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Wenshan Ding, Duyan Bi, Linyuan He, Zunlin Fan

PII: S1350-4495(18)30018-5
DOI: https://doi.org/10.1016/j.infrared.2018.06.029
Reference: INFPHY 2608

To appear in: *Infrared Physics & Technology*

Received Date: 10 January 2018
Revised Date: 24 April 2018
Accepted Date: 25 June 2018

Please cite this article as: W. Ding, D. Bi, L. He, Z. Fan, Infrared and visible image fusion method based on sparse features, *Infrared Physics & Technology* (2018), doi: https://doi.org/10.1016/j.infrared.2018.06.029

Infrared and visible image fusion method based on sparse features

Wenshan Ding, Duyan Bi, Linyuan He, Zunlin Fan*

Air Force Engineering University, Aeronautics and Astronautics Engineering College, No. 1 Baling Road, Baqiao District, Xi' an, Shaanxi, People' s Republic of China, 710038

* Correspondence: 18191261397@163.com

Abstract: Since the object information cannot be extracted efficiently by the traditional infrared and visible image fusion algorithms, an infrared and visible image fusion method based on the non-subsampled shearlet transform(NSST) and sparse structure features is proposed to retain the context information on visible image in this study. Firstly, we decompose the source images into low-frequency sub-band and high-frequency sub-band coefficients by the NSST. Then, benefit from the advantage of PCA on extracting principle information, the fusion rule in low-frequency sub-bands coefficients are merged by using the PCA-based approach. Afterwards, to retain the sparse structures from source images better, we propose a novel sparse feature extraction on high-frequency sub-band coefficients and fuse high-frequency components of source images. Finally, the inverse NSST is employed to obtain the fused image. The experimental results demonstrate that the proposed method preserves the background information on visible image and highlights the structural information on infrared image.

Keywords: image fusion, infrared images, NSST, PCA, visible images.

1 Introduction

The image fusion synthesizing the information on the same scene from different sensors is useful and important technique in image processing, and has a wide range of applications: medical image processing [1], pattern recognition [2], remote sensing [3], military [4] and so on. With the development of multiple sensor image fusion, an infrared and visible image fusion has had a wide application in recent years [5].

Based on a thermal radiation of the target or reflected scene, infrared image reflects the outline of the target scene, but lacks details and textures. On the other hand, the visible image based on the spectral reflection of the target scene contains a rich and detail information about the scene such as information on edges and textures, but is affected by the scene lighting. The infrared and visible image fusion provides the comprehensive and accurate full use of the complementary information on the scene, and is required in many fields [6].

Recently, the fusion algorithms based on transform domain are developed rapidly in the infrared and visible image fusion field. The wavelet transform is a multi-resolution analysis algorithm with a computational efficiency, and has become the mainstream method in the image fusion field. However, it cannot provide the best sparse representation of image. On the other hand, the shearlet transform (ST) proposed by D. Labate et al. [7] in 2005 overcomes the restrictions of wavelet transforms, and it captures the structure information effectively. Therefore, it has been used in image fusion successfully.