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Maximum Likelihood Estimation Methods on a Two-Parameter Rayleigh Distribution under Progressive Type-Ii Censoring

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Abstract : Data from economic, social, clinical, and industrial studies are in some way incomplete or incorrect due to censoring. Such data may have adverse effects if used in the estimation problem. We propose the use of Maximum Likelihood Estimation (MLE) under a progressive type-II censoring scheme to remedy this problem. In particular, maximum likelihood estimates (MLEs) for the location (μ) and scale (λ) parameters of two Parameter Rayleigh distribution are realized under a progressive type-II censoring scheme using the Expectation-Maximization (EM) and the Newton-Raphson (NR) algorithms. These algorithms are used comparatively because they iteratively produce satisfactory results in the estimation problem. The progressively type-II censoring scheme is used because it allows the removal of test units before the termination of the experiment. Approximate asymptotic variances and confidence intervals for the location and scale parameters are derived/constructed. The efficiency of EM and the NR algorithms is compared given root mean squared error (RMSE), bias, and the coverage rate. The simulation study showed that in most sets of simulation cases, the estimates obtained using the Expectation-maximization algorithm had small biases, small variances, narrower/small confidence intervals width, and small root of mean squared error compared to those generated via the Newton-Raphson (NR) algorithm. Further, the analysis of a real-life data set (data from simple experimental trials) showed that the Expectation-Maximization (EM) algorithm performs better compared to Newton-Raphson (NR) algorithm in all simulation cases under the progressive type-II censoring scheme.

Keywords : expectation-maximization algorithm, maximum likelihood estimation, Newton-Raphson method, two-parameter Rayleigh distribution, progressive type-II censoring
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