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Power robustification of approximately linear tests. (English) Zbl 0843.62053

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Summary: We present a general method of improving the power of linear and approximately linear tests when deviations from a translation family of distributions must be taken into account. This method involves the combination of a linear statistic measuring location and a quadratic statistic measuring change of shape of the underlying distribution. The tests ("funnel tests") are constructed as certain Bayes tests. In general they gain a sizeable amount of power over the linear tests adapted to the translation family when a change of shape of the underlying distribution occurs, while losing little for translation alternatives ("power robustification").

We introduce the concept of funnel tests in a Gaussian framework first. The effect of power robustification is studied by means of a power function expansion, which applies to a large class of tests sharing a certain invariance property. The funnel tests are characterized by a maximin property over a region defined by a rotational cone. The idea of the construction is then carried over to a finite sample situation where the Gaussian model is used as an approximation. As a particular application, we construct power-robustified nonlinear rank tests in the standard two-sample situation. A simulation study demonstrates the good overall performance of these tests as compared to other nonlinear tests.

MSC:

62G10 Nonparametric hypothesis testing
62F15 Bayesian inference
62F03 Parametric hypothesis testing

Keywords:

conical alternatives; dimensional asymptotics; Hellinger geometry; location-shape alternatives; omnibus test; power comparison; approximately linear tests; linear statistic; location; quadratic statistic; change of shape; Bayes tests; linear tests; translation family; funnel tests; power robustification; power function expansion; invariance; maximin property; rotational cone; Gaussian model; nonlinear rank tests; two-sample situation; simulation study

Full Text: DOI