

光通信与光信息技术

改进的小波变换算法在图像融合中的应用

高颖<sup>1</sup>, 王阿敏<sup>1</sup>, 王凤华<sup>1</sup>, 郭淑霞<sup>2</sup>

1. 西北工业大学 航海学院, 西安 710072;
2. 西北工业大学 无人机特种技术重点实验室, 西安 710065

摘要:

为了改善传统图像融合方法在精确制导武器系统中对目标检测模糊、识别率低与实时性差等缺陷,采用了一种将小波变换与Canny算子相结合的图像融合的新方法。该方法的具体改进在于首先对源图像在垂直和水平方向上进行了适合图像重构的3层小波分解,并依据各分解层不同频率分量的自身特性,采用独特的融合规则,即对低频分量采用加权平均融合算法,对高频分量采用Canny算子与局部区域均方差准则结合法改变图像的小波系数,最后对融合后的小波系数进行逆变换,得到重构的目标图像。结果表明,利用该方法不仅降低了融合图像的边缘模糊性,突出了目标色彩,达到良好的视觉效果,而且计算效率高、实时性好,特别有助于伪装目标的检测与识别,具有较好的应用价值。

关键词: 图像处理 图像融合 边缘检测 小波变换 图像评价

Application of improved wavelet transform algorithm in image fusion

GAO Ying<sup>1</sup>, WANG A-min<sup>1</sup>, WANG Feng-hua<sup>1</sup>, GUO Shu-xia<sup>2</sup>

1. School of Marine Engineering, Northwestern Polytechnical University, Xi'an 710072, China;
2. Science and Technology on UAV Laboratory, Northwestern Polytechnical University, Xi'an 710065, China

Abstract:

In order to overcome the defects of fuzzy detection, low recognition rate and poor real-time of traditional fusion methods used in precision-guided weapons systems, a new image fusion algorithm was proposed combining wavelet transform with Canny operator. Firstly, the source image was decomposed into 3 layers in vertical and horizontal directions, which are suitable for image reconstruction; then due to its own characteristics of the different frequency components, an unique fusion rule was used to change wavelet coefficients of images, that is, for the low frequency components, the weighted average fusion algorithm was adopted, and for the high-frequency components, wavelet coefficients were changed using Canny operator and the local area variance criteria method. Finally, images were reconstructed using the inverse wavelet transform for different components. Results show the improved method not only reduces the fuzziness of edge, highlights target color, gets better visual effects, but also makes computational efficiency high, real-time good, particularly can detect and recognize pretend targets. It has better theoretical research and application value.

Keywords: image processing image fusion edge detection wavelet transform image evaluation

收稿日期 2012-12-20 修回日期 2013-03-07 网络版发布日期

DOI: 10.7510/jgjs.issn.1001-3806.2013.05.028

基金项目:

航天科技创新基金资助项目(CASC201102)

通讯作者:

作者简介: 高颖(1965- ),男,副教授,现主要从事虚拟现实技术、多源信息融合技术及人工智能的研究。E-mail: gaoying@nwpu.edu.cn  
作者Email:

参考文献:

- [1] LIU S T, ZHOU X D. Recent development of image fusion techniques [J]. Laser & Infrared, 2006, 36(8): 627-631 (in Chinese).

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF (3799KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 图像处理
- ▶ 图像融合
- ▶ 边缘检测
- ▶ 小波变换
- ▶ 图像评价

本文作者相关文章

PubMed

[2] ZHUANG Y F. Research on image edge detection based on wavelet transform and its applications [D]. Harbin: Harbin Institute of Technology,2007: 18-26(in Chinese).

[3] WANG W L. On infrared image processing based on wavelet transform [D]. Xi'an: Xi'an University of Electronic Science and Technology,2008: 3-9(in Chinese).

[4] WANG X S, SONG K. The algorithm of edge detection based on multiscale wavelet transform [J]. Transactions of Shenyang Ligong University,2008,27(4): 16-19(in Chinese).

[5] ZHANG Y, HONG G. An IHS and wavelet integrated approach to improve pan-sharpening visual quality of natural colour IKONOS and quick bird images [J]. Information Fusion,2005,6(3): 225-234.

[6] XIAO H. Research of infrared and visible image fusion algorithm based on wavelet transform [D]. Changchun: Changchun University of Science and Technology,2009: 23-31(in Chinese).

[7] DI H W, ZHANG W I. Application of wavelet edge detection based on Canny criteria in image fusion [J]. Opto-Electronic Engineering,2005,32(6): 79-82(in Chinese).

[8] LI H H, GUO L, LIU H. Current research on wavelet-based image fusion algorithms [J]. Proceedings of SPIE,2005,5813: 360-367.

[9] CHANG H W, LAN Sh D. Image fusion based on addition of wavelet coefficients [C]//International Conference on Wavelet Analysis and Pattern Recognition. Beijing, China: IEEE,2007: 1585-1588.

[10] LIAN J, WANG K, LI G X. Edge-based image fusion algorithm with wavelet transform [J]. Journal on Communications,2007,28(4): 18-23(in Chinese).

[11] ZENG H, LI Y X, WANG Q. Some applications in image procession with wavelets [C]//Proceedings of 2010 Asia-Pacific Youth Conference on Communication. Kunming, China: IEEE,2010: 356-359.

[12] NIU Y F, XU Sh T, HU W D. Fusion of infrared and visible image based on target regions for environment perception [J]. Applied Mechanics and Materials,2012,128/129: 589-593.

[13] DENG A, WU JI Y Sh. An image fusion algorithm based on discrete wavelet transform and canny operator [C]//Communications in Computer and Information Science 2011. Wuhan, China: Springer,2011,175: 32-38.

[14] HU L M, GAO J, HE K F. Research on quality measures for image fusion [J]. Electronics,2004,32(s1): 218-221 (in Chinese)

[15] WEN C Y, CHEN J K. Multi-resolution image fusion technique and its application to forensic science [J]. Forensic Science International,2004,140(2/3): 217-232.

#### 本刊中的类似文章

1. 未永飞.激光雷达扫描数据的快速三角剖分及局部优化 [J]. 激光技术, 2009,33(6): 642-642
2. 张羽鹏 王开福.LabVIEW和MATLAB在电子散斑图像处理中的应用 [J]. 激光技术, 2009,33(6): 582-582
3. 郭常盈.基于小波变化阈值的光干涉信号去噪 [J]. 激光技术, 2009,33(5): 506-506
4. 陈凤超 黄佐华 李榕.干涉条纹周期的测量及其在位相检测中的应用 [J]. 激光技术, 2008,32(1): 105-105
5. 周维.原型装置主放光路稳定性实验研究 [J]. 激光技术, 2007,31(4): 400-400
6. 冯煦 张瑞瑛 周萍 李松.大功率半导体线激光图像处理方法研究 [J]. 激光技术, 2010,34(5): 0-0
7. 魏柏林 陈国庆 徐建才 闫冠峰 马超群 朱拓 高淑梅.荧光光谱结合概率神经网络用于无醇啤酒的识别 [J]. 激光技术, 2010,34(6): 0-0
8. 顾国庆 王开福 燕新九.基于同态滤波的电子散斑干涉图像处理 [J]. 激光技术, 2010,34(6): 0-0
9. 虞文俊, 顾国华, 杨蔚.基于小波变换的红外偏振图像融合算法[J]. 激光技术, 2013,37(3): 289-292
10. 张海庄, 姚梅, 雷萍, 李鹏, 曾庆平.远场激光光斑图像处理方法研究[J]. 激光技术, 2013,37(4): 460-463

