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论文

利用奇异值分解的鲁棒盲信源分离

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摘要：

利用Amari等提出的估计函数分析了在最小化非线性主分量标准的意义上分离矩阵的最优解，将其描述为归一化的输入与非线性输出的互相关，提出了一种采用奇异值分解的鲁棒盲信源分离方法．该方法将分离矩阵的估计解释为一种非线性的能量迭代问题．在求解过程中对能量项进行了奇异值分解，从而避免了归一化矩阵的求逆以及计算平方根问题，减小了运算量．由于使用了能量项的正定逆平方根来归一化分离矩阵，因此提高了算法的鲁棒性，并且在每一步迭代中都能使分离矩阵保持正交．实验仿真验证了算法的性能．

关键词： 盲信源分离 奇异值分解 非线性能量迭代 预白化

SVD based robust approach for blind source separation

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Abstract:

From the point of view of the estimating function proposed by Amari, we investigate the intrinsic characteristics of the optimal separating matrix for blind source separation (BSS) in the sense of minimizing nonlinear principal component analysis criterion, which formulates the optimal solution as the normalized cross correlation between the input and nonlinearized output. We thus present a singular value decomposition (SVD) based robust scheme for BSS, which considers the estimating procedure of the separating matrix as a nonlinear power iteration problem. By performing SVD of the power term, the computational load can be significantly reduced, which results from circumventing the difficulty of solving the inverse square root of the normalization term. Since the separating matrix is properly normalized by the positive definite inverse square root of the power term, the robustness of this algorithm is greatly improved. Moreover, this guarantees the orthonormality of the separating matrix at each iteration. Some simulation results are also provided to demonstrate the performance of the proposed algorithm.

Keywords: blind source separation (BSS) singular value decomposition (SVD) nonlinear power iteration (NPI) pre-whitening

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