Smart Estimation in High-Dimensional Sparse Settings

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Abstract

In this talk, we address estimation and prediction problems in regression models where the coefficients may be constrained to lie in a candidate subspace, considering both low- and high-dimensional settings. We propose a class of penalized, pretest, and shrinkage estimators, and establish their large-sample properties through the analysis of asymptotic distributional quadratic bias and risk.

Monte Carlo simulations are conducted to support the theoretical results and to assess the finite-sample performance of the proposed methods. In addition, real data applications-including comparisons with standard penalized techniques and machine learning-based approaches-illustrate the practical advantages of our methodology.

Our proposed strategies consistently outperform competing methods over meaningful regions of the parameter space induced by commonly assumed sparsity structures. Moreover, they continue to perform well even when the sparsity assumption is substantially violated, providing strong evidence of their robustness.