Estimation of superimposed complex exponentials using covariance matching and sparsity

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Abstract

The inferencial problem of estimating superimposed complex exponentials in general linear models is an old problem that plays a key role in multiple fields such as seismics, medical diagnosis, array signal processing, etc. Recent works based on sparse representations show promising results that outperform traditional subspace methods.

A new algorithm based on a covariance-matching approach that preserves sparsity is derived. The method considers a covariance matrix model based on an overcomplete basis representation that tries to fit the variance of the unknown parameters to the sample covariance estimate. Sparsity is enforced by means of an l_1-norm penalty term. The problem is reduced to an objective function that can be solved efficiently using the LARS/homotopy algorithm subject to a positive constraint. The algorithm proceeds in an iterative fashion solving small linear systems of equations until a stopping criterion is fulfilled.

Keywords

Sparse signal representation, Least absolute shrinkage and selection operator, Overcomplete basis, Least angle regression and selection.