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A Robust Test for Detecting a Signal
in a High Dimensional Sparse Normal Vector

Abstract

Let Z_i, $i = 1, ..., n$, be independent random variables, $E(Z_i) = \mu_i$, and $Var(Z_i) = 1$. We consider the problem of testing $H_0 : \mu_i = 0, i = 1, ..., n$, when n is large, and the vector $(\mu_1, ..., \mu_n)$ is 'sparse'. We suggest a robust test which is not sensitive to the exact tail behavior implied under normality assumptions. In particular, our test is 'robust' if the 'moderate deviation' tail of the distribution of Z_i may be represented as the product of a tail of a standard normal and a 'slowly changing' function. This implies that whenever an Anderson-Darling type of test is robust, our proposed test is also 'robust'. We provide examples and simulation evidence to demonstrate the robustness of our proposed test and the need for such robust tests. We also present a real data example highlighting the importance of robustness.

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