Classic and Bayes Shrinkage Estimation in Rayleigh Distribution Using a Point Guess Based on Censored Data

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Extended Abstract

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Introduction

In classical methods of statistics, the parameter of interest is estimated based on a random sample using natural estimators such as maximum likelihood or unbiased estimators (sample information). In practice, the researcher has a prior information about the parameter in the form of a point guess value. Information in the guess value is called as nonsample information. Thompson (1968) proposed a shrinkage estimator by combining sample and nonsample information which is a linear combination of a natural estimator and the guess value.

The best linear unbiased estimator and it's risk is computed under the considered loss function. Shrinkage testimators are proposed based on the acceptance or rejection of a null hypothesis of the form equality or guess value and the true value of the parameter and their risks are computed. The relative efficiency of shrinkage testimators and the best linear unbiased estimator is calculated for the comparison of them. In Bayesian approaches, a Bayes estimator is derived by employing a flexible prior distribution for the parameter of interest. A Bayesian shrinkage estimator is provided using a Bayesian shrinkage approach and its performance is compared with the best linear unbiased estimator via the relative efficiency of them. Finally, a numerical example is used for illustrating the results.

Results and discusion

The results show that the shrinkage testimators have higher efficiency than the best linear estimator when the guess value is close to the true value of the parameter. Our findings show that the Bayes shrinkage estimator outperforms the best linear estimator if the prior point information about the value of the parameter is not too far from its true value. Moreover, the Bayes shrinkage estimator performs well with respect to the best linear estimator for guess value in the vicinity of true value. In this case, the Bayes shrinkage estimators with larger values of hyperparameters outperforms other estimators in neighborhood guess value, when other parameters held fixed.

Conclusion

In this paper, some shrinkage testimators and a Bayes shrinkage estimator are proposed for the scale parameter of Rayleigh lifetime distribution based on censored samples under a scale invariant squared error loss function. The following conclusions were drawn from this research:
- The shrinkage testimators are better than the best linear estimator for guess value in neighborhood of true value of parameter. Moreover, the first proposed shrinkage testimator

have higher efficiency than other testimators for small sample size when the guess value is close to the true value of the parameter.

- The proposed Bayes shrinkage estimator performs well with respect to the best linear estimator for guess value in the vicinity of true value. Also, the Bayes shrinkage estimators with larger values of hyperparameters outperforms other estimators in neighborhood guess value, when other parameters held fixed

Keywords and phrases: Shrinkage estimator; Scale invariant squared error loss function ; Rayleigh distribution.

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