Shrinkage Estimation of Large Covariance Matrices: Keep It Simple, Statistician?

A seminar by Michael Wolf (University of Zurich)

Thursday 29 September 2022 | 12:00 pm
Room U7-14, building U7 Civitas, University of Milano-Bicocca

Under rotation-equivariant decision theory, sample covariance matrix eigenvalues can be optimally shrunk by recombining sample eigenvectors with a (potentially nonlinear) function of the unobservable population covariance matrix. The optimal shape of this function reflects the loss/risk that is to be minimized. We solve the problem of optimal covariance matrix estimation under a variety of loss functions motivated by statistical precedent, probability theory, and differential geometry. A key ingredient of our nonlinear shrinkage methodology is a new estimator of the angle between sample and population eigenvectors, without making strong assumptions on the population eigenvalues. We also introduce a broad family of covariance matrix estimators that can handle all regular functional transformations of the population covariance matrix under large-dimensional asymptotics. In addition, we compare via Monte Carlo simulations our methodology to two simpler ones from the literature, linear shrinkage and shrinkage based on the spiked covariance model.

DEMS Statistics Seminar series, Department of Economics, Management and Statistics, University of Milano-Bicocca.
The seminar will not be recorded nor streamed online.

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