International Journal of Innovative
Computing, Information and Control
Volume **5**, Number **11(A)**, November **2009**

ICIC International ©2009 ISSN 1349-4198
pp. **3677–3690**

A PDF-MATCHED SHORT-TERM LINEAR PREDICTABILITY APPROACH TO BLIND SOURCE SEPARATION

Mahdi Khosravy*, Mohammad Reza Asharif*,[1]
and Katsumi Yamashita**

*Faculty of Engineering
University of the Ryukyus
1 Senbaru, Nishihara, Okinawa 903-0213, Japan
k078661@eve.u-ryukyu.ac.jp; asharif@ie.u-ryukyu.ac.jp

**Graduate School of Engineering
Osaka Prefecture University
1-1 Gakuen-cho, Sakai, Osaka, Japan
yamashita@eis.osakafu-u.ac.jp

Received July 2008; revised December 2008

Abstract. *This paper presents a PDF-matched measure of short-term linear predictability of signal as a merit function for blind sources separation (BSS) of linearly mixed signals/images. BSS based on the proposed merit function (PSLP-BSS) achieves both high separation performance and low computational complexity. Despite the conventional predictability measurement, the proposed one does not need any long-term predictor, and it achieves 50.5 times less computational complexity by utilizing only short-term linear (STL) predictors. Furthermore, PSLP-BSS not only recovers signals with maximized predictability, but also increases non-gaussianity that concludes more independent recovered signals. This is because the coefficients of STL predictors are chosen in an objective probabilistic algorithm based on an assumed high kurtosis PDF for source signals. Source signals are recovered by finding an un-mixing matrix that maximizes the proposed measure of short-term predictability for each extracted signal. The un-mixing matrix can be obtained as the solution to a generalized eigenvalue problem, and signals can be extracted simultaneously using the fast eigenvalue routine. The dominance of PSLP-BSS to conventional one has been demonstrated by many tests performed over artificial mixtures of audio signals (music and speech) and artificial mixtures of gray-scale images.*
Keywords: Blind source separation, Gaussianity, Gradient ascent, Eigenvalue routine, Kurtosis, Predictability, Short term linear (STL) predictors

1. **Introduction.** Blind Source Separation (BSS) [1,2] that is separation of blind sources from mixed observed data is a fundamental signal processing problem, which a lot of its promising applications can already be found in processing of communication signals [3,4] and biomedical signals [5,6], image processing [7,8], financial problems [9,10], reflection canceling [11], fruit ripeness detection [12], etc. Blind means that, the source signals are not observed and also no information is available about the mixture. The solution to BSS is based on the realistic assumption as its basic principle that different physical mixing processes generate signals with different properties from source signals. Generally, BSS methods look for a separation matrix which minimizes the mixing effect on some signals properties. The desired signal properties which are measured by a merit function depend on the BSS method.

[1]Also, Adjunct Professor at School of Electrical and Computer Engineering, University of Tehran.