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RECENT ADVANCES ON THE AREA UNDER THE ROC CURVE OF A DIAGNOSTIC TEST WITH SMALL SAMPLES

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Diagnostic tests are often used to distinguish between diseased and non-diseased patients. When the response of a diagnostic test is continuous, the most popular summary measure for its performance, is the area under the ROC curve (AUC), based on the sensitivity and the complement to specificity at different cut-off points of the range of possible test values. Parametric inference about AUC has been discussed under various distributional assumptions (see e. g. Kotz et al., 2003). One important statistical problem with the study of AUC is interval estimation. Estimation for confidence intervals is usually based on the likelihood function, which can be inaccurate when the sample size is small, in particular in presence of many unknown parameters (Obuchowski and Lieber, 1998).
In this work, a high-order likelihood based inference procedure for AUC is discussed, which provides more precise inferences than one given by standard theory (Brazzale et al., 2007). The proposed procedure is quite general and it is applicable to complete data as well as to right censored data.
The usefulness and the advantages of the proposed method are illustrated assuming different distributions within the exponential family. In regard of this, two real-life examples with small sample size are considered. The first data set concerns results of different diagnostic tests for measuring the diameter of the abdominal aorta. A second analysis was performed on data about silica levels in lung tissue, detected by an environmental scanning electron microscopy, in subjects with and without lung cancer.

These data show how the proposed methodology is easy to apply and gives extremely accurate results both with small and moderate sample sizes.

References

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