

HETEROSCEDASTIC SURVIVAL DATA ANALYSIS WITH ACCELERATED FAILURE TIME MODEL

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Abstract: Recently, the accelerated failure time model has been extended to accommodate heteroscedastic survival data. However, the existing methods often require stringent assumptions or complex algorithms. In this paper, a weighted least squares method is developed based on Laplace approximation for quasi-likelihood subject to conditionally independent censoring. The Laplace approximation is used to approximate the quasi-survival function of the censored observations, which results in simpler and more computationally efficient estimation than the existing methods. The consistency and asymptotic distribution of the resulting estimator are also established. Extensive simulations are conducted to evaluate the performance of the proposed method. Finally, we apply the new proposed method to Stanford heart transplant data and colon cancer data to demonstrate its use in real applications.

Key words and phrases: Heteroscedasticity, Laplace approximation, local polynomial regression.

1. Introduction

Right-censored survival data is the most popular data type in survival analysis. It is characterized by the possibility of censoring time, which refers to observations that terminate before the events of interest can be observed. This may be due to the reasons such as being alive at the end of study, dying from other reasons, or losing contact before the end for various reasons. The Cox model (Cox, 1972) is the most popular model for analyzing such data. However, the accelerated failure time (AFT) model (Wei, Ying and Lin, 1990; Kalbfleisch and Prentice, 2002) provides an attractive alternative, because it directly interprets the effects of covariates on the mean survival time. It was traditionally proposed to handle homoscedastic survival data. Many inference methods have been proposed for the homoscedastic AFT model. Under the strong unconditional independence assumption that survival time and censoring time are unconditionally independent, Koul, Susarla and Van Ryzin (1981), Leurgans (1987), and Fan and Gijbels (1994) proposed to replace the censored observations with synthetic data constructed by inverse weighted probability of censoring distribution. Under a weaker conditional independence assumption (currently

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