短文与研究通讯

基于压缩感知的双基SAR二维高分辨成像算法

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摘要：

双基地合成孔径雷达(SAR)由于收发分置，具有广阔的应用前景，但常规的频域算法不仅面临距离史双根号问题，而且数据采集受Nyquist理论限制，数据量大。近年来提出的压缩感知(CS)理论指出，在一定条件下可以从很少的采样点中以很大的概率重建原始未知稀疏信号。本文将CS理论与双基地SAR模型相结合，提出一种基于CS的双基地SAR二维高分辨成像算法。该算法将二维随机降采样回波数据作为测量值，根据发射信号构造距离向测量矩阵，通过方位向多普勒相位因子构建方位向测量矩阵，利用CS恢复算法对目标进行了分维重建。仿真结果与性能分析表明，该算法在严重欠采样情况下仍能完好的重建原始目标，而且对噪声具有一定的鲁棒性和免疫性。与传统双基SAR成像算法相比，该算法具有更高的分辨率，成像结果峰值更加尖锐，峰值旁瓣比(PLSR)和积分旁瓣比(ILSR)都较低，而且采样率低、数据量少，具有一定的有效性和实用性。

关键词： 双基SAR;压缩感知;稀疏信号;随机降采样；测量矩阵

Two-Dimensional High Resolution Bistatic SAR Imaging Algorithm Based on Compressed Sensing

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Abstract:

The bistatic SAR, when transmitter and receiver move along nonparallel tracks with unequal velocities, has the potential for various applications. But the double-square-root term of range history and a large amount of echo storage are two basic challenges of traditional frequency domain imaging for bistatic SAR. Recent theory of Compressed Sensing (CS) suggests that exact recovery of an unknown sparse signal can be achieved from few measurements with overwhelming probability. In this paper, a novel bistatic SAR high resolution imaging algorithm is proposed based on CS theory and the model of bistatic SAR. In the novel algorithm, the 2-D random down-sampling echo data is as measurement value and the targets are reconstructed via CS in the range and azimuth direction, respectively. The simulation results show that the targets can be perfectly reconstructed by only using few down-sampling echo data instead of all numbers of measurements and also verify the validity of the proposed algorithm which is higher resolution, lower peak side-lobe ratio (PSLR) and integrated side-lobe ratio(ISLR), less sampled data than traditional bistatic SAR imaging algorithm.

Keywords: Bistatic SAR compressed sensing sparse signal random down-sampling measurement matrix

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