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A SURVEY ON MULTIFOCAL DIGITAL IMAGE FUSION USING DIFFERENT TECHNIQUES

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Abstract *- Image fusion is the process of combining one or more images which are obtained from different environment into a single image which is more useful for image processing tasks. Image registration and image fusion are of great importance in defence and civilian sectors, particularly for recognizing a ground/air force vehicle and medical imaging. Image fusion aims at improving spectral information in a fused image as well as adding spatial details to it. Image fusin is the process of combining relevent information from two or more images into single images. Multisensor data fusion has become a discipline which demands more general formal solutions to a number of application cases. Several situations in image processing require both high spatial and high spectral information in a single image. In this paper, we have proposed a new approach of multimodal image fusion on wavelet transform coefficients. The performance of proposed image fusion method is compared with existing algorithms and evaluated with mutual information between input and output images, entropy, standard deviation and fusion factor metrics*

Keywords: Spatial domain-based methods, Transformed Domain-based methods, Multisensor, Wavelet, Image fusion.

I. INTRODUCTION

Image fusion is the process of detecting salient features in the source images and fusing these details to a synthetic image. Through image fusion, extended or enhanced information content can be obtained in the composite image, which has many application fields, such as digital imaging, medical imaging, remote sensing, and machine vision. As an example, optical imaging cameras suffer from the problem of finite depth of field, which cannot make objects at various distances (from the sensor) all in focus. Therefore, if one object in the scene is in focus, then the other objects at different distances from the camera will be out focus and thus, blurred. The solution to get all the objects focused in one image is multifocal image fusion technique. In this technique, several images of a scene are captured with focus on different parts. Basically, these methods can be categorized into two categories. The first category is the spatial domain-based methods, which directly fuse the source images into the intensity values. The other category is the transformed domain-based methods, which fuse image with certain frequency or time–frequency transforms. Image fusion has become an important subarea of image processing. For one object or scene, multiple images can be taken from one or multiple sensors. These images usually contain complementary information.

Image fusion has most common word used in medical diagnostics as well as treatment. Image fusion means it is combination of two input images of same scene to form a single image. The process of combining together relevant information or some of their features into a single image is termed as image fusion. The significance is to merge complementary information from two or more images of the same scene or part, so as to obtain an image which is more suitable for human visualization and machine perception. A single mode of image cannot give accurate and comprehensive information and hence the main focus is the image fusion. Image fusion is the technology that can take advantage of complementary information and redundancy information from different image sensors at the same time or at different times for the same scene by using some certain fusion rules and then the fused images are more accurate and more complete than the single image and more suitable for human visual perception and processing.

In many remote sensing and mapping applications, the fusion of multispectral and panchromatic images is a very important issue. Many image fusion techniques and software tools have been developed. The well-known methods are, for example, the IHS (Intensity, Hue, and Saturation) color model, the PCA (Principal Components Analysis) method, and wavelet based method. Wavelet-based image fusion method provides high spectral quality of

the fused satellite images. The spatial information of fused image is an important factor as much as the spectral information in many remote sensing applications. In particular, this improves the efficiency of the image fusion application, such as unsupervised image classification. In other words, it is necessary to develop advanced image fusion method so that the fused images have the same spectral resolution as the multispectral images and the same spatial resolution as the panchromatic image with minimum artifacts. In wavelet transform used for image we obtain four wavelet coefficients which are called as horizontal, approximation, vertical and diagonal coefficients. These coefficients of each of the image are to be fused together by applying fusion rule. There are two approaches to image fusion, namely Spatial Fusion and Transform fusion. In spatial domain, the pixel values from sources images are taken and average is obtained to form the composite fused image. Transform fusion uses pyramid or wavelet transform for representing the source image at multi scale. There are three levels in multi resolution fusion scheme namely Pixel level fusion, feature level fusion and region level fusion. The image fusion algorithm based on Wavelet Transform which faster developed was a multi resolution analysis. Wavelet Transform has good time frequency characteristics. It was applied successfully in image processing field. Nevertheless, its excellent characteristic in one-dimension can't be extended to two dimensions or multidimensional simply. Separable wavelet which was spanning by one-dimensional wavelet has limited directivity. We presents a new method for fusing two or more images in short we present a method, for extracting both color texture and color image and it is based on a Haar Wavelet Transform (HDWT) and Continuous Discrete Wavelet Transform (CDWT) using a single color camera. Firstly, the source images are fuzzified. Secondly, the highest value of entropy is used to find the membership and non-membership degree.

II. LITERATURE REVIEW

Deepak Kumar Sahu, M. P. Parsai [1] presented a process of combining the relevant information from a set of images into a single image, where the resultant fused image will be more informative and complete than any of the input images. Image fusion techniques can improve the quality and increase the application of these data. Image fusion like, primitive fusion (Averaging Method, Select Maximum, and Select Minimum), Discrete Wavelet transform based fusion, Principal component analysis (PCA) based fusion etc.

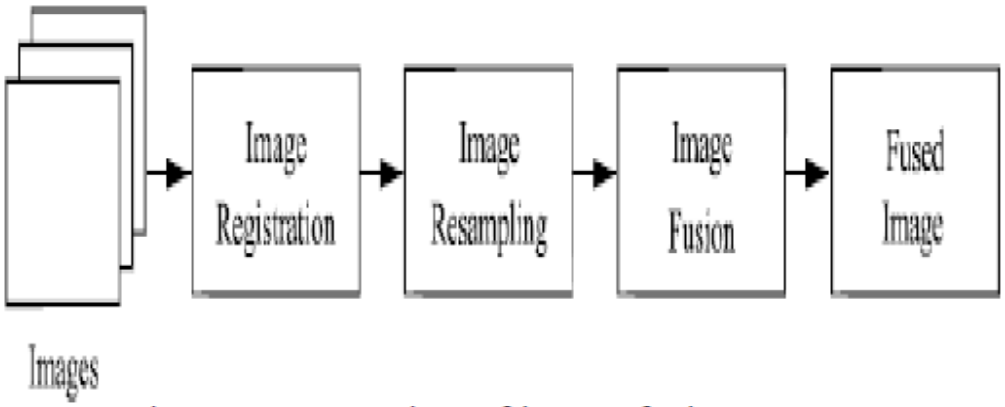

Fig1: Preprocessing of image fusion

Sheng Zheng, Wen-zhong Shi, Jian Liu, and Jinwen Tian [2] presented an MS Pansharpening method using the proposed multiscale mapped least-squares support vector machine (LS-SVM). Under the LS-SVM framework, the salient features underlying the image are represented by support values, and the support value transform (SVT) is developed for image information extraction. The low-resolution MS bands are resampled to the fine scale of the Pan image and sharpened by injecting the detailed features extracted from the high-resolution Pan image. The support value analysis is implemented by using a series of multiscale support value filters that are deduced from the mapped LS-SVM with multiscale Gaussian radial basis function kernels. Experiments are carried out on very high resolution QuickBird MS + Pan data. Fusion simulations on spatially degraded data, whose original MS bands are available for reference, show that the proposed MS Pan-sharpening method performs comparable to the state-of-the-art in terms of the pertained quantitative quality evaluation indexes, such as the Spectral Angle Mapper, relative dimensionless global error in synthesis (ERGAS), modulationtransfer- function-based tool and quality index (Q4).

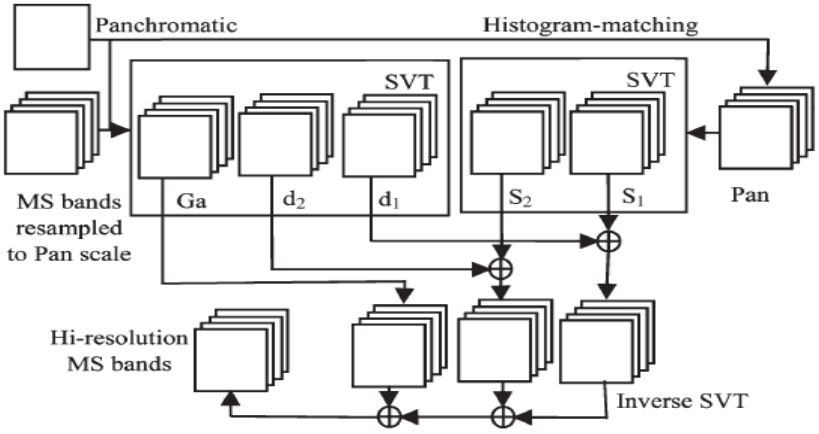

Fig. 2. Flowchart of an SVT-based fusion of MS and Pan data with 4 : 1 ratio.

Vishal P. Tank, Divyang D. Shah, Tanmay V. Vyas, Sandip B. Chotaliya, Manthan S. Manavadaria [3] presented a put forward an image fusion algorithm based on wavelet transform and second generation curvelet transform. The wavelet transform does not represent the edges and singularities well. So the second generation curvelet transform is performed along with the wavelet transform and the image fusion is done. Finally, the proposed algorithm is applied to experiments of multi focus image fusion and complementary image fusion. The proposed algorithm holds useful information from source multiple images quite well.

Myungjin Choi, Rae Young Kim, Moon-Gyu Kim [4] presented a The fusion of high-spectral but low spatial resolution multispectral and low-spectral but high spatial resolution panchromatic satellite images is a very useful technique in various applications of remote sensing. Recently, some studies showed that wavelet-based image fusion method provides high quality of the spectral content of the fused image. However, most of wavelet-based methods have a spatial resolution of the fused result less than the Brovey, IHS, and PCA fusion methods.

Bin Yang and Shutao Li [5] presented a sparse representation-based multifocus image fusion method is proposed. In the method, first, the source image is represented with sparse coefficients using an overcomplete dictionary. Second, the coefficients are combined with the choose-max fusion rule. Finally, the fused image is reconstructed from the combined sparse coefficients and the dictionary.

Shashidhar Sonnad [6] presented furnish a survey on various image fusion algorithms of MS and PAN images such as, Brovey transform, Intensity- Hue-Saturation(IHS) transform, Principal Component Analysis (PCA), Highpass Filtering, Wavelet transform, Integration of different transform methods with IHS , fusion method based on PCA and feature product of Wavelet transform, Fourier transform, General Intensity- Hue-Saturation (GIHS) transform, Optimal Filter design, modified Wavelet Averaging Merging method and modified Bi-cubic Interpolation method in non Subsampled Contourlet transform, improved IHS and PCA merges based on Wavelet decomposition.

Hamid Reza Shahdoosti and Hassan Ghassemian [7] presented filter based fusion methods are the ability to improve spatial and spectral information of multispectral (MS) and panchromatic (PAN) images. Filter-based approaches extract spatial information from the PAN image and inject it into MS images.The optimal filter coefficients extracted from statistical properties of the images are more consistent with type and texture of the remotely sensed images compared with other kernels such as wavelets.

K. Kannan and S. Arumuga Perumal [8] presented a image fusion is required which is usually refers to the process of combining two or more different images, each containing different features into a new single image retaining important features from each and every image with extended information content. The approaches to image fusion can be classified into two namely Spatial Fusion and Transform fusion. The most commonly used transform for image fusion at multi scale is Discrete Wavelet Transform since it minimizes structural distortions.

III. CONCLUSION

Image fusion algorithm based on Wavelet Transform. Although selection of fusion algorithm is problem dependent but this review results that spatial domain provide high spatial resolution. But spatial domain have image blurring problem. Visual analysis shows that stationary wavelet transform method appears better than discrete wavelet transform. The wavelet transforms is the very good technique for the image fusion provide a high quality spectral content. In vision, the fusion algorithm proposed and acquires better fusion result.

References

[1] Hamid Raza.; Shahadoosti.; Hassan Ghassemina, “Fusion of MS and PAN Images Preserving Spectral Quality,” IEEE Transactions on Geoscience and Remote Sensing Letters, vol:12, issue:3, pp. 611-615, March 2015.

[2] Reshma James.; M. Vadivel, “Improvement of Spectral and Spatial Information using Modified WAMM and Modified Bi- Cubic Interpolation Method in Non-Subsampled Contourlet Transform domain,”IEEE International Conference on Circuit, Power and Computing Technologies, pp. 1-5, 2015.

[3] Gharbia, Reham, Ali Hassan El Baz, Aboul Ella Hassanien, and Mohamed F. Tolba. "Remote Sensing Image Fusion Approach Based on Brovey and Wavelets Transforms". In Proceedings of the Fifth International Conference on Innovations in Bio- Inspired Computing and Applications IBICA 2014, pp. 311- 321. Springer International Publishing, 2014.

[4] Gharbia, Reham, Ali Hassan El Baz, Aboul Ella Hassanien, and Mohamed F. Tolba. "Remote Sensing Image Fusion Approach Based on Brovey and Wavelets Transforms." In Proceedings of the Fifth International Conference on Innovations in Bio- Inspired Computing and Applications IBICA 2014, pp. 311- 321. Springer International Publishing, 2014.

[5] NIng MA, ZE-Ming ZHOU, Peng ZHANG, LImin LOU "A New Variational Model for Panchromatic and Multispectral Image Fusion," Elsevier conference on Acta Automatica Sinica,vol:39, issue:2, pp. 179-187, 2013.

[6] Firouz Abdullah Alwassai.; N.V. kalyankar.; Ali A. Al-Zuky, " The IHS Based Image Fusion," Computer Vision & Pattern Recognition (CS.CV), 19 July, 2011.

[7] Deepali A. Godse, Dattatraya S. Bormane (2011) **"**Wavelet based image fusion using pixel based maximum selection rule" International Journal of Engineering Science and Technology (IJEST), Vol. 3 No. 7 July 2011, ISSN : 0975-5462.

[8] Paresh Rawat, Sapna Gangrade, Pankaj Vyas, "Implementation of Hybrid Image Fusion Technique Using Wavelet Based Fusion Rules," International Journal of Computer Technology and Electronics Engineering vol.1, pp.1-5, 2011.

[9] S. Daneshvar and H. Ghassemian, "MRI and PET image fusion by combining IHS and retina-inspired models," Inf. Fusion, vol. 11, no. 2, pp. 114–123, Apr. 2010.

[10] Shih-Gu Huang, "Wavelet for Image Fusion".

[11] S. Ibrahim and M. Wirth, "Multiresolution region-based image fusion using the Contourlet Transform," in IEEE TIC-STH, Sept. 2009

[12] Z. Liu, D. S. Forsyth, M.-S. Safizadeh, andA. Fahr, "Adata-fusion scheme for quantitative image analysis by using locally weighted regression and Dempster Shafer theory," IEEE Trans. Instrum. Meas., vol. 57, no. 11, pp. 2554–2560, Nov. 2008.

[13] T. Stathaki, Image Fusion: Algorithms and Applications. New York: Academic, 2008.

[14] W. Huang, Zh. L. Jing, "Multi-focus image fusion using pulse coupled neural network", Pattern Recognition Letters, vol. 28, no. 9, 2007, pp. 1123-1132.

[15] A. A. Goshtasby, S. Nikolov, Image fusion: advances in the state of the art, Inf. Fusion 8 (2) (2007) pp. 114–118.

[16] W. Huang, Zh.L. Jing, "Multi-focus image fusion using pulse coupled neural network", Pattern Recognition Letters, vol. 28, no. 9, 2007, pp. 1123-1132.

[17] Garzelli, A. & Nencini, F. 2005. Interband structure modeling for Pan-sharpening of very high resolution multispectral images. Information Fusion 6(3) pp. 213–224.

[18] Z. Wang, D. Ziou, C. Armenakis, D. Li, and Q. Li, "A comparative analysis of image fusion methods," IEEE Trans. Geosci. Remote Sens., vol. 43, no. 6, pp. 1391–1402, Jun. 2005.

[19] Z. Wang, D. Ziou, C. Armenakis, D. Li, and Q. Li, "A comparative analysis of image fusion methods," IEEE Trans. Geosci. Remote Sens., vol. 43, no. 6, pp. 1391–1402, Jun. 2005.

