On Robust Estimation and Random Matrix Theories applied to Signal and Image Processing

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Résumé

This talk deals with general problems of covariance matrix estimation with applications in signal and image processing. Under the widely used Gaussian assumption, the Sample Covariance Matrix (SCM) estimate provides optimal results in terms of estimation performance. However, when the observations turn to be non-Gaussian, the resulting performance of the SCM can be strongly degraded. To fill this gap, the general framework of the Robust Estimation Theory is introduced, with a particular focus on the Complex Elliptically Symmetric (CES) distributions and robust covariance matrix estimates. Performance analysis is provided in details using several approaches, notably a comparison with the SCM ones. Then, recent results of the robust estimates performance are applied to radar detection as well as to Direction-Of-Arrival estimation. The second part of the presentation is devoted to the generalization of classical results on robust estimation in the context of Random Matrix Theory in a large dimensional regime, i.e. where both the number of observations and their dimension tends to infinity at the same rate. Particularly, the performance improvement will be shown on signal processing applications.

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