A Survey on Image Fusion Techniques used to Improve Image Quality

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Abstract **- The objective of Image fusion is to combine the information of the images with focus on different objects or the number of images of the same scene from different sensors. The result of image fusion is an image which is more informative and better quality. Finding application in all spheres of life by the image fusion techniques. Some of the image fusion methods has been taken in this paper approaches.**

Keywords – Image fusion, Transforms, Multispectral, Multifocus, Panchromatic images

I. INTRODUCTION

The fusion in general means, an approach to extract information that is in several domains. The image fusion (IF) process is to integrate multi-view or multi-focus or multisensory information into a new image that contains better quality features and is more informative of all the individual input information. The measurement, meaning and its quality depend on the particular application. Image fusion is referred as Pan sharpening used to integrate the geometric details of the high resolution (Panchromatic) images and color of the low resolution or multispectral (MS) images. The result image contains high resolution multispectral image. Panchromatic images are broad visual wavelength range and it is colored in white and black. Multispectral image is that is obtained in different spectral band. Image fusion finds its application in such as medical sciences, military digital cameras multi-focus imaging, satellite imaging etc.

II. METHODS

Image fusion methods can be broadly classified into spatial domain and transform domain fusion. Spatial domain fusion techniques are Principal Component analysis (PCA), IHS (intensity hue saturation), Brovey method, and High pass filtering methods. Spatial image fusion work by combining the pixel values of the two or more images. The simplest average is the pixel values of the input images [1] laplacian transform and wavelet transform come in the transform domain. In the transform domain method the multiscale decomposition of the images is done and the composite image is constructed by using the fusion rule. Then inverse multiscale transform is applied to achieve the fused image.

1) PRINCIPAL COMPONENT ANALYSIS

Principal component analysis (PCA) is used abundantly in all forms of analysis - from neuroscience to computer graphics - because it is a simple, non-parametric method of relevant information extracting from confusing data sets. For images, it creates an uncorrelated feature space which can be used for further analysis instead of the original multispectral feature space. The PC analysis transform converts inter correlated MS bands into a new set of uncorrelated components. It is, therefore, replaced by a high-resolution PAN for the fusion. This PAN image is fused into the low-resolution and its MS bands by performing a reverse PCA transform [7].The panchromatic image is histogram matched to the first principal component (sometimes to the second). The advantage of the PC fusion is that the number of bands is not restricted (such as for the original IHS or Brovey fusions). The statistical procedure which means that it is sensitive to the area to be sharpened by its fusion methods. This fusion results may vary depending on the selected imaging subsets [8].

2) IHS TRANSFORM

The IHS technique is one of the most commonly used fusion techniques for sharpening of the images. It has become a standard procedure in image analysis for feature enhancement, color enhancement, improvement of spatial resolution and the fusion of disparate data sets [4]. From the visual system, one can conclude that the intensity change has little effect on the spectral information and is easy to deal with. For the fusion of the multispectral remote sensing images high-resolution, the goal is ensuring the spectral information and the detail information of high spatial resolution, therefore, the fusion has more adequate for treatment in IHS space [5]. The commonly used RGB (XS3, XS2, and XS1) colour space is not suitable for a merging processThe IHS system offers the advantage that the separate channels outline certain colour properties, namely intensity (I), hue (H), and saturation (S).

3) BROVEY TRANSFORM

Transform should not be used if preserving the original scene radiometry is important. So, it has well for producing RGB images with a higher degree of contrast in the low and high ends of the image histogram and for producing “visually

appealing" images. Multispectral image has normalized by other spectral bands and multiplied by the Pan image to add the spatial information to the output image. RGB produce images, only three bands at a time should be merged from the input multispectral scene [3].

4) HIGH PASS FILTERING

The ratio of the spatial resolution of the panchromatic and the multispectral image is calculated for the high pass filter fusion. A high pass convolution filter is kernel which is created and used to filter the high resolution input data The HPF image is added to each multispectral band. Before the summation, the HPF image is weighted relative to the global standard deviation of the multispectral bands with the weight factors are again calculated from the ratio. It shows acceptable results also for multisensoral and multi temporal data. Sometimes the edges are emphasized too much. [9]

III. WAVELET TRANSFORM

Wavelet transform is one of the important tools used for signal processing and image processing. Compression and Cleaning of the images is finds using wavelet transforms. The wavelets transforms have two types, first one is easily reversible, in this, and we are able to easily recover the original signal after its transformation. It have used in image compression and image cleaning. Second type is used for the sensor measurement fault detection and signal analysis. The wavelet transform decomposes the image into low-High, low-low, high-high, high low frequency bands. The HH-High High, HL-High Low, LH-Low High and LL-Low Low are the output frequency components obtained after two level compressions of both the input images. The basic is the decomposition of the signal which can be written by the equations

$$c(n) = 0.5x(2n)+0.5\ x(2n+1) \quad (1)$$

$$d(n) = 0.5x(2n)-0.5\ x(2n+1) \quad (2)$$

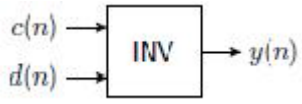
The above mentioned equations are represented by the block diagram

The below equations for reverse of the decomposed signal.

$$y(2n) = c(n) + d(n) \quad (3)$$

$$y(2n+1) = c(n) - d(n) \quad (4)$$

The above equations can be shown by the diagram



The wavelet based image fusion block diagram is shown in below figure

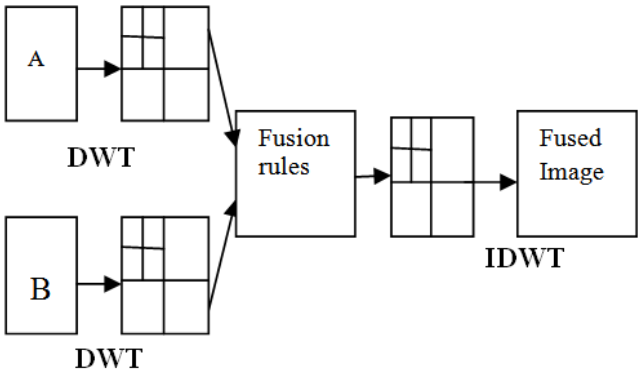


Fig.1 *Wavelet Transform Basic Diagram*

IV. QUALITY-BASED FUSION

The quality of acquired biometric data directly impacts the ability of the biometric matcher to perform the matching process effectively. The quality of an iris image generally affects both the iris segmentation process and the amount of texture information available in the segmented iris pattern. Quality assessment is application dependent; different application may require different aspects of image quality. These include for instance, visibility, spatial and spectral resolution, and quantity of information, contrast and details of features of interest.

V. CONCLUSION

The requirement of the user that one might have desire to obtain the visually beautiful image someone else may require the more details of the colors for getting more detailed accurate results about the image The Brovey method provides nice images which present sharp details but close examination indicated that the dark areas must darker, and the white area is whiter than the original images. The PCA method provides better enhanced fused images and has better fused image without much change in the spectral and spatial information of the original image. [10] In general, the Wavelet, and the PCA fusion techniques preserve the original colors in all the possible RGB band combinations. Wavelet fusion is a technique which is also induces small distortion. One should clearly understand that no one specific image fusion technique is superior over others instead the best technique.

REFERENCES

[1] Anjali Malviya1, S. G. Bhirud a short paper on 'Image Fusion of Digital Images' in International Journal of Recent Trends in Engineering, Vol 2, No. 3, November 2009 pp. 146 - 148.

[2] Pohl C. and Van Genderen J. L. (1998), Multisensor Image Fusion In Remote Sensing: Concepts, Methods And Applications (Review Article), International Journal Of Remote Sensing, Vol. No.5, pp. 823 - 854.

[3] Konstantinos G. Nikolakopoulos a paper on Comparison of Nine Fusion Techniques for Very High Resolution Data Photogrammetric Engineering & Remote Sensing, Vol. 74, No. 5, May 2008, pp. 647– 659.

[4] Zhang, Y., 2002. Problems in the fusion of commercial high resolution satellite images as well as Landsa images and Initial solutions.
International Archives of Photogrammetric and Remote Sensing (IAPRS), Volume 34, Part 4, ISPRS, CIG, SDH Joint International Symposium on "Geo Spatial Theory, Processing and Applications, Ottawa, Canada.

[5] Hui Y. X. And Cheng J. L., 2008. "Fusion Algorithm for Remote Sensing Images Based on Non subsample Contour let Transform". ACTA AUTOMATICA SINICA, Vol. 34, No. 3.pp. 274- 281.

[6] Jon Shlens, A Tutorial On Principal Component Analysis Derivation, Discussion And Singular Value Decomposition.

[7] Zhang, Y., 2004. Understanding Image Fusion, "Photogrammetric Engineering & Remote Sensing", 70(6):657–661.

[8] Anjali Malviya1, S. G. Bhirud 'Image Fusion of Digital Images' in "International Journal of Recent Trends in Engineering, Vol 2, No. 3, November 2009" pp. 146-148.

[9] Manfred Ehlers & Sascha Klonus, Performance of evaluation methods in image fusion by Institute for Geo informatics and Remote Sensing, University of Osnabrueck, Germany.

[10] R. Riyahi, C. Kleinn & H. Fuchs. Comparison of Different Image Fusion Techniques For Individual Tree Crown Identification Using Quick bird Images.

[11] Konstantinos G. Nikolakopoulos a paper on "Comparison of Nine Fusion Techniques for Very High Resolution Data," Photogrammetric Engineering & Remote Sensing, Vol. 74, No. 5, May 2008, pp. 647–659.