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基于压缩感知的DOA估计稀疏化模型与性能分析

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Sparsity Model and Performance Analysis of DOA Estimation with Compressive Sensing

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摘要 利用压缩感知理论解决阵列信号到达角(DOA)估计问题，具有对快拍数据量要求求低、可处理相关源等优点。将压缩感知理论应用于信源DOA估计的一个关键问题是建立信源信号的稀疏化模型。该文在均匀线阵模型下系统分析了角度划分对DOA估计稀疏重构性能的影响，从对相关性的分析出发给出了信号的最优稀疏化模型。分析结果表明在实际应用中基于信源信号等正弦空间稀疏化的重构模型是最优的。实验对比了新的稀疏化模型与传统的等角度划分方式得到的流形矩阵的可重构性能，并进行了关于信号重构和信源DOA估计的详细实验分析，验证了所提模型的优越性。

关键词： 压缩感知(CS) 稀疏化模型 到达方向(DOA)估计 相关性

Abstract： The method of Direction-Of-Arrival (DOA) estimation of array signals based on Compressive Sensing (CS) theory has advantages such as fewer snapshots requirement and the capacity of dealing with the coherent sources. Exploiting the CS theory on DOA estimation, one of the key issues is to construct the sparsity model of source signals. This paper proposes the systemic analysis about how the way of space-partition affects the performance of DOA estimation, and presents a new optimal sparse reconstruction model based on space-partition with equal sine interval through the analysis about coherence. The theoretical result shows that the reconstruction model based on the manifold matrix with equal sine interval is the best model in the practical application. Finally the experiments compare the reconstruction performance of the manifold matrix with equal sine interval with that of the manifold matrix with equal angle interval. This paper provides the experiment results about the performance of signal reconstruction and DOA estimation, respectively. The advantage of the presented sparsity model is verified.

Keywords： Compressive Sensing (CS) Sparsity model Direction-Of-Arrival (DOA) estimation Coherence

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