A Subspace Estimator for Fixed Rank Perturbations of Large Random Matrices

Walid Hachem (LTCI), Philippe Loubaton (LIGM), X. Mestre (CTTC), Jamal Najim (LTCI), Pascal Vallet (LIGM)

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This paper deals with the problem of parameter estimation based on certain eigenspaces of the empirical covariance matrix of an observed multidimensional time series, in the case where the time series dimension and the observation window grow to infinity at the same pace. In the area of large random matrix theory, recent contributions studied the behavior of the extreme eigenvalues of a random matrix and their associated eigenspaces when this matrix is subject to a fixed-rank perturbation. The present work is concerned with the situation where the parameters to be estimated determine the eigenspace structure of a certain fixed-rank perturbation of the empirical covariance matrix. An estimation algorithm in the spirit of the well-known MUSIC algorithm for parameter estimation is developed. It relies on an approach recently developed by Benaych-Georges and Nadakuditi, relating the eigenspaces of extreme eigenvalues of the empirical covariance matrix with eigenspaces of the perturbation matrix. First and second order analyses of the new algorithm are performed.

Comments:	Assumption A6 has been modified (the speed of convergence of the matrix S*S to its limit must be controlled). Proof of Proposition 3 has been added accordingly. This article is accepted for publication in Journal of Multivariate Analysis
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