Classification Procedures for Exponential Populations under Restrictions on Parameters

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We consider procedures for classification of an observation into one of two (or more) exponential populations when there are restrictions on parameters. First we consider two exponential populations with ordered scale parameters. Here minimum guarantee time is assumed to be zero. A class of classification rules is proposed based on mixed estimators for scale parameters. Our study shows that each classification rule in this class is better than the standard likelihood ratio based classification rule. Comparison of these classification rules with respect to the correct probability of classification has been done by extensive simulations.

Next two-parameter exponential populations are considered. We study classification procedures assuming a known ordering between population parameters. We propose classification rules when either location or scale parameters are ordered. Some of these classification rules under ordering are better than usual classification rules with respect to the expected probability of correct classification. We also derive likelihood ratio-based classification rules. Comparison of these classification rules has been done using Monte Carlo simulations.

When we have several two-parameter exponential populations, a commonly used model assumes common location (minimum guarantee time). First, we consider the estimation of scale parameters when an isotonic ordering among the scale parameters is present. We show the superiority of a class of mixed estimators over the maximum likelihood estimators of scale parameters under a scale invariant loss function. Bayes and generalized Bayes estimates of scale parameters are obtained assuming proper and improper prior distributions, respectively. As an application of these new estimators, we have considered the problem of classifying an observation into one of k populations under order restrictions on scale parameters. Classification rules are proposed based on mixed estimators. We also derive plug-in Bayes classification rules and likelihood ratio-based classification rules. Extensive simulations are performed to compare these rules with respect to the expected probability of correct classification. An application of the classification rules is done on a real data set.