

Sparse Source Separation from Orthogonal Mixtures

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Abstract

This paper addresses source separation from a linear mixture under two assumptions: source sparsity and orthogonality of the mixing matrix. We propose efficient sparse separation via a two-stage process. In the first stage we attempt to recover the sparsity pattern of the sources by exploiting the orthogonality prior. In the second stage, the support is used to reformulate the recovery task as an optimization problem. We then suggest a solution based on alternating minimization. Random simulations are performed to analyze the behavior of the resulting algorithm. The simulations demonstrate convergence of our approach as well as superior recovery rate in comparison with alternative source separation methods and K-SVD, a leading algorithm in dictionary learning.

I. INTRODUCTION

Blind source separation (BSS) is a fundamental problem in data analysis where the goal is to recover a set of source signals from their linear mixture, typically in the presence of noise. The blind aspect refers to the lack of prior information about the exact mixture coefficients or source values. A BSS problem is ill-posed unless additional source properties are assumed, *e.g.*, statistical independence or an underlying deterministic structure. In sparse component analysis (SCA), only a few (active) sources contribute to each measurement. Mathematically, a vector $\mathbf{s}(t)$ of n sources is constrained to have only K non-zero entries per each time instant t . The linear mixture model is described by

$$\mathbf{x}(t) = \mathbf{\Psi}\mathbf{s}(t) + \mathbf{n}(t), \quad t = 0, 1, \dots, T-1, \quad (1)$$

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