Optimal Shrinkage Estimator for High Dimensional Mean Vector

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In this paper we derive the optimal linear shrinkage estimator for the large dimensional mean vector using the random matrix theory. We concentrate on the case when both the dimension p and the sample size n tend to infinity such that their ratio tends to a constant $c \in (0, +\infty)$. Using weak assumptions on the underlying distribution we find the asymptotic equivalents of the optimal shrinkage intensities and estimate them consistently. The obtained non-parametric estimator is of simple structure and is proven to minimize asymptotically the quadratic loss with probability 1 in the case $c \in (0, 1)$. In the case $c \in (1, +\infty)$ we improve the derived estimator by setting the feasible estimator for the precision covariance matrix. At the end, an exhaustive simulation study is provided, where the proposed estimator is compared with known benchmarks from the literature.