

短文与研究通讯

一种基于四阶循环累积量的盲源分离方法

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摘要:

盲源分离是指在无源信号任何先验知识的情况下, 只根据多个接收机的观测信号实现对源信号的恢复。本文基于四阶循环累积量提出了一种简单易行的循环平稳信号的盲源分离方法。针对两个信号混合的情况, 该方法首先对观测矩阵进行循环白化, 使得观测矩阵的循环自相关阵为单位阵, 这样分离矩阵变为酉阵, 可用单个参数来表示。之后运用循环统计量的性质找到一个评判函数, 求得该参数的最佳值从而确定分离矩阵。本文对BPSK信号和AM信号混合的情况分别进行了仿真实验, 通过信号分离的直观图、参数选择以及串音误差的分析表明该方法的有效性, 并将其与自然梯度算法, 循环自然梯度算法做了比较, 表明本算法的优势, 尤其是在AM信号的分离中更是如此。文章最后讨论了算法的运行时间。

关键词: 循环累积量 循环平稳信号 盲源分离

A Blind Source Separation Method based on the Fourth-order Cyclic Cumulant

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Abstract:

Blind source separation is how to recover a set of signals from a set of their observations coming to multi-sensors, without any prior knowledge of sources. In this paper, a simple blind source separation method of cyclostationary signals based on the properties of forth-order cyclic cumulant is proposed. In the case of two mixed cyclostationary signals, firstly the observed signal matrix is cyclic whitened in order to change the cyclic autocorrelation matrix to a unit matrix. Thus the separation matrix is turned into a unitary, which can be described by one parameter. Then the optimal value of this parameter can be achieved by the judge function based on the characteristic of cyclic statistics, through which the separating matrix can be determined. This paper makes simulations of mixed BPSK signal and AM signal separately, and the analysis of the result figure of the signal separation, parameter determining and crosstalk error show the effectiveness of the proposed method. Besides, the proposed method is compared with natural gradient algorithm and cyclostationary natural gradient algorithm, and shows great advantages specially in the case of AM signals. At last, the run time of the proposed method is discussed.

Keywords: cyclic cumulant cyclostationary signals blind source separation

收稿日期 2011-03-31 修回日期 2011-08-14 网络版发布日期 2011-09-25

DOI:

基金项目:

国家自然科学基金资助项目(60872122)

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