

算法研究

宽带协方差矩阵的多字典联合稀疏表示DOA估计

何振清,刘庆华,欧阳缙

桂林电子科技大学信息与通信学院

摘要:

为了直接处理相干宽带信号和提高其波达方向估计的分辨率,提出一种基于宽带协方差矩阵的多字典联合稀疏分解估计方法。首先,利用多个频率点处的过完备基对其协方差矩阵进行稀疏表示,然后形成多个字典的多测量矢量稀疏表示模型,最后通过多字典稀疏表示系数的联合稀疏约束以求解稀疏反问题的形式实现宽带信号的波达方向估计。对于均匀线阵结构,多字典协方差矩阵稀疏表示系数的联合稀疏性使其不再受空域采样条件的限制,既可通过增大阵元间距提高分辨率,而又无空域混叠现象。通过对噪声功率的预估计抑制噪声,提高了波达方向估计的稳健性。另外,该方法与信号协方差矩阵的秩无关,对相干信号和不相干信号都适用。仿真实验验证了该方法的有效性。

关键词: 波达方向估计; 宽带信号; 稀疏表示; 压缩感知

Direction-of-Arrival Estimation with Multiple-Dictionary Joint Sparse Representation via Wideband Covariance Matrix

HE Zhen-Qing, LIU Qing-Hua, OU Yang-Shan

School of Information and Communication, Guilin University of Electronic Technology

Abstract:

In order to estimate coherent wideband signals directly and achieve a higher resolution, a new method based on wideband covariance matrix using multiple-dictionary joint sparse representation is proposed in the light of DOA (Direction-of-Arrival) estimation of wideband signals. Firstly, the covariance of wideband signals at every discrete frequency point is represented by its overcomplete dictionary, and then the multiple-dictionary joint sparse MMV (multiple-measurement vector) model is obtained. Finally, the DOAs are estimated by solving the multiple-dictionary joint sparse inverse problem with the joint-sparse constraint of MMV's sparse representation coefficients. For ULA (Uniform Linear Array) structure, the joint sparsity of multiple-dictionary joint sparse MMV model makes this proposed approach can breakthrough the classical spatial sampling theorem, so we can increase the element spacing exceeding half-wavelength spacing which leads to a significant improvement in the resolution limit without spatial ambiguity or aliasing. Noise suppression via the pre-estimation of the noise power can also improve the robustness to DOA estimation in a lower SNR (Signal-to-Noise Ratio). In addition, the proposed method has the capability of estimating both uncorrelated and coherent wideband signals because of its independence with the rank of wideband covariance matrix. The simulation results demonstrated the efficacy of our proposed approach.

Keywords: direction-of-arrival estimation wideband signal sparse representation compressed sensing

收稿日期 2011-12-15 修回日期 2012-04-13 网络版发布日期 2012-05-25

DOI:

基金项目:

国家重点基础研究发展计划(2008CB317109); 国家自然科学基金(60572054); 广西自然科学基金(0832007Z)

通讯作者:

作者简介:

作者Email: hehe8619@hotmail.com

参考文献:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(780KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 波达方向估计; 宽带信号; 稀疏表示; 压缩感知

本文作者相关文章

- ▶ 何振清
- ▶ 刘庆华
- ▶ 欧阳缙

PubMed

- ▶ Article by He, Z. Q.
- ▶ Article by Liu, Q. H.
- ▶ Article by Ou, Y. S.

反馈人	<input type="text"/>	邮箱地址	<input type="text"/>
反馈标题	<input type="text"/>	验证码	<input type="text" value="6015"/>