电子与信息学报 2009 31 (9): 2274-2277 ISSN: 1009-5896 CN: 11-4494/TN

研究简报

基于负熵准则的FastICA盲多用户检测的研究

杨家轩,贾传荧,史国友, 冯锡炜

大连海事大学航海学院 大连 116026

收稿日期 2008-10-20 修回日期 2009-4-2 网络版发布日期 2009-9-2 接受日期

摘要
该文给出了一种基于负熵准则的FastICA盲多用户检测方法。修改了FastICA算法中的非2次函数，引入4次幂函数，把基于负熵的非高斯性测度转化为信号峰度的形式，这样降低了计算量。同时，算法充分考虑了各个用户信号的统计独立性，在下行链路干扰用户的扩频码未知情况下，把目标用户的扩频码作为训练序列，并用于初始化FastICA算法的分离向量，使用随机梯度法进行优化计算，能够获得优异的符号估计性能。对算法的计算复杂度的分析可以看出，计算量随着接收数据长度和用户数的增加而增加。通过与传统匹配滤波器，MMSE检测算法比较，表明在同步CDMA信道中，MAI较低时算法检测性能与MMSE检测器的性能接近，随着MAI增加，算法的性能明显优于MMSE算法。

关键词 盲多用户检测 独立分量分析 CDMA系统 峰度

分类号 TN911.23

Research on FastICA Blind Multi-user Detection Based on Negentropy

Yang Jia-xuan, Jia Chuan-ying, Shi Guo-you, Feng Xi-wei

Navigation College, Dalian Maritime University, Dalian 116026, China

Abstract
A FastICA blind multi-user detection algorithm based on negentropy is proposed, which is based on independent component analysis combined with CDMA receiver in this paper. The non-quadratic function in FastICA algorithm is revised as function with power 4, therefore, based negentropy non-Gaussianity measurement can be transformed into kurtosis form, which could decrease the computational complexity. Meanwhile, by exploiting the independence of the source signals of different users and utilizing spreading codes of target user as training sequence and initialization of unmixing matrix, excellent symbol estimation performance are obtained through stochastic gradient method while the codes of the interfering users in downlink are unknown. Analysis for computational complexity of algorithm shows that computational complexity increases with length of receiving data and number of users. In this work, the ICA blind detection method is compared with traditional matched filter and well-known linear MMSE multi-user detector. Numerical simulations indicate that ICA based detection ability is comparable to MMSE detection performance when MAI is lower in synchronous CDMA channels. With the increase of MAI, the superior performance of ICA has significant improvement gains over exact-MMSE.

Key words Blind multi-user detection Independent Component Analysis (ICA) CDMA systems Kurtosis

DOI:

通讯作者

作者个人主页 杨家轩;贾传荧;史国友; 冯锡炜