

CHANGE-POINT MODELS FOR HAZARD FUNCTIONS

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A review is presented of parametric and nonparametric models and corresponding estimation procedures for change-points in hazard functions where the data are possibly subject to random censoring. In particular, we discuss nonparametric models and the application of nonparametric smoothing techniques for change-point estimation and estimation of a hazard function when a change-point is present. Preliminary theoretical results are mentioned and a simulation study provides further insight.

1. Introduction. Change in distribution at an unknown time point arises in quality control problems and has been studied extensively. Another related type of problem is a change-point in a hazard function which may occur in medical follow up studies after a major operation, e.g. bone marrow transplantation. There is usually a high initial risk and then the risk settles down to a lower constant long term risk. A simple mathematical model is the following

MODEL 1: PARAMETRIC CHANGE-POINT MODEL. *The hazard function λ of a failure time variable T is of the form*

$$\lambda(t) = \begin{cases} \lambda_1, & t \leq \tau, \\ \lambda_2, & t > \tau; \end{cases} \quad (1.1)$$

with constants $\lambda_1, \lambda_2 > 0$.

There are three parameters (λ_1, λ_2 and τ) in this model, τ is called the change-point. We refer to this model as the three-parameter change-point model. A short review of the pertinent literature is given in Section 2. In most of the published work to date the mathematical theories were developed

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