光学 精密工程
OPTICS AND PRECISION ENGINEERING
核心期刊
主管：中国科学院
主办：中国科学院长春光学精密机械与物理研究所
中国仪器仪表学会
主编：曹健林

光学精密工程 2013, 21(8) 2201-2208 ISSN: 1004-924X CN: 22-1198/TH

信息科学

利用线性预测与查表法的高光谱图像压缩

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摘要： 提出了一种线性预测和多谱带查表相结合的高光谱图像无损压缩算法。首先，根据高光谱图像谱带间具有强相关性的特点，建立基于Yule-Walker方程的线性预测模型，其中方程系数矩阵为非Toeplitz形式的对称矩阵，需要使用改进的Levinson算法进行求解。其次，针对校正后的高光谱图像具有稀疏直方图的特点，提出了多谱带查表法，对线性预测的结果进行修正，去除这些图像中因校正引起的信息冗余，而对未校正图像，则不使用该步骤处理。最后，使用熵编码器对预测误差进行编码。分别使用自适应算术编码和Golomb-Rice编码作为熵编码器进行了测试，结果表明：本文算法具有较高的压缩比，压缩效果好于国际空间数据系统咨询委员会（CCSDS）的标准算法。

关键词： 超光谱图像 无损压缩 线性预测 多谱带查表法 Yule-Walker方程 Levinson算法

Hyperspectral Imagery Compression via Linear Prediction and Lookup Tables

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Abstract: A lossless compression scheme consisting of a linear prediction and multiband lookup tables was proposed to compress the airborne hyperspectral imagery efficiently. Firstly, based on the Yule-Walker equation, a linear prediction model whose equation coefficient matrix is a non-Toeplitz type covariance matrix and it should be solved by an extension form of Levinson algorithm was established by exploiting the strong correlation of spectral bands of hyperspectral imagery. Then, a multiband lookup table algorithm was adopted to refine the prediction result based on the calibrated hyperspectral imagery containing a sparse histogram induced by calibration techniques, however, for the uncalibrated imagery, the multiband lookup tables could be neglected. Finally, the prediction residuals were sent to the entropy encoder. In the experiment, the Adaptive Arithmetic Code and Golomb-Rice Code were both tested as the entropy encoder. The experimental results show that the proposed scheme has a higher compression ratio and the compression effect is better than that of the standard from Consultative Committee for Space Data System（CCSDS）.

Keywords: Hyperspectral imagery lossless compression Linear Prediction Multiband Lookup Tables Yule-Walker Equations Levinson Algorithm

收稿日期 2013-01-17 修回日期 2013-03-25 网络版发布日期 2013-08-20

基金项目:

中国科学院空间科学与应用研究中心“五个重点培育方向”项目

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