Mathematics > Statistics Theory

Geometric sensitivity of random matrix results: consequences for shrinkage estimators of covariance and related statistical methods

Noureddine El Karoui, Holger Koesters

(Submitted on 7 May 2011)

Shrinkage estimators of covariance are an important tool in modern applied and theoretical statistics. They play a key role in regularized estimation problems, such as ridge regression (aka Tykhonov regularization), regularized discriminant analysis and a variety of optimization problems.
In this paper, we bring to bear the tools of random matrix theory to understand their behavior, and in particular, that of quadratic forms involving inverses of those estimators, which are important in practice.
We use very mild assumptions compared to the usual assumptions made in random matrix theory, requiring only mild conditions on the moments of linear and quadratic forms in our random vectors. In particular, we show that our results apply for instance to log-normal data, which are of interest in financial applications.
Our study highlights the relative sensitivity of random matrix results (and their practical consequences) to geometric assumptions which are often implicitly made by random matrix theorists and may not be relevant in data analytic practice.

Comments:	68 pages
Subjects:	**Statistics Theory (math.ST)**
Cite as:	**arXiv:1105.1404 [math.ST]**
	(or **arXiv:1105.1404v1 [math.ST]** for this version)

Submission history

From: Noureddine El Karoui [view email]
[v1] Sat, 7 May 2011 00:40:03 GMT (61kb)

Which authors of this paper are endorsers?