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信息科学

精确质量控制的遥感图像JPEG2000压缩方法

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摘要: 提出了一种精确控制图像压缩质量的遥感图像JPEG2000压缩方法。根据小波变换的完全重构和子带系数量化误差统计独立性, 建立了压缩图像峰值信噪比质量指标与小波系数编码量化误差的数学表达关系式。在传统JPEG2000率失真理论的基础上, 建立以压缩图像质量为目标, 最小化编码码率的模型, 并给出了压缩图像质量控制的码流优化截取方法。对标准测试图像以及卫星遥感图像进行实验, 并与传统JPEG2000方法进行比较。结果显示, 该方法具有相同的编码架构和复杂度, 能够精确控制压缩图像质量, 控制精度小于1%。对于序列多幅遥感图像, 在相同平均码率条件下, 提出的方法具有更高的整体压缩图像峰值信噪比。

关键词: 遥感图像 图像压缩 图像质量 JPEG2000 小波变换

JPEG2000 compression for remote sensing images with precise quality control

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Abstract: A remote sensing image JPEG2000 compression scheme with precise quality control was proposed. According to the perfect reconstruction of wavelet filter banks and the statistical independence of subband coefficient quantization error, a mathematical expression formula was established to describe the relation between the peak signal to noise ratio and the wavelet coefficient quantization error. Based on the traditional JPEG2000 rate distortion model, a distortion-based rate minimization model was constructed and optimization truncation coding stream to obtain a desired target image compression quality was given. An experiment on standard test images and satellite remote sensing image was performed and obtained results were compared with that of the conventional rate-based distortion minimization JPEG2000 encoding. Results indicate that the new method has the same coding structure and computing complexity, and it can accurately control the compression image quality with an average control precision less than 1%. In addition, this proposed method has higher global compression image peak signal to noise ratio at the same total coding rate for sequence remote sensing images.

Keywords: Remote sensing image Image compression Image quality JPEG2000 Wavelet transform

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参考文献:

- [1]TAUBMAN D. High-performance scalable image compression with EBCOT [J]. IEEE Transactions on Image Processing, 2000, 9(7):1158-1170.
- [2]TAUBMAN D, MARCELLIN M. JPEG2000 Image Compression Fundamentals, Standards and Practice [M]. USA: Kluwer Academic Publishers, 2002.
- [3]孟伟, 金龙旭, 韩双丽. 二维提升小波的VLSI结构设计及FPGA验证[J]. 液晶与显示, 2011, 26 (3): 404-408. MENG W, JIN L X, HAN SH L. Design of VLSI architecture of 2D lifting wavelet and FPGA verification [J]. Chinese Journal of Liquid Crystals and Displays, 2011, 26 (3): 404-408. (in Chinese)
- [4]杜列波, 肖学敏, 罗武胜, 等. 星载遥感图像JPEG 2000压缩算法的去量化[J]. 光学精密工程, 2009, 17(3): 690-694. DU L B, XIAO X M, LUO W SH, et al.. Quantification removing for satellite on-board remote image JPEG2000 compression algorithm [J]. Opt. Precision Eng., 2009, 17(3): 690-694. (in Chinese)
- [5]TAUBMAN D. Kakadu Software [EB/OL]. (2001-09-25)[2012-07-23]. http://www.kakadusoftware.com/.
- [6]MICHAEL D A. Jasper Software [EB/OL]. (1999-05-20)[2006-12-07]. http://www.ece.uvic.ca/~frodo/jasper/.
- [7]Communications and Remote Sensing Lab(UCL). OpenJPEG Home Page [EB/OL]. (2004-05-03)[2012-11-19]. http://www.openjpeg.org/.
- [8]杜伟娜, 孙军, 倪强. 基于JPEG2000的高效率控制算法[J]. 上海交通大学学报, 2006, 40(1): 16-19. DU W N, SUN J, NI Q. An efficient rate control scheme for JPEG2000 [J]. Journal of Shanghai Jiao Tong University, 2006, 40(1): 16-19. (in Chinese)
- [9]庄怀宇. 内嵌图像编码中高效率控制技术研究[D]. 西安: 西安电子科技大学博士学位论文, 2006. ZHUANG H Y. Researches on high efficiency rate control for embed image coding [D]. Xi'an: Xidian University, 2006. (in Chinese)
- [10]FRANCESC A L, JOAN S S. JPEG2000 quality scalability without quality layers [J]. IEEE Transactions on Circuits and Systems for Video Technology, 2008, 18(7): 923-936.
- [11]FRANCESC A L, JOAN S S, JOAN B R. Enhanced JPEG2000 quality scalability through block-wise layer truncation [J]. EURASIP Journal on Advances in Signal Processing, 2010, 2010: 1-11.
- [12]陶宏江, 韩双丽, 张宇, 等. 基于ADV212的远程图像采集系统设计[J]. 液晶与显示, 2013, 28(1): 105-109. TAO H J, HAN SH L, ZHANG Y, et al.. Design of remote image collection system based on ADV212 [J]. Chinese Journal of Liquid Crystals and Displays, 2013, 28 (1): 105-109. (in Chinese)
- [13]汤毅, 辛勤, 李纲, 等. 基于内容的高光谱图像无损压缩[J]. 光学精密工程, 2012, 20(3): 668-674. TANG Y, XIN Q, LI G, et al.. Lossless compression of

hyperspectral images based on contents [J]. Opt. Precision Eng., 2012, 20(3):668-674. (in Chinese) [14]刘春香,郭永飞,李宁,等.星上多通道遥感图像的实时合成压缩[J].光学精密工程, 2013,21(2):445-453. LIU CH X, GUO Y F, LI N, et al.. Composition and compression of satellite multi-channel remote sensing images [J]. Opt.Precision Eng.,2013,21(2): 445-453. (in Chinese) [15]PARISOT C, ANTONINI M, BARLAUD M. Stripe-based MSE control in image coding[C]. 2002 International Conference on Image Processing, Piscataway, NJ, USA, 2002, 2: 649-652. [16]LIU Z, KARAM L J, WATSON A B. JPEG2000 encoding with perceptual distortion control [J]. IEEE Transactions on Image Processing, 2006,15(7):1763-1778. [17]MALLAT S. A Wavelet Tour of Signal Processing [M]. 3rd Edition. San Diego: Academic Press, 2008.

本刊中的类似文章

1. 陶小平 罗霄 薛栋林.地球静止轨道面阵凝视成像系统分时积分抑振技术[J]. 光学精密工程, 2013,21(8): 2169-2179
2. 张立保 丘兵昌.基于快速方向预测的高分辨率遥感影像压缩[J]. 光学精密工程, 2013,21(8): 2095-2102
3. 周丽平 孙志峻 张泉.显微视觉自动聚焦及控制策略[J]. 光学精密工程, 2013,21(3): 807-812
4. 蒋慧琴 李萍 王忠勇 刘玉敏.医学图像感兴趣区域近无损压缩[J]. 光学精密工程, 2013,21(3): 759-766
5. 陈勇 李愿 吕霞付 谢正祥 冯鹏.视觉感知的彩色图像质量积极评价方法[J]. 光学精密工程, 2013,21(3): 742-750
6. 刘春香 郭永飞 李宁 司国良 李云飞.星上多通道遥感图像的实时合成压缩[J]. 光学精密工程, 2013,21(2): 445-453
7. 张士杰 李俊山 杨亚威 张仲敏.湍流退化红外图像降晰函数辨识[J]. 光学精密工程, 2013,21(2): 514-521
8. 陈维真 张春华 赵仕伟 李红林.面向卫星遥感海面高度图像的中尺度涡自动提取[J]. 光学精密工程, 2013,21(10): 2704-2712
9. 李云红, 伊欣.基于脉冲耦合神经网络模型的小波自适应斑点噪声滤除算法[J]. 光学精密工程, 2012,20(9): 2060-2067
10. 汤毅, 辛勤, 李纲, 万建伟.基于内容的高光谱图像无损压缩[J]. 光学精密工程, 2012,20(3): 668-674
11. 张明照, 牟建华, 刘扬, 彭晓军, 王伯雄.应用复Morlet小波变换分析条纹图相位[J]. 光学精密工程, 2012,20(3): 643-650
12. 王兴玲, 刘龙飞, 于钢, 雷宇, 陶亮.全球陆地光学遥感影像获取技术与应用[J]. 光学精密工程, 2012,20(10): 2324-2330
13. 王建军, 刘波.适于硬件实现的无损图像压缩[J]. 光学精密工程, 2011,19(4): 922-928
14. 范媛媛, 沈湘衡, 桑英军.基于对比度敏感度的无参考图像清晰度评价[J]. 光学精密工程, 2011,19(10): 2485-2493
15. 曲锋, 刘英, 王健, 董科研, 刘建卓, 郭帮辉, 孙强.红外双波段图像实时融合系统[J]. 光学精密工程, 2010,18(7): 1684-1690

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