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Image Fusion of Remote Sensing Kerala Flood Images based on DWT with Multiple Wavelet Families

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Abstract:

Image fusion plays a key role in image processing for retaining the required information from various images. This paper presents overall view of an image fusion process of remote sensing images based on DWT with multiple wavelets family. These two images are acquired at different timings by using Sentinel-2 with SAR sensor. Testing images are Kerala flood images which are occurred in the year of 2018. In this regard various types of wavelets filter coefficients such as Haar wavelet, Daubechies wavelet coefficients (db2), Symlets coefficients, Coiflets coefficients have been employed for performing the image fusion. MATLAB 2017a tool has been used for simulation purpose.

Keywords: *Remote sensing, DWT, Image fusion, Wavelet family.*

I. INTRODUCTION

Remote sensing images are very useful in the field of earth observing process, monitoring and assessment of natural disasters. In this paper two remote sensed images have been taken as testing images of Kerala flood images. One image is before occurrence of the flood and second image is captured after the occurrence of flood. Testing images are captured by Sentinel-2 with SAR sensor where SAR sensor can able to capture the image of the earth in all-weather condition.Not like as the passive sensors, visualizingSAR signal not provides any desired data on the captured scene. It is only that an image will be obtainedafter signal processing. In the year of 2018almost 40 percent of the Kerala state has been damaged due to heavy floods. In this regard remote sensing images played a vital role for monitoring and analysis of the damage. The SAR image usuallydisplays the image in terms of intensity and the pixel in the image gives an information of the reflectivity of the captured target on the ground. In this process two extra steps will be applied in processor output signal those are calibration and geocoding. The calibration results the intensity value which represents the sigma zero (σv) value of the reflectivity.2D drawings display .from drawings are the established design and drafting format and used in all engineering and architectural industries.

Generally, image fusion technique has been used to extract spatial information from the two or more images. It is well known fact that the image fusion process could be used for merging multiple images where the resulting image contains the required information. Usually, in the process of image fusion various types wavelet filter coefficients have been used such as Haar wavelet, Daubechies wavelet coefficients (db2), Symlets coefficients, Coiflets coefficients. Each wavelet filter coefficients family has its own advantages and disadvantages. Testing images are SAR images with intensity measure. DWT has been opted for image fusion purpose

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where it represents both time and frequency. Wavelet filter coefficients have been selected from various wavelet families.

The entire paper structure consists of IV sections. Section II deals with basic theory of image fusion based on DWT and section III deals with the results and discussion and section IV deals about the conclusion.

II. Image Fusion Using DWT

Generally various wavelet families have been used for performing the image fusion. Fig1 shows the process of single level 2dimensional DWT. Two images are applied as input images and IDWT will be [1-6] performed to attain the original image from the fusion image.

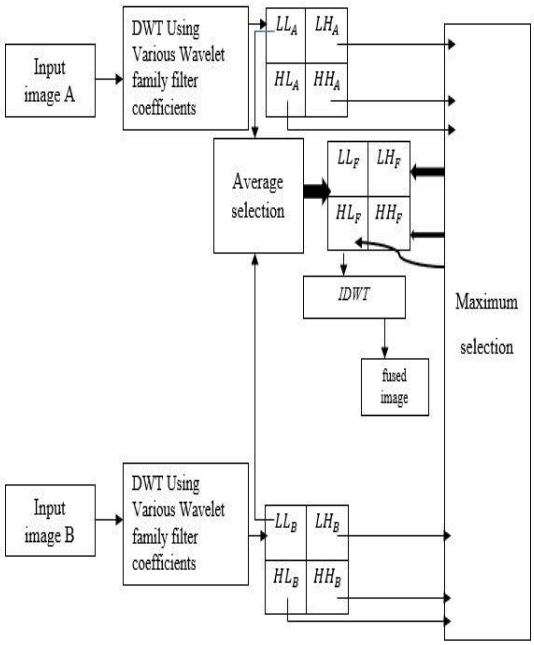

Fig .1. Single level 2D-DWT process

As depicted in fig 1 Kerala image before flood as applied as input image A and Kerala image after flood as applied as input image B. The resulting fused image consisting of average of approximation components of two images and maximum of diagonal component. As shown in fig 2 various wavelet family filter coefficients have been utilised for performing image fusion.

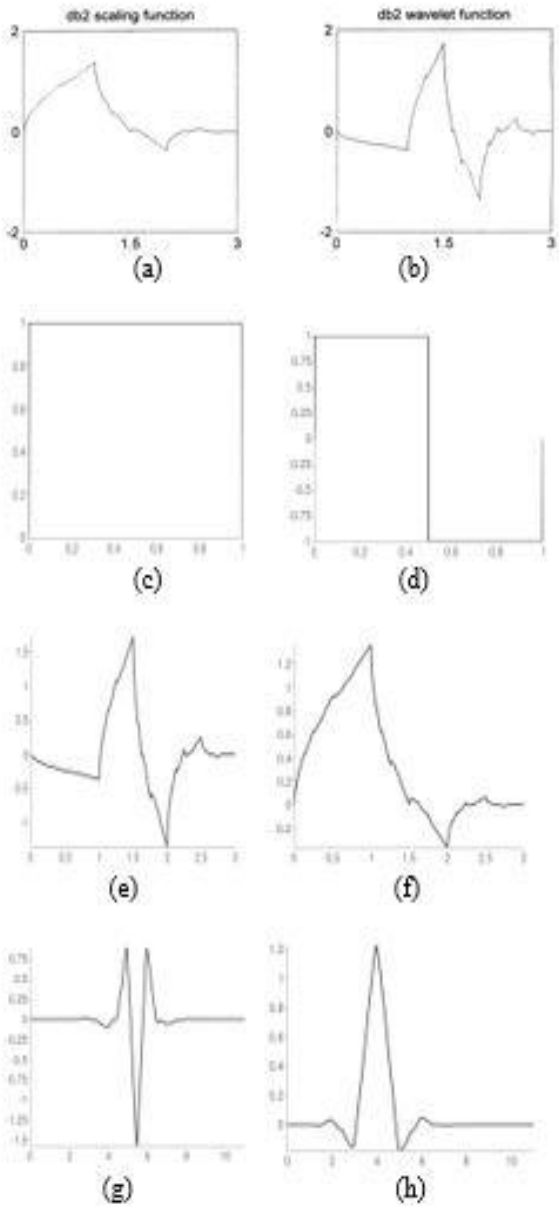

Fig .2. Various Wavelet Families Filter coefficients

Fig 2 (a) and (b) shows scaling function and wavelet function of Daubechies waveletcoefficients respectively. Fig 2 (c) and (d) shows scaling function and wavelet function of Haar waveletcoefficients respectively. Fig 2 (e) and (f) shows scaling function and wavelet function of Symletwavelet coefficients respectively. Fig 2 (g) and (h) shows scaling function signal and wavelet function signal of the Coifletswaveletcoefficients respectively.

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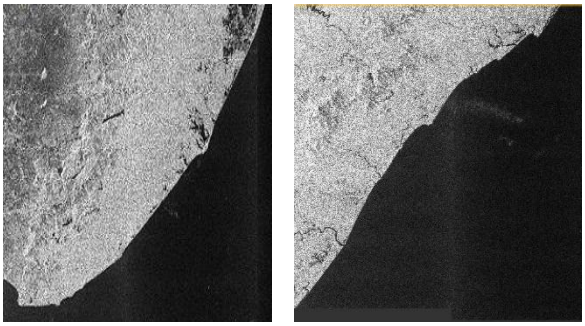
III. Results and Discussions



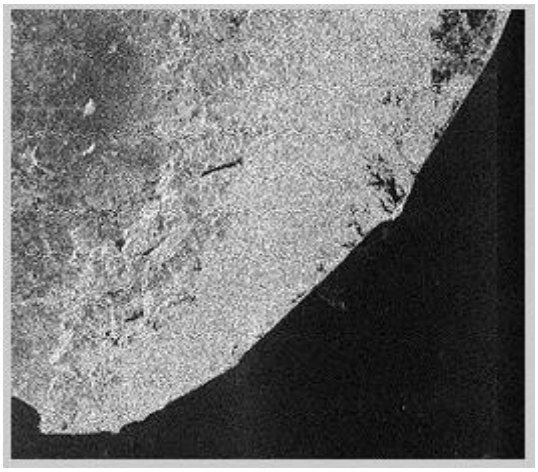
(a) (b)

Fig .3. Input images (a) Before flood (b) After flood

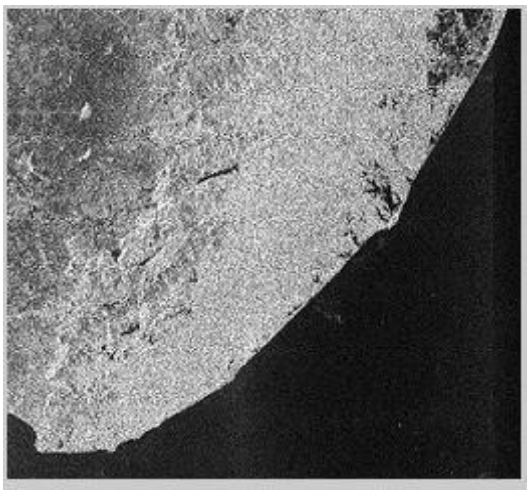
In fig.3. (a) shows the image before flood which was captured on 09-08-2018 by Sentinel-2 using SAR sensor. Fig.3. (b) shows the image after flood which was captured on 14-08-2018 by Sentinel-2 using SAR sensor. The resulting images by using multiple wavelets is illustrated in Fig.4.

(a) Image fusion using Haar wavelet

(b) Image fusion using Daubechies wavelet



(c) Image fusion using Coiflets wavelet



(d) Image fusion using Symlet wavelet

Fig. 4. Fusion images based on multiple wavelets

As illustrated in fig.4. (a) shows the resulting image of DWT process with Haar wavelet coefficients. As illustrated in fig.4. (b) shows the resulting image of DWT process with Daubechies2 wavelet coefficients. As shown in fig.4. (c) shows the resulting image of DWT process with Coiflet wavelet coefficients. As depicted in fig.4. (d) shows the resulting image of DWT process with Symlet wavelet filter coefficients [7-10].

As illustrated in fig 4 dark colour can visible in the image capture after the flood. This the main important property of SAR sensor image where due the less intensity of the reflected signal from the target. The reason for getting less intensity in capture image is water contains more dielectric constant.Therefore, due to floods more water flows

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and that water will be visible as dark colour in the captured image.

IV. Conclusion

Finally, by using various wavelet families filter coefficients image fusion has been performed. The corresponding output images are shown in Fig 4. Hence image fusion of satellite images has been performed by using various wavelet families filter coefficients.

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