Analysis of Censored Data
IMS Lecture Notes – Monograph Series (1995) Volume 27

Maximum Modified Kernel Likelihood Estimation of the Intensity for a Counting Process

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Abstract

A method which may be called a maximum modified kernel likelihood estimation is introduced to estimate the intensity of the multiplicative intensity model for a counting process. This model can be used in survival analysis under general censoring patterns. The asymoptotic properties of the resulting estimator and the selection of the kernel bandwidth are discussed. Its asymptotic distribution is found to be same as that of Ramlau-Hansen's estimator. From a simulation study, it is seen that the finite sample behaviour of the proposed estimator for the hazard rate with right censored data is better than that of Ramlau-Hansen's estimator.

1. Introduction. The multiplicative intensity model introduced by Aalen (1978) is the statistical model for counting processes for which the stochastic intensity admits the decomposition into a functional deterministic factor $\alpha(t)$ and a predictable stochastic process $Y(t)$. This model has been widely applied to the life history data arising in biomedical studies (see Andersen, Borgan, Gill and Keiding (1993)). Using martingales and stochastic integrals, Aalen (1976,1978) developed nonparametric estimators for certain cumulative intensities.

Ramlau - Hansen (1983) proposed an estimator for the intensity of a counting process by smoothing the martingale estimator (the Nelson-Aalen estimator) of the cumulative intensity. Other methods, analogous to that of density estimation, have been studied for estimation of α. Detailed bibliographic remarks concerning these are given in Andersen et al (1993, p.324). It is known that a nonparametric unconstrained maximum likelihood estimator for α does not exist since the likelihood is unbounded. One of the approaches adopted to overcome this problem, is Grenander's (1981) method of sieves. In this approach the log-likelihood function is maximized over a subset of the parameter space with the subset 'converging' to the parameter