The probability of type I and type II errors in imprecise hypothesis testing

Ingo Neumann and Hansjörg Kutterer

Geodetic Institute, Leibniz University of Hannover
Nienburger Strasse 1, D-30167 Hannover, Germany
[neumann, kutterer]@gih.uni-hannover.de

Abstract

In many engineering disciplines the interesting model parameters are estimated from a large number of heterogeneous and redundant observations by a least-squares adjustment. The significance of the model parameters and the model selection itself are checked with statistical hypothesis tests. After formulating a null hypothesis, the test decision is based on the comparison of a test value with a quantile value. The acceptance and the rejection of the null hypothesis are strongly related with two types of errors. A type I error occurs if the null hypothesis is rejected, although it is true. A type II error occurs if the null hypothesis is accepted, although it is false. This procedure is well known in case of only random errors for the observations.

If the uncertainty budget of the observations is assumed to comprise both random variability (probabilistic errors) and imprecision (interval errors), the classical test strategies have to be extended accordingly. In this study we focus on the relation of imprecision and the probability of type I and type II errors. These steps are based on newly developed one- and multidimensional hypothesis tests in case of imprecise data (see, [1], [2] and [3]). The applied procedure is outlined in detail showing both theory and one numerical example for the parameterization of a monitoring network. Its main benefit is an improved interpretation of the influence of imprecision in model selection and significance tests.

References

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