SMART: Simultaneous Multistage Adaptive Ranking and Thresholding for Sparse Signal Recovery

by

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Abstract

Multistage design provides a cost-effective way to glean significance from data by adaptively reducing a large set of variables to a much smaller set in a sequential manner. By allocating sensing resources adaptively according to the estimated supersets of the signal support, one can eliminate null locations and localize signals more effectively. We formulate a decision theoretical framework for simultaneous multi-stage adaptive testing and study how to minimize the total number of measurements while meeting pre-specified constraints on both the false discovery rate (FDR) and missed discovery rate (MDR). The new procedure, which effectively pools information from all stage-wise tests using a simultaneous multistage adaptive ranking and thresholding (SMART) scheme, and can greatly reduce the approximation errors in individual SPRTs and leads to savings in total sensing costs. We show that SMART is valid for FDR and MDR control, and achieves the information-theoretic lower bounds. Numerical studies show that SMART outperforms existing methods in power. The method is demonstrated through the analysis of spatial imaging data.

All interested are welcome!
For details, please contact ISOM Department.