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Nasser Mourad, James P. Reilly, T. Kirubarajan

www.elsevier.com/locate/sigpro

PII: S0165-1684(16)30199-2
DOI: http://dx.doi.org/10.1016/j.sigpro.2016.08.015
Reference: SIGPRO6242

To appear in: *Signal Processing*

Received date: 17 December 2014
Revised date: 23 June 2016
Accepted date: 10 August 2016

Cite this article as: Nasser Mourad, James P. Reilly and T. Kirubarajan, Majorization–Minimization for Blind Source Separation of Sparse Sources *Signal Processing,* http://dx.doi.org/10.1016/j.sigpro.2016.08.015

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Nasser Mourad[1,3], James P. Reilly[2], and T. Kirubarajan[2]

[1] Department of Electrical Engineering, Aswan Faculty of Engineering,
Aswan University, Aswan 81542, EGYPT.

[2] Department of Electrical and Computer Engineering
McMaster University, Hamilton, On., CANADA L8S 4K1.

[3] Department of Electrical Engineering, College of Engineering & Information Technology,
Buraydah Colleges, Al-Qassim 31717, SAUDI ARABIA.

Abstract

In this paper we propose the Majorization–Minimization Blind Spare Source Separation (MM-BSSS) algorithm for solving the blind source separation (BSS) problem when the source signals are known *a priori* to be sparse, or can be sparsely represented in some dictionary. The algorithm capitalizes on a previous result in [24] that shows certain classes of nonconvex functions perform better than the convex ℓ_1-norm in measuring sparsity of a signal. In this paper we propose a majorization–minimization (MM) method for minimizing such a nonconvex objective function. The method can be simplified by choosing the non–convex function to be separable. In this paper we employ a previously–developed technique [26] for constructing the MM surrogate function, which reduces the sparse BSS problem to an iterative computation of the minor eigenvectors of particular covariance matrices. These features permit a computationally efficient implementation. The proposed algorithm enjoys several advantages such as robustness to noise and the ability to estimate the number of source signals. Numerical results show that the proposed algorithm outperforms other well–known algorithms that solve the same problem.

keywords: Blind source separation, Compressed sensing, Majorization–Minimization, Optimization.

I. Introduction

The blind source separation (BSS) problem has been studied extensively over the past decades, with a wide range of potential applications including those in biomedical engineering, sonar, radar, geophysical data processing, data mining, speech analysis, image recognition [1]–[4]. The BSS problem deals with reconstructing n *unknown* source signals from m linear combinations of the sources when the mixing matrix is *unknown*. The relation between the measured signals and the original source signals can be