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Local Asymptotic Normality of Family of Distributions from Incomplete Observations

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In this paper we prove the property of local asymptotic normality of the likelihood ratio statistics in the competing risks model under random censoring by non-observation intervals.

Keywords: competing risks, random censoring, likelihood ratio, local asymptotic normality.

Introduction

The likelihood ratio statistics (LRS) plays an important role in decision theory. For example, while testing a simple hypothesis H_0 against a complicated alternative H_1 with an undefined law of distribution the criteria based on the LRS, according to the Neyman-Pearson lemma, are uniformly more powerful for any size n of observations (see [1, 2]). Here appear some interesting examples when the alternative H_1 depends on n and is close to H_0 , i.e. $H_1 = H_{1n} \rightarrow H_0$ as $n \rightarrow \infty$. In such cases asymptotic properties of the LRS become transparent, which are useful for estimation theory and hypothesis testing. Among them there is the local asymptotic normality (LAN) of LRS. There is a number of papers devoted to investigations of the LAN for LRS and its applications in statistics. The most remarkable works are [2–5], which show that the LAN allows the development of asymptotic theory for most maximum likelihood and Bayesian type estimators and prove the contiguity properties of the family of probability distributions. In the papers [6–11] the properties of the LAN for LRS in the competing risks model (CRM) under random censoring of observations on the right and both sides were established. This paper includes investigations of the LAN for LRS in the CRM under random censoring by non-observation intervals.

1. Competing risks model under random censoring by non-observation intervals

In the CRM it is interesting to investigate a random variable (r.v.) X with values from a measurable space $(\mathcal{X}, \mathcal{B})$ and events $(A^{(1)}, \dots, A^{(k)})$ forming a complete group, where k is fixed. In practice, a r.v. X means, obviously, the survival or reliability time of some object (individual, physical system) exposed to k competing risks and failing in case one of the events $\{A^{(i)}, i = 1, \dots, k\}$. The pairs $\{(X, A^{(i)}), i = 1, \dots, k\}$ denote the time and reason the object fails (see more about the CRM in [6, 12, 13]). During the experiment under homogenous conditions an ensemble $(X, A^{(1)}, \dots, A^{(k)})$ is observed, and we obtain a sequence $\{(X_j, A_j^{(1)}, \dots, A_j^{(k)}), j \geq 1\}$. Let $\delta_j^{(i)} = I(A_j^{(i)})$ be the indicator of the event $A_j^{(i)}$. Every vector $\zeta_j = (X_j, \delta_j^{(1)}, \dots, \delta_j^{(k)})$ induces

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