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论文

非正交联合对角化盲分离算法的可辨识性研究

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摘要
该文从非正交联合对角化的唯一性条件出发，研究了盲分离算法的可辨识性问题。由接收信号的二阶统计量和高阶累积量分别组成的目标矩阵具有可对角化的结构，因此可以用非正交联合对角化的方法解决盲分离问题。指出非正交联合对角化的唯一存在条件是：由对角矩阵中相同位置的对角元素所组成的向量两两线性无关。从该条件出发推导出基于二阶统计量的非正交联合对角化算法实现盲分离的充分必要条件是源信号自相关函数的形状不同，基于高阶累积量的算法实现盲分离的充分必要条件是源信号中没有高斯信号，从而为运用非正交联合对角化解决盲分离问题提供了理论指导。数值仿真试验验证了结论的正确性。

关键词 信号处理 盲信源分离 联合对角化 可辨识性 唯一存在条件 高阶累积量

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A Study of Identifiability for Blind Signal Separation via Nonorthogonal Joint Diagonalization

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Abstract
Based on the uniqueness condition of the solution of Nonorthogonal Joint Diagonalization (NJD), the identifiability for Blind Signal Separation (BSS) is analyzed. Firstly, it is proved that the target matrices consisting of Second-Order Statistics (SOS) or higher-order cumulant are diagonalizable, so the problem of BSS can be solved by NJD. The uniqueness condition for NJD is that the vectors consisting of diagonal elements in the same position of diagonal matrix are pairwise linearly independent. From this proposition，the necessary and sufficient condition for BSS is deduced. For second-order statistics based BSS, the condition is that the source signals have not the identical autocorrelation shape. For higher-order cumulant, there is not Gaussian signal in sources. The above conclusion provides a mathematical foundation for the BSS methods based on the NJD. Numerical simulations confirm the conclusion in this paper.

Key words Signal processing Blind Signal Separation (BSS) Joint diagonalization Identifiability Uniqueness condition Higher-order cumulant

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