Asymptotically optimal linear bias corrections in minimum mean square error estimation

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Abstract

We investigate the class of bias corrections given by affine functions of parameter estimators minimizing the mean square error (MSE) in a general linear model. We consider both linear minimum MSE estimators in a Bayesian setting as well as linear unbiased minimum variance estimators that are given as a function of the population covariance matrix of the observation.

In principle, naive methods based on simple scaling and leading to an optimal correction factor that depends upon the population covariance matrix are not realizable if the latter is unknown. We concentrate on the set of solutions relying on directly replacing the covariance matrix with its sample covariance matrix estimator. By resorting to some recent results from random matrix theory, we derive a family of realizable estimators that are asymptotically optimal under a general asymptotic regime considering high dimensional observations and relatively small sample-sizes.

Keywords

Linear estimation, Bias correction, Sample covariance matrix, Random matrix theory.