



合成孔径雷达压缩感知成像方法

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On compressive sensing applied to SAR imaging

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摘要

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摘要 为解决大带宽、多通道空间雷达系统的数据量大导致数据无法存储和传输的问题,介绍了一种基于压缩感知理论(CS,Compressive Sensing)的、全新的合成孔径雷达数据获取体制和脉冲压缩方法.在观测场景满足一定稀疏特性的前提条件下,使用该方法取代传统的匹配滤波方法进行脉冲压缩处理,可以从远远低于常规雷达所获取的数据量中恢复出原始场景.压缩感知脉冲压缩是通过使用一种贪婪追踪算法解一个逆问题来重建脉冲压缩后的信号.给出了该方法的原理和过程,并通过计算机仿真验证了该方法的有效性.这种新方法可以简化雷达系统,有效降低存储和传输的数据量,将设计重点从昂贵的接收机硬件上转移到智能信号重建算法上去.

关键词: 压缩感知 脉冲压缩 合成孔径雷达

Abstract: State of the art radar systems apply a large bandwidth and an increasing number of channels produce huge amount of data. The data easily exceeds that be stacked in the sensor or downlinked to the ground station. In order to solve this trouble, a novel synthetic aperture radar (SAR) raw data retrieval and a corresponding pulse compression method based on compressive sensing (CS) theory were presented. Under the assumption that the observed scene shows characteristic of a sparse reflectivity distribution, traditional matched filter can be replaced by CS for pulse compression. Benefits from this substitution include much lower data amount for scenario reconstruction than traditional SAR. In this method, the pulse compressed signal was reconstructed by solving an inverse problem through a greedy pursuit. The principle and process of the algorithm were given, and the effectiveness was validated by computer simulation. The new approach greatly simplifies the radar system, effectively reduces the huge amount of data, thus shifting emphasis from expensive receiver design to smart signal recovery algorithms.

Keywords: [compressive sensing](#) [pulse compression](#) [synthetic aperture radar](#)

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