin and Chiang (2001) proposed an informative censoring model, which avoids the complexity of modeling the censoring distribution, to model the recurrent event process and the censoring mechanism as below.

(A1) Suppose there exists a nonnegative-valued latent variable Z_i so that, conditioning on $(\mathbf{x}_i, z_i)$, $N_i(t)$ is a non-stationary Poisson process with the subject-specific rate function $\lambda_i(t) = z_i \lambda_0(t) \exp(\boldsymbol{\beta}^T \mathbf{x}_i)$, where the baseline rate function $\lambda_0(t)$ is a continuous function and $\boldsymbol{\beta}$ is a $p \times 1$ parameter vector.

(A2) Conditioning on $(\mathbf{x}_i, z_i)$, $N_i(\cdot)$ is independent of Y_i.

Moreover, the expectation of Z conditioning on $\mathbf{x}$ is reasonably assumed to be 1. Based on the above model with or without using the information of covariates, Chiang and Wang (2002), Wang, Qin and Chiang (2001), and Wang and Chiang (2002) suggested the estimation methods for the baseline rate function $\lambda_0(t)$ and the regression parameters $\boldsymbol{\beta}$. From their works, it was shown that the moments of the estimators are influenced by a latent variable. Thus, the selection of bandwidths and the construction of confidence intervals, which are separately based on the asymptotic mean squared errors and the asymptotic distributions of the estimators, become impractical to directly estimate the unknown quantities in the

moments of the estimators. To overcome these difficulties, we develop a random weighted bootstrap procedure which is simple and fast to implement from a practical point of view, and is at least as accurate as other bootstrap methods. Since the considered estimators involve vectors of observations, the traditional bootstrap methods, such as the naive bootstrap and the wild bootstrap procedures, in this setting are impractically slow in terms of Monte-Carlo simulations. However, in our proposed approach, the weighted bootstrap framework identifies alternative scheme without resampling from the data or generating the bootstrap data from the shape function of the recurrent event times and is markedly superior in terms of practical computational efficiency. One can find that the weighted bootstrap framework discussed here encompasses many of the known bootstrap methods and can be applied to many other similar settings as well. The method which we highlight here can be seen as an extension of the Bayesian bootstrap and Bayesian Bootstrap clones (BBC) discussed in Rubin (1981), Lo (1987, 1991), among others.

In the current status, we have accomplished the following works:

1. We summarize the estimation methods for the baseline rate function $\lambda_0(t)$ and the regression parameters $\boldsymbol{\beta}$.

2. The random weighted bootstrap analogues are proposed and used to approximate the sampling quantities of interest related to the estimators. Based on the behaviors of the proposed random weighted bootstrap estimators, a class of approximated confidence intervals are constructed.

3. The distributional properties of the random weighted bootstrap estimators are derived.

出席國際會議心得報告:

在2003年加州三藩市所舉行之美國統計年會, 吾參與了統計人之年度盛會並報告了此計劃主題之相關成果, 此外, 在此會議其間, 吾與研究合作者有更進一步之討論及作更深入 研究方向之釐定, 並聆聽多場統計精英之最近研究成果分享。對於此類大型國 際會議之參與, 確可增進對不同領域發展之深入瞭解並擴展新視野, 希望爾後有機會參與更多此類型之國際會議。