ON THE MAXIMUM LIKELIHOOD ESTIMATION IN CASE 1 INTERVAL RIGHT CENSORED SURVIVAL DATA

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We consider a model of right-censored survival data observed at some fixed or random (observation) time. Let the failure time $T$ be subject to random censoring by a random variable $U$. Right-censored observation consists of the event time $X = T \wedge U$ and the indicator $\delta = 1_{\{T \leq U\}}$. We assume that the event time is not observed exactly, but in a random inspection time $W$. The case 1 interval right-censored observation is given as $(W, \kappa, \kappa \delta)$, where $\kappa = 1_{\{X \leq W\}}$. Note that the indicator $\delta$ is observed only in the case of $\kappa = 1$. The observed data is a sample from the distribution $(W, \kappa, \kappa \delta)$. The current status (or case 1 interval censored) data and the life table data with a single breakpoint are particular cases of the case 1 interval right-censored data we have discussed here, with $U = \infty$ and with $W = w_0$ being a fixed time point, respectively.

Under the independence assumption of $T$, $U$ and $W$ having distribution functions $F$, $G$ and $J$, respectively, we create nonparametric maximum likelihood estimator (NPMLE) from the case 1 interval right-censored data and investigate its asymptotic properties. Unlike the particular case of current status data, the parameter in the likelihood has two infinite-dimensional components $Q(x) = \int_0^x (1 - G) dF$ and $Q^*(x) = \int_0^x (1 - F_\cdot) dG$. The EM-algorithm and the two-step iterative convex minorant (ICM) algorithm to get maximum likelihood estimator for $(Q, Q^*)$ are created. At the last stage we recover the distribution function $F$ from the parameter $(Q, Q^*)$. An alternative three-step nonparametric pseudo-maximum likelihood estimator will be given, too.

We’ll show Hellinger consistency of the NPMLE with the rate of convergence $O_P(n^{-1/3})$, the same as in the particular case of the interval censored data [1], and a simulation study, which display good enough approximation of the true distribution function of failure time by the NPMLE. Several problems with convergence of the EM-algorithm and the ICM-algorithm will be discussed, too.

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References