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Title:REGRESSION ANALYSIS OF CLUSTERED INTERVAL-CENSORED FAILURE TIME DATA

Clustered failure time data occur when the failure times of interest are clustered into small groups or some study subjects are related such as siblings, families, or communities. The subjects from the same cluster or group usually share certain unobserved characteristics and their failure times tend to be correlated as a result. Siblings, for example, share similar genetic and environmental influences. Interval censoring arises when the event of interest cannot be observed directly and is only known to have occurred over a time interval. This is common and natural, for example, in a clinical trial or longitudinal study in which there is a periodic follow-up. For instance, an individual who is monitored weekly for a response may miss visits for a few weeks and return in a changed
response state, thus contributing an interval-censored observation. In this dissertation, we will focus on regression analysis of clustered interval-censored failure time data.

In the first part of this dissertation, we will discuss regression analysis of clustered interval-censored failure time data under a Cox frailty model by employing a sieve estimation procedure. In particular, a two-step algorithm is developed for the regression parameter estimation and the asymptotic properties of the resulting sieve maximum likelihood estimators are established. The finite sample properties of the proposed estimates are investigated through a simulation study and the method is illustrated by the data arising from a lymphatic filariasis study.

The second part of this dissertation proposes an estimating equation-based approach for regression analysis of clustered interval-censored failure time data generated from the additive hazards model. A major advantage of the proposed method is that it does not involve estimation of any baseline hazard function. Both asymptotic and finite sample properties of the proposed estimates of regression parameters are established and the method is illustrated again by the lymphatic filariasis data used above.

Although the proportional hazards model is the most commonly used regression model in survival analysis, it may not provide a good fit to observed failure time and thus a different or more general model is necessary. The last part of the dissertation considers the regression analysis of the same type of data in the context of a class of generalized proportional hazards models, termed linear transformation models. For the inference about the regression parameters, a marginal model approach based on within-cluster resampling method is proposed and its large sample properties are also established. The performance of proposed approach is demonstrated through a simulation study and the lymphatic filariasis study data.