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Image Fusion Using Absolute Maximum Fusion Rule Using Biorthogonal Wavelet Transform

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Abstract*: In this work, I am proposing method of image fusion uses the biorthogonal wavelet transform for decomposing and reconstruction of the source images. The overall fusion scheme based on biorthogonal wavelet transform .Firstly, we decompose source images of same scene using Biorthogonal wavelet transform (BWT) and then coefficients obtained are merged using absolute maximum selection fusion rule. We have used wavelet and scaling functions used in BWT for decomposition of source images. The selection of proper wavelet for decomposition varies from application to application. Although vanishing moment and regularity (smoothness) of wavelet can be considered to decide wavelet function. For image fusion application, selection of wavelet with sufficient vanishing moment is desired. Therefore, we have used biorthogonal filters to get desired number of vanishing moments. The coefficients obtained by decomposition of source images are fused using absolute maximum fusion rule.Image fusion is the technique to combine relevant information from two or more than two images of the same scene into only one composite image that is more informative and which is mostly suitable for human and machine interaction..*

Keywords–*Image Fusion, Biorthogonal Wavelet Transform, Fusion Rules*

1. INTRODUCTION

Sometimes Texture Identification is not done accurately when images are captured from no. of sensing devices. So, there is requirement of such a technique of identification which can identify texture correctly even when images captured from many sensing devices. Images of the same view from sensors having different characteristics and resolution, at different time provides complementary information about that view. Image fusion is an image processing technology, which produces a new integrated image with retaining the essential feature of these images. Image fusion is used to combine retrieved information from two or more images of the same view into one composite image which is more informative and effectivefor human and machine interaction. This paper makes the modest suggestion that Biorthogonal Wavelet Transform based Image Fusion is such a beneficial technique of image fusion which produces a new integrated image and retaining the important feature of these images. Research into getting a new integrated composite image using image fusion with the help of various wavelet transform methods such as Biorthogonal Wavelet Transform is required and hopes to have inspired others to use image fusion in for effective and accurate image identification.

2. PROPOSED SCHEME

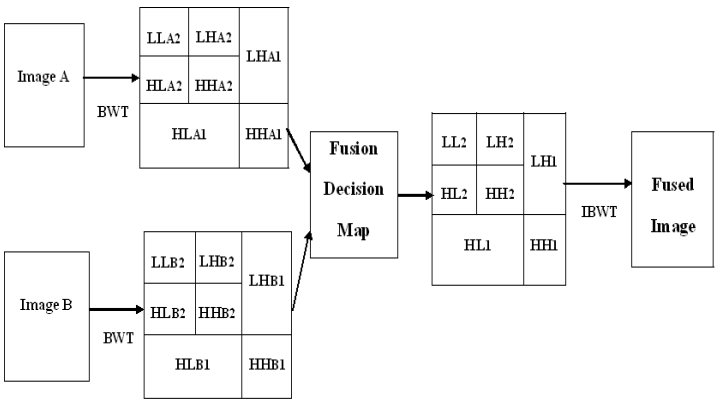

Fig.1: Block diagram of proposed system

The proposed method of image fusion uses the biorthogonal wavelet transform for decomposion and reconstruction of the source images. The overall fusion scheme based on BWT is shown in Fig 1.
Firstly we decompose source images of same scene (can have different focusing and modality) using Biorthogonal wavelet transform (BWT) and then coefficients obtained are merged using absolute maximum selection fusion rule. We have used wavelet and scaling functions used in BWT for decomposition of source images. The selection of proper wavelet for decomposition varies from application to application. No general selection criteria for wavelet and scaling function is available in literature. Although vanishing moment and regularity (smoothness) of wavelet can be considered to decide wavelet function. For image fusion application, selection of wavelet with sufficient vanishing moment is desired. Therefore, we have used biorthogonal filters to get desired number of vanishing moments. The coefficients obtained by decomposition of source images are fused using absolute maximum fusion rule.

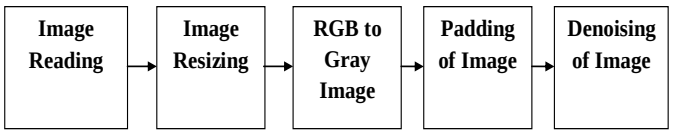

Fig.2 Image processing before passing to wavelet transform

2.1 BWT (Biorthogonal Wavelet Transform)

Perfect reconstruction is available for Biorthogonal Transform. Orthogonal wavelets give two parameters: orthogonal matrices and unitary transforms; biorthogonal wavelets also give two parameters: invertible matrices and perfect reconstruction. The Low pass and high pass filters does not have the same length for biorthogonal wavelet filter. The low pass filter is always Symmetric, but high pass filter is symmetric or anti symmetric. It allows unusual flexibility for choosing a filter for any task which involves multiresolution analysis and synthesis. Using this method, one can choose low pass filter for multiresolution filtering.Firstly we decompose source images of same scene (can have different focusing and modality) using Biorthogonal wavelet transform (BWT) and then coefficients obtained are merged using absolute maximum selection fusion rule. We have used wavelet and scaling functions used in BWT for decomposition of source images. The selection of proper wavelet for decomposition varies from application to application. No general selection criteria for wavelet and scaling function is available in literature. Although vanishing moment and regularity (smoothness) of wavelet can be considered to decide wavelet function.

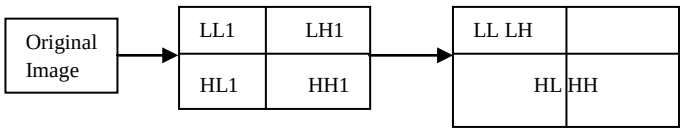

Fig 3. Process of decomposing using BWT of an image

The symbol L refers to low pass filter and H indicates high-pass filter respectively. LL refers the approximation sub-band & LH, HL and HH are the detailed sub-bands. LL is low frequency sub-band that gives global description of an image having directional features. Horizontal coefficients (LH) refers to the low-frequency component in horizontal direction and the high-frequency component in the vertical direction. DWT based wavelet transform gives better multiresolution analysis when compared to other wavelet transform. It has better time and frequency properties. It is used in image processing field. Its characteristic in one dimension can not be improved to two dimensions or multi-dimension. Separable wavelet has limited directivity which was spanning by one dimensional wavelet.The most common form of transform based image fusion algorithms is wavelet fusion algorithm as it has simplicity and also capability to save frequency and time details of the images that are to be fused. Some requirements can be imposed on the fusion result. The fused image have to preserve all relevant information which contained in input images. Fusion process should not introduce artifacts that can distract human observer or any other image processing steps. In the fused image some of the irrelevant features and the noise should be suppressed to maximum value. When fusion is done at pixel level, input images are combined without any preprocessing. There are two scaling functions in Biorthogonal case as $\phi, \tilde{\phi}$, that may

generate different multiresolution analyses, and two wavelet functions$\psi, \tilde{\psi}$. Hence, the numbers *N*and *M* of coefficients in scaling sequences $a, \tilde{a}$may differ. The scaling sequences should satisfy biorthogonality condition

$$\sum_{n\in\mathbb{Z}} a_n \tilde{a}_{n+2m} = 2 \cdot \delta_{m,0} \tag{1}$$

Then wavelet sequences can be determined as

$$b_n = (-1)^n \tilde{a}_{M-1-n} \qquad (n = 0, \ldots, N-1) \tag{2}$$

$$\tilde{b}_n = (-1)^n a_{M-1-n} \qquad (n = 0, \ldots, N-1) \tag{3}$$

2.2 Image Fusion and Its Techniques

Pixel level fusion is the technique includes information associated with each picture element. In the fused image, each pixel value is obtained from the corresponding pixel values of original images. Source images are divided into regions and some features (like pixel intensities, edges or texture features) in feature level fusion and these features are used for fusion process. Decision level fusion is high level fusion technique which uses decisions coming from various fusing sensors. Decision level fusion methods are based on some statistics, voting, fuzzy logic, prediction and heuristics etc.Image fusion is used to combine relevant information from two or more than two images of the same view into one composite image which is more informative and suitable machine and human interaction. Sometimes Texture Identification is not done accurately when images are captured from no. of sensing devices. So, there is requirement of such a technique of identification which can identify texture correctly even when images captured from many sensing devices.Images of the same view from sensors having different characteristics and resolution at different time provides different information about the view. Image fusion is an enhanced image processing technology, which produces a new integrated image with retaining the essential feature of these images. This paper makes the modest suggestion that Biorthogonal Wavelet Transform based Image Fusion is such a beneficial technique of image fusion which produces a new integrated image and retaining the important feature of these images. There are different techniques of Image Fusion are available such as: Spatial Domain Method Principal Component Analysis (PCA), Sharpness Criteria, Linear Fusion, and Wavelet Domain Method**.**Wavelet domain methods are genrally used because it gives multiresolution analysis.

2.3 I*B*WT (Inverse Biorthogonal wavelet transform)

After BWT sub band coding diffrent low and high bands are obatined after low pass filtering and high pass filtering.these subbands from two images are obatined and fused with image fusion technology and then pass for inverse biorthogonal wavelet transform to obatin reconstructed original image.

3. APPLICATIONS

The object of image fusion of MRI and PET images is toget a high spatial resolution image with the functional and structural information about bodies of people and animals [6].In the forensic labs, Image fusion is used to identify and recognize theft from different fingerprints images. In optical remote sensing fields, multispectral (MS) image contains the color information which is produced by three sensors which covers the RGB (red, green and blue) spectral wavelengths.

4. RESULTS

Proposed system is used when different images captured from the same scene using sensing devices and decomposed and fused using first some spatial domain methods and then Biorthogonal Wavelet Transform (BWT) in which Absolute Maximum Fusion Rule is we are going to usefor fusion**.**

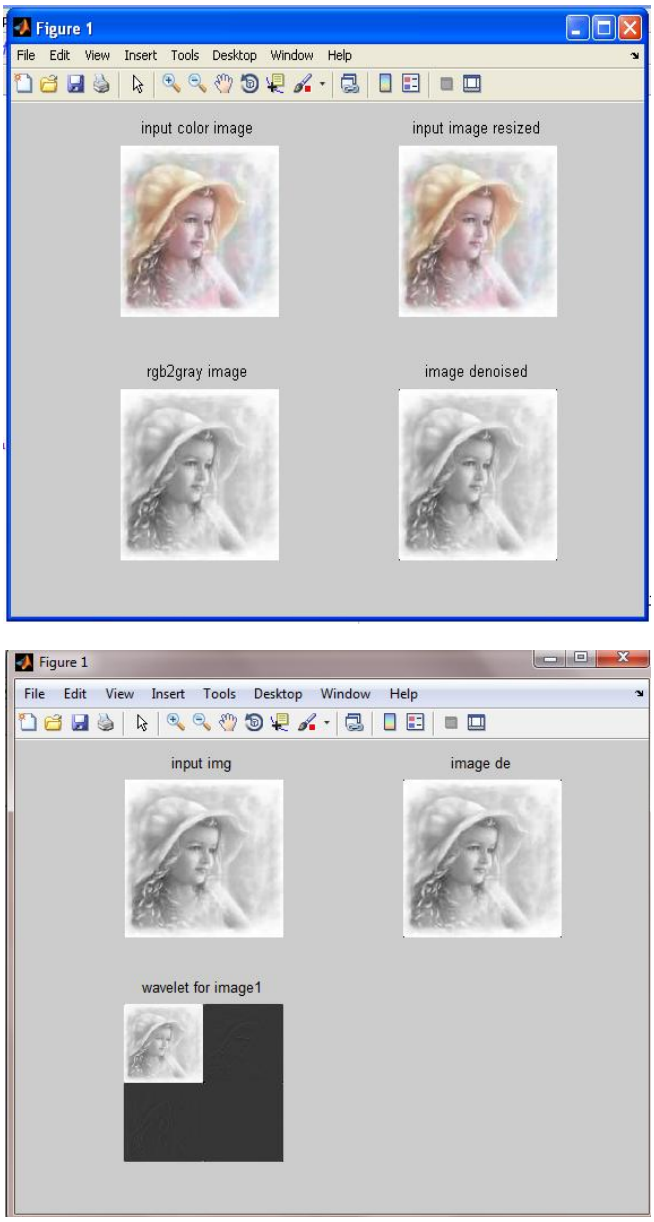

Fig **4**. Results

Biorthogonal wavelet transform is applied on images to obation sub band coding which gives diffrent low and high pass bands.As level of BWT increases then dimenshionality reduction is obtained.Diffrent transform like haar ,daubeshian are als o tested. Images are read. Resizing of the images into standard format is done. Applied functions to convert RGB to Gray Image. Padding zeros at the two dimensions of images is done.Denoised the images to remove the noise.BWT processing also happens with diffrent levels and diffrent transforms..Further processing is going on.

5. CONCLUSION

In this paper, I propose a pixel-level image fusion scheme using multiresolution Biorthogonal wavelet transform (BWT). Wavelet coefficients at different decomposing levels are fused using absolute maximum fusion rule. Two important properties wavelet symmetry and linear phase of BWT have been exploited for image fusion because they are capable to preserve edge information and hence reducing the distortions in the fused image

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