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Satellite Image Fusion scheme using Framelet Transform and Averaging Contrast method

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ABSTRACT

With the ease of access of multisensor in sequence in various areas, image fusion has established mounting deliberation in the researching area for a widespread field of advantages. Fusing of image is the aim to join information from an assortment of images of the indistinguishable view. These images possibly obtained from a mixture of sensors arrived at different times. In this work, an image fusion method depends on Framelet Transform is projected to develop the superiority of image and convene the requirements of submission of apparition. More images to be fused must be decaying using Framelet with multi resolution frequencies. The ensuing sub-images are fused using Averaging Contrast rule to find the mixed image. As the Multi wavelet transform has various extraordinary facial appearances in estimate with scalar wavelets on image fields, excluding it keeps the intrinsic in sequence. The usefulness of the future method is described using different image sets such as the multi-sensor images, multi-detector satellite image. The proposed Framelet transform based fusion technique has compared with Multi wavelet transform image fusion method relating and comparing. Experimental results concluded that the projected format performs superior for image fusion in comparison with Multi wavelet transform.

KEY WORDS: Framelet Transform, Satellite Images, Averaging fusion, Multi wavelet Transform.

1. INTRODUCTION

Image Fusion is a method of integrating the significant data from a set of pictures of the same sight into an exclusive image, and the ensuing fused image is more revealing and inclusive than the input images. Input images could be the multi-sensor, multimodal or multi-focal point. The fused image is supposed to keep all significant facts from the input images. The image fusion avoid introducing artifacts that contribute to an incorrect analysis. One of the imperative basic steps of the fusion process is image registration. Image registration is the procedure of transforming various sets of data into one organize system. Image fusion finds application in the field of navigation guidance, target detection, and recognition, medical diagnosis, satellite imagery for remote sensing, military, and civilian surveillance, etc. Image fusion techniques are classified into pixel, feature, and decision points.

Pixel fusion works straight on the pixels of source images while feature fusion techniques function on features taken out from the source images. The wavelet grasp the phantom and time, where the former system failed. Multiwavelet Transform (MWT) is unrivaled of the extensively applied tools. The WPT fusion strategy is selecting the maximum sub-bands in every elevated enormity. The demerits of wavelet is sensitive in the vicinity of the information. In this work, the Multi-Resolution Analysis (MRA) is achieved by directional non-subsampled Contourlet transform.

2. MATERIALS AND METHODS

Framelet Transform: The proposed technique is the framelet transform which eliminates coefficient noises and is effectively shift invariant when compared to Multi wavelet Transform. Framelet transform is similar to that of wavelet transform but has some differences.

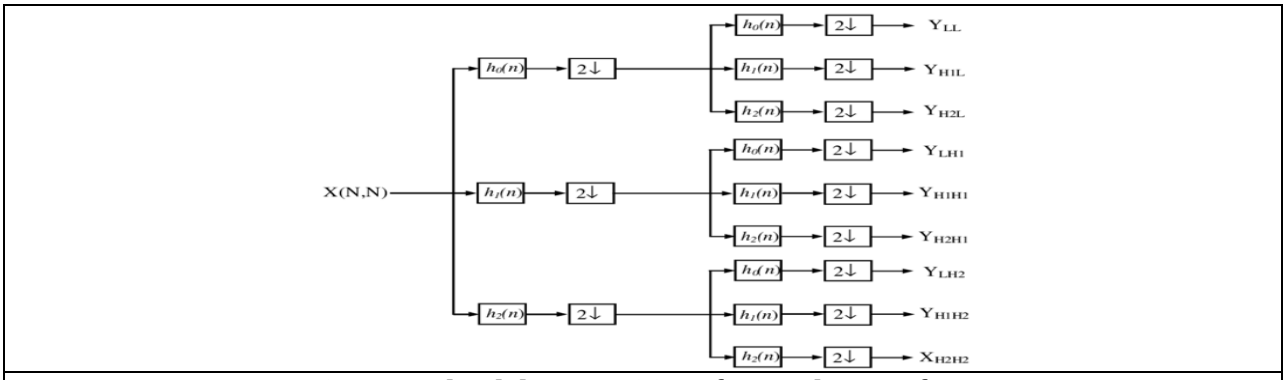

Fig.1. Two level decomposition of Framelet transform

Framelets has higher incidence sieve banks to develop large sub bands in decomposition. Image fusion finds application in the field of navigation guidance, target detection, and recognition, medical diagnosis,

satellite imagery for remote sensing, military, and civilian surveillance, etc. Image fusion techniques are classified into pixel, feature, and decision points. Pixel fusion works straight on the pixels of source images while feature fusion techniques function on features taken out from the source images. The block diagram of framelet transform is given in Fig.1.

Fusion of Image: Image fusion is combining pertinent information from two or more source images into a single image such that it contains most of the data from all the source images. In this work, Image fusion is employed for integrating an Satellite images in rainy and summer periods of Puzhal river in chennai. The resulting fused image contains both the periods in colour image. A average method of fusion process with FT approach is done.

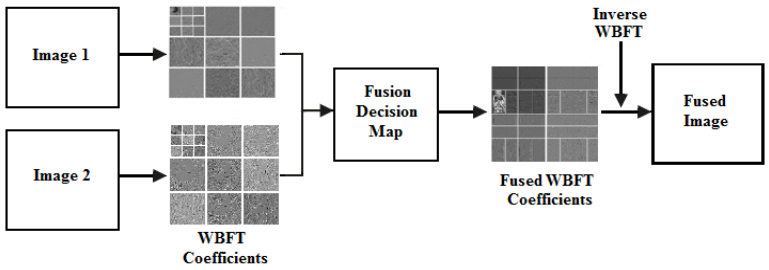

Fig. 2. Block diagram of Framelet based Image fusion

Wavelet based Framelet image fusion method block diagram is shown in fig.2. Image 1 is an Puzhal river in rainy season and Image 2 is a Puzhal river in summer season. Image 1 is analyzed by FT and Image 2 is also analyzed discretely. After decomposition several coefficients are obtained in all images. In this coefficients, single is approximation sub-band and the remaining sub-bands are detail coefficients. The proposed averaging fusion rule is implemented on the detail coefficients. Averaging is applied to fuse approximation coefficient. Finally, fused FT coefficients are obtained and inverse FT is finished to obtain the fused image.

Averaging Fusion Rule: Low frequency coefficients stand for the background of an image, so the operation of the low frequency coefficients from visible and infrared images is the basis of image fusion. In this paper low frequency coefficients of the images are averaged for the combination of the two backgrounds. The equation is as follows:

$$W_j^a = \alpha * W_{Aj}^a + \beta * W_{Bj}^a \quad (1)$$

$$W_j^d = \begin{cases} W_{Aj}^d, & \left|W_{Aj}^d\right| \geq \left|W_{Bj}^d\right| \\ W_{Bj}^d, & \left|W_{Aj}^d\right| \leq \left|W_{Bj}^d\right| \end{cases} \quad (2)$$

i) To fuse approximation sub-sets, average is implemented as an alternative of averaging.

$$A_i(new) = average(A, B) \quad (3)$$

3. RESULT AND DISCUSSION

The Puzhal river image in rainy season of size 512x512 is considered as Image 1, and RGB Puzhal river image in summer season image of size 512x512 is taken as Image 2 are shown in Figs. 3 and in Fig.4, respectively. One level and two level decomposition using Framelet transform for both the images are shown in Figs.5 and 6. Y, U, V components of image 2 are shown in Figs.7, 8, and 9, respectively. One level and two level decomposition using Framelet transform for both the images are shown in Figs.10 and 11.

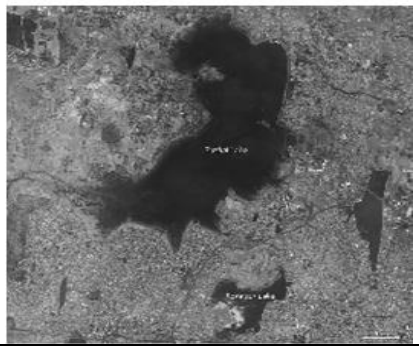

Fig.3. Image1 (Rainy season)

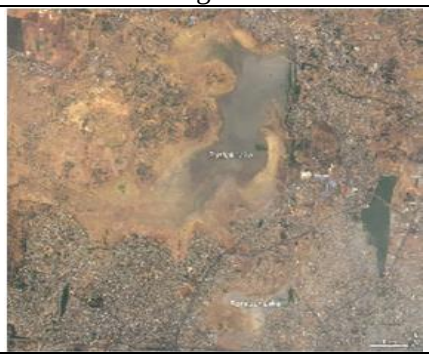

Fig.4. Image2 (Summer season)

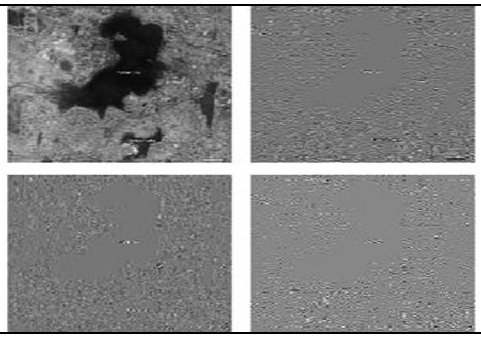

Fig.5. One level Framelet for Image 1

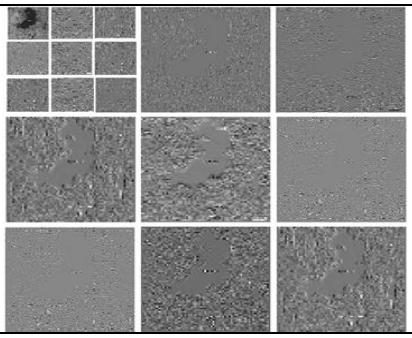

Fig. 6. Two level Framelet for Image 1

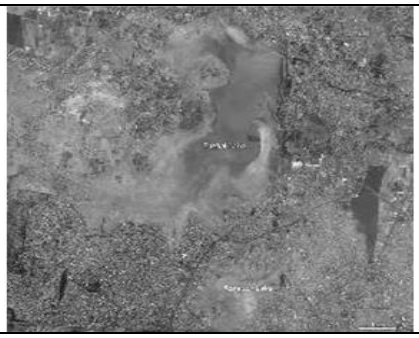

Fig.7. Y component of input image 2

Fig.8. U component of input image 2

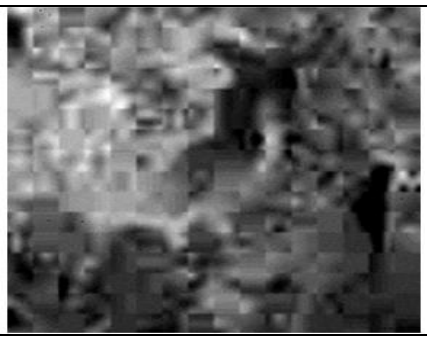

Fig.9. V component of input image 2

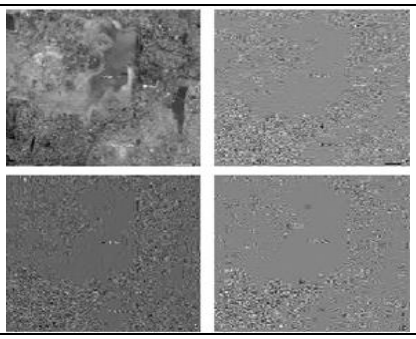

Fig. 10. One level Framelet for Image 2

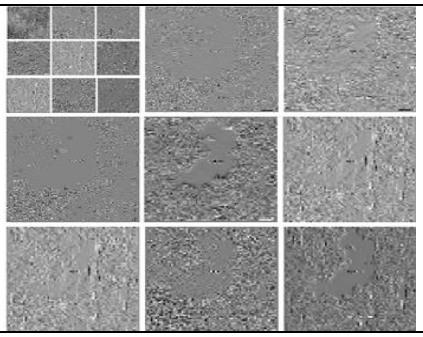

Fig. 11. Two level Framelet for Image 2

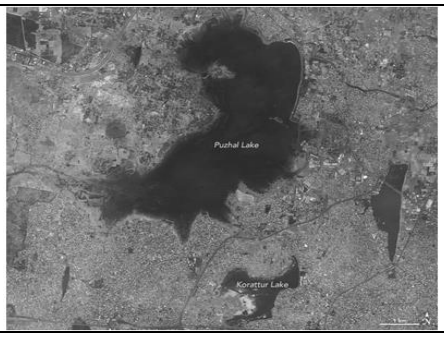

Fig. 12. Output fused image

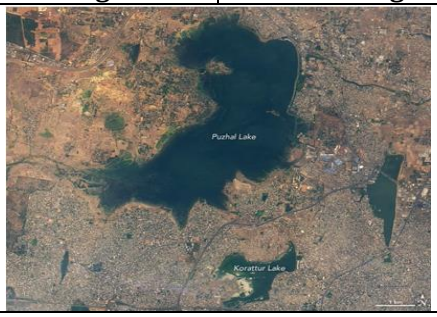

Fig. 13. RGB fused image

The fused image using proposed Framelet Transform is shown in Fig.12. Fused RGB image is shown in Fig.13. The values are tabulated in table.1. PSNR, Similarity Measure and MSE are calculated for the above and compared with Multiwavelet Transform and tabulated in table.1.

Table.1. Performance comparison of proposed Framelet and Multiwavelet (MWT) for PSNR, Similarity Measure and MSE

Images	MSE		PSNR(dB)		Similarity Measure	
	MWT	Framelet Transform	MWT	Framelet Transform	MWT	Framelet Transform
Proposed PUZHAL	0.8634	**0.7789**	47.3925	**49.9736**	0.9665	**0.9894**
INSAT	0.8987	**0.7667**	46.2819	**48.7301**	0.9572	**0.9865**
LANDSAT	0.8817	**0.7458**	46.7319	**49.3692**	0.9657	**0.9851**
PAN - MS	0.8681	**0.7324**	47.2815	**49.1875**	0.9591	**0.9826**

4. CONCLUSION

In this paper, Framelet Transform based image fusion and Averaging contrast based fusion technique is presented for Puzhal River in rainy and summer seasonal images. Simulation results arrived using MATLAB reveals that the supremacy of the proposed Framelet Transform technique to Multiwavelet. This fusion technique found to be successful for the fusion in the survival of intrusion.

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