ISSN: 1391-8796
Proceedings of 11th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 24, 2024

Parameter estimation in eurvival distribution by using Expectation Maximization (EM) algorithm

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For ages, actuaries, medical officers, and governments have used survival analysis to estimate life expectancies, medical treatment effectiveness, insurance premiums, and annuities. Censored data, the motivating factor for survival analysis, can be thought of as a special case of a more general statistical topic, missing data. Let $X_1, X_2, \ldots, X_n$ be the failure data from some absolutely continuous distribution function $F(t, \theta)$; where t is the time, and let $Y_1, Y_2, \ldots, Y_n$ be the censored data from some distribution function $G(t)$. We further assume that two samples are mutually independent. In this study, we consider the right censoring data $(Z_1, \delta_1), (Z_2, \delta_2), \ldots, (Z_n, \delta_n)$, where $Z_i = min(X_i, Y_i)$ and $\delta_i = I(X_i < Y_i)$ and $I(.)$ is the indicator function, and explain how to estimate the unknown parameter θ of relevant distribution, and hence obtained the parametric estimator for the survival distribution. In this study, we used the EM algorithm to estimate the unknown parameter θ because the EM algorithm is efficient for handling missing data. We conducted all simulation studies by using R software. In the simulations study, survival data are generated by using a one-parameter Exponential distribution and then a two-parameter Weibull distribution. In both cases, we compared the obtained parametric survival distributions with the nonparametric version, the Kaplan-Meier estimator. The results obtained by the three methods: Maximum likelihood method, Expectation Maximization algorithm, and Kaplan-Meier estimator, were the same. So, we can conclude that both estimation methods are suitable for parameter estimation in survival analysis.

Keywords: Censored data, Expectation Maximization, Kaplan-Meier, Survival Analysis

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