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传感器与信号处理

基于压缩感知的GPR成像算法

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摘要：

传统的探地雷达(ground penetrating radar, GPR)数据采集需要满足Nyquist采样定理,严重影响了GPR成像效率。基于压缩感知理论,稀疏信号可以在远低于Nyquist采样率的情况下通过求解l_1范数约束下的凸最优化问题得到精确恢复,克服了传统算法中数据采集的局限。将压缩感知理论应用于GPR成像,利用仿真数据系统分析了测量矩阵维度、信噪比、数据损失程度和目标密集度等因素对成像结果的影响。实验结果表明,与传统的GPR成像算法相比,压缩感知成像算法成像精度高,虚警少,对噪声和数据损失有一定的鲁棒性,可以大大节省数据存储空间和采集时间。

关键词： 探地雷达成像 压缩感知 Nyquist采样定理 反向投影算法

GPR imaging algorithm based on compressive sensing

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Abstract:

The Nyquist sampling theorem must be satisfied in traditional data acquisition of the ground penetrating radar (GPR), which degrades the imaging efficiency dramatically. However, the theory of compressive sensing (CS) shows that sparse signals can be precisely reconstructed by solving a convex l_1 minimization problem at a rate significantly below the Nyquist rate, and it can overcome the shortcomings of traditional data acquisition. The CS theory is applied into the GPR imaging, and the effects on imaging results caused by the dimension of measurement matrix, signal to noise ratio (SNR), incomplete data and compactness of targets are analyzed systematically through the simulated data. Experimental results show that compared with the traditional GPR imaging algorithm, the proposed algorithm has higher precision and fewer false alarms. This algorithm is also robust to noise and incomplete data, and saves the resources of data storage and acquisition.

Keywords: ground penetrating radar imaging compressive sensing Nyquist sampling theorem back projection algorithm

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参考文献：

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1. 屈乐乐   1,2 ,黄琼   1,2 ,方广有 1.基于压缩感知的频率步进探地雷达成像算法[J]. 系统工程与电子技术, 2010,32(2): 295-297

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