

短文与研究通讯

基于压缩转发的协作MIMO雷达成像算法

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摘要:

以实现地面目标的快速、高分辨率成像为目的, 本文提出了一种基于压缩感知和协作通信技术的解决方案。在分析压缩感知理论和传统协作MIMO雷达成像算法的基础上, 提出了基于匹配滤波器的协作MIMO雷达回波信号的稀疏表示方法和用于恢复重构的基函数, 并建立了基于压缩转发的协作MIMO雷达系统模型。该系统主要由收发雷达、转发节点和压缩感知成像处理中心组成, 转发节点利用模拟/信息转换(AIC)测量框架将雷达回波数据压缩后转发, 压缩感知成像处理中心接收到各转发节点转发的数据后, 利用正交匹配追踪算法(OMP)进行距离向压缩和方位向压缩, 从而实现快速、高分辨率成像。仿真结果表明, 该方法比传统MIMO雷达对各转发节点的传输负荷要求低, 成像速度快, 目标旁瓣低, 成像效果好。

关键词: 压缩感知(CS) 协作MIMO雷达 正交匹配追踪算法(OMP) 雷达成像

Cooperative MIMO Radar Imaging Algorithm Based on Compressing-and-Forward Scheme

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Abstract:

For the purpose of obtaining high-resolution image of ground target with high speed, this paper proposes a technical approach based on the theory of compressive sensing (CS) and cooperative communication. Firstly, on the basis of analyzing the theory of compressive sensing and the imaging algorithm of cooperative MIMO radar, we propose the sparse representation models of the baseband echo under matched filtering and the base function used for signal reconstruction. Then, a cooperative MIMO radar system model based on compressing-and-forward scheme is established. The system mainly consists of a radar with transmitting and receiving antenna, forwarding nodes and a compressed sensing imaging center. Forwarding nodes receive and forward the echoes of cooperative MIMO radar using the analog-to-information conversion (AIC) measure framework. Finally, the orthogonal matching pursuit (OMP) reconstruction algorithm for range compression and azimuth compression is studied, and fast, high-resolution imaging is implemented. Simulation results show that compared to the traditional MIMO radar, the proposed method requires low transmitting load of the forwarding nodes and can imaging with high speed and low sidelobe.

Keywords: compressive sensing (CS) cooperative MIMO radar orthogonal matching pursuit (OMP) Radar imaging

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