A Proposed Method of Medical Image Fusion using Non-Subsampled Counterlet Transform and Wavelet Transform

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Abstract— Fusion of image is describe combination of two or more source images from different modals or instruments into a more information single images. Fusion of medical image is important role in medical treatment and diagnosis. There are many transform based image fusion methods are NSCT, DWT, Curvelet and Counterlet Transform are define accurate image and high frequency. Improve the science information technology, image fusion are used to process multiple images from different sensors [2]. Image fusion is a process by combining two or more source images from different modals or instruments into a more information single images. This paper defines the combination of Non Sub-sampled Counterlet Transform (NSCT) and Discrete Wavelet Transform (DWT) both are to be sufficient and effective for image fusion. Medical Image Fusion is to derive the information from multimodal medical image data. For medical diagnosis, Computed Tomography (CT) provides the accurate information on denser issue with less distortion. Magnetic Resonance Image (MRI) provides good information on soft tissue with more distortion [3]. Two methods, NSCT and DWT are covers the decomposition of fusion algorithms fusion of medical image of CT and MRI, implementation of fusion rules and fusion image quality form. The image fusion is performance based on the root mean square error (RMSE), Entropy and peak signal to noise ratio (PSNR).

Key words: Fusion, NSCT, DWT

I. INTRODUCTION

Image fusion is represents the most moderrn, accurate and useful diagnostic techniques in medical imaging. Image fusion can define different purposes, the main goal of fusion is spatial resolution enhancement or image sharpening. Define the objective of image fusion is to combination of information from different images of the same scene in to a single image retaining the important and required features in to a single image retaining the important and required features from each of the original image Medical image processing is a challenging, complex and interesting area of research for scientists from last three decades with the invention of different imaging sensors like X-ray, MRI (Magnetic Resonance Imaging), CT (Computed Tomography) scanners etc. Interest of researchers in medical imaging describes a different range of applications like denoising, registration, classification, segmentation and fusion. Unlike other applications, of medical imaging, image fusion[2].

The main goal of medical image fusion is to obtain a high resolution image with as much and accurate details as possible for diagnosis of disease and better medical treatment [5]. For medical diagnosis, MR and CT images are define important of main concern, both images represents special sophisticated characteristics of the organ to be imaged. CT image provides detail information about dense structure such as bones and MRI image provides better information about soft tissue. Although here two methods are define the combine the fusion by using NSCT and wavelet transform. NSCT is refers the Non Sub-sampled Pyramid (NSP) and the Non Sub-sampled Directional Filter Banks (NSDFB) and wavelet transform is refers to decomposition of low and high frequency using fusion rule to fused images [3]. NSCT is to finding the proper and accurate the multidirectional and multiscale of transforms have been successfully used to image fusion in recent years, NSCT is a shift-invariant version of the contourlet transform into image fusion field. The wavelet based transform approach for the fusion of computed tomography (CT) and magnetic resonance images (MR) images based on wavelet transform has been represented. Fusion rules are then performed and define on the wavelet coefficients of low and high frequency portions. So, it is easily analysis and to develop and the efficiently automatic image fusion system analysis to doctor's workload is decrease and improve the consistence of diagnosis [3].The main motivation of image fusion these new multiscale transformations is to define the proper and accurate information of the image of the medical image fusion and retrieve exact information to treatment of illness [6].

II. EXISTING METHODS

A. NSCT:

NSCT is a kind of multiscale and multi-direction computation framework of the discrete images. It can be define divided by two stages including non-subsampled pyramid (NSP) and non-subsampled directional filter bank (NSDFB). These refers stage define the multiscale property by using two channel non-subsampled filter bank, and one low and high-frequency image can be produced at each NSP decomposition level. This refer of subsequent NSP decomposition stages are carried out to decomposition of low-frequency component available iteratively to capture the singularities in the image. As a result describe, the NSP can result in k+1 sub-images, which consists of one low and high-frequency images having the same size as the two source image where represents the number of decomposition levels.

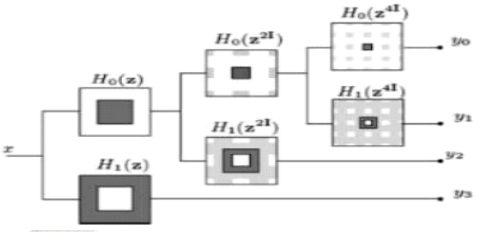

Fig. 1: Three-stage non-subsampled pyramid decomposition.

Fig.1 Defines the NSP decomposition with different levels. The NSDFB is two channel non subsampled filter banks they are worked by combining the directional fan filter banks.

NSDFB define the direction decomposition levels with stages in high-frequency images refer NSP at each scale and produces directional sub images with the same size as the source image.

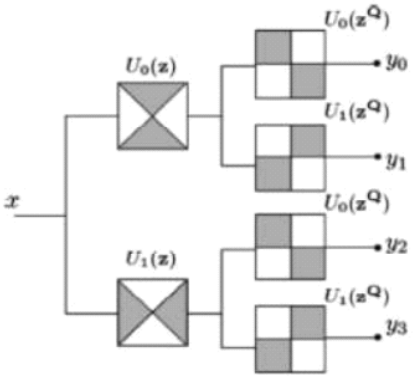

Fig. 2: Four-channel non-subsampled directional filter bank.

Here, the NSDFB represents the NSCT with the multidirectional property and define us with more precise directional details information. A NSDFB four channel constructed with two-channel fan filter banks is illustrated in Fig. 3.[2].

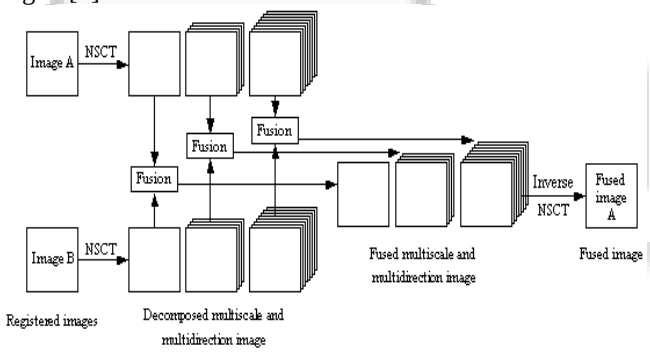

Fig. 3: The image fusion framework based on the NSCT.

The image fusion approach is as work: Taking two images are geometrically registered to each other. First define the NSCT to decompose the image A and B into multiscale and multidirection images. Then using different fusion rules to fuse the low and high frequency parts. Finally, the fused image F is reconstructed by inverse NSCT is shown figure 3[4].

B. Wavelet Transform:

Wavelet transforms is a framework is describe signal is decomposed, with each level corresponding to resolution of coarser or lower and higher frequency bands. Wavelet transform is invertible and non redundant [3].

The DWT is refers to a spatial-frequency decomposition that provides a flexible multiresolution analysis of an image. Discrete wavelet transform (DWT) is mostly used wavelet transform for fusion of image. It provides better and proper directional selectivity three ways like in horizontal, vertical and diagonal directions and has accurate image representation [3]. Here Maximum and weighted average fusion rules are applied for fusion of different source images using DWT. Another approach for image fusion is describe based on Lifting wavelet transform (LWT) [9] using modulus maxima criterion.

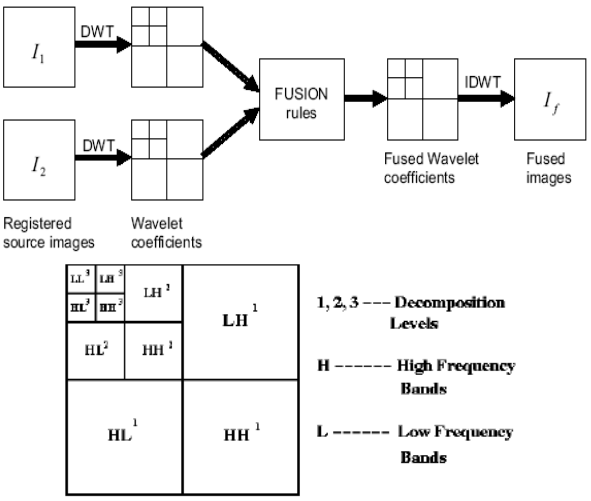

Fig. 4: image fusion scheme using the wavelet transforms.

A wavelet transform is desribe to the result of imagine in a four-component image: a low-resolution component (LL) and three ways of horizontal (HL), vertical (LH), and diagonal (HH) wavelet coefficients which contain information of local spatial of data detail. The low resolution component is then replaced by a selected band of the multispectral image. This process is continue repeated for each band then all bands are transformed. A reverse wavelet transform is process to the components of fused to create the fused multispectral image [3].

C. Curvelet:

Curvelet transform define a multiscale and directional transform of useful for analysis of image edges having curve shape objects and retrieve information. The curvelet transform primary based on wrapping is a multi-scale pyramid consisting of different orientations and different positions in frequency domain. It uses define the use of Fast Fourier transform (FFT) in special spectral domain. Whenever using FFT, both image and curvelet at a given scale and orientation are transformed into the Fourier domain. After computation process, we refers to a set of curvelet coefficients by applying inverse FFT to the spectral product. This set contains curvelet coefficients of image in ascending order of the scales and orientations. Figure define the steps of applying fast discrete curvelet transform based on frequency wrapping[7].

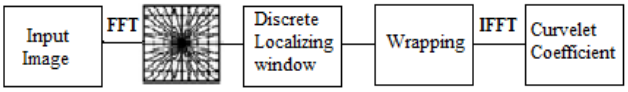

Fig. 5: Steps of Fast discrete curvelet transform based on wrapping.

D. Counterlet Transform:

The contourlet transform is most recently and important geometrical image transforms, which can define efficiently, represent images containing contours and textures. The image fusion framework using contourlet transform. First, the source images were decomposed using contourlet transform. Then, the low and high-frequency components were processed unique. Supposed that refer the original images are A and B and they have been perfectly co-aligned.

III. PROPOSED METHOD

- Step 1: Take input image (CT and MRI).
- Step 2: Decompose both image by NSCT and Wavelet Transform.
- Step 3: Add NSCT and Wavelet Transform component for CT and MRI image separately.
- Step 4: Use the concept of hybrid fusion on both image.
- Step 5: Reconstruct the fused image.
- Step 6: Obtain the fused image as a output.

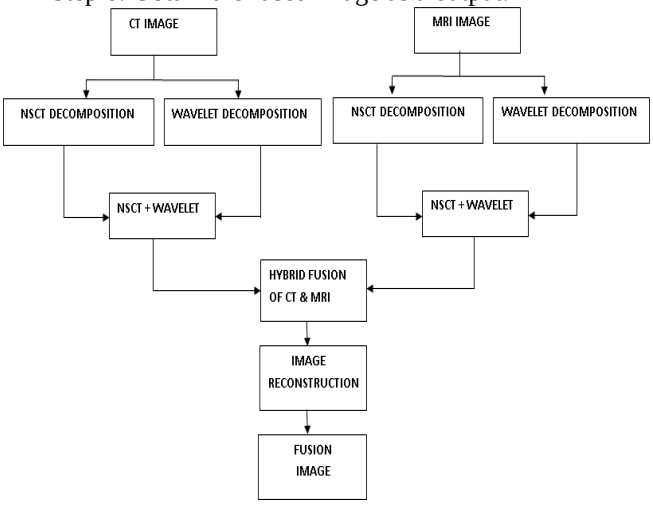

Fig. 4: Proposed method of image fusion of NSCT and DWT

IV. QUANTITATIVE ANALYSIS

Quantitative analysis is define the comparison of different image fusion methods based on NSCT and discrete wavelet transform. In this paper, 3 different parameters are used as follows:

A. RMSE

The RMSE describe the root mean square error which represents the difference in the pixel values between the corresponding pixels of the two images. The RMSE value must be small for better fused image. Here two MxN images S and F, where image S is define a source image and I is the fused image[7].

$$RMSE = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}[S(i,j)-I(i,j)]^2}{M \times N}$$

B. Entropy

The entropy describes richness of information content in an image. Entropy is represents the image is a statistical measure of randomness that can be used to characterize the texture of the input image. The value of entropy should be large for better information in an image[7].

C. PSNR

The PSNR is represents the most commonly used as quality of reconstruction of fused image. It describe the peak signal to noise ratio. So, the value of PSNR must be high for less noise in an image[7]. It is defined as,

$$PSNR = 10 \log_{10}(255^2/MSE)$$

V. CONCLUSION AND FUTURE WORK

Medical image fusion is represents important task of medical imaging to retrieve information from different modality of medical images. In this paper, we read and analysis the different methods like NSCT, DWT, Curvelet Transform and Counterlet Transform. But NSCT and DWT are the good for image fusion so here define the combination of this two methods. New image fusion method based on combine the NSCT and wavelet based transform. We have combine the NSCT and DWT based to fuse CT and MRI image. It provides the framework can be define the decomposition of images and measuring images by the multiscale and multidirection and also the signal is decomposed, with each level corresponding to a coarser resolution or lower and higher frequency bands. This fusion scheme is helpful for better information of image as well as strong features such as multiscale, multidirection, edges, corners etc. On the basis of quantitative analysis, the proposed energy based fusion method is found of better images and modern and accurate results of image.

REFERENCES

[1] M. Nazrudeen, Mrs. M. Rajalakshmi, Mr. S. Sureshkumar "Medical image fusion using Non-Subsampled Counterlet Transform" International Journal of Engineering Research & Technology IJERT, 2014
[2] S. Niveditha, P. Mahalakhmi "NSCT Based Multimodal Medical Image Fusion" International Journal of Research and Development in Engineering,IJRDE,2014
[3] Hari Om Shankar Mishra, Smriti Bhatnagar, Amit Shukla, Amit Tiwari Medical Image Fusion Based on Wavelet Transform" International Journal of Scientific & Engineering Research ,IJERT,
[4] Lei Tang, Feng Zhao,Zong-Gui Zhao, "The Non-Subsampled Contourlet Transform for Image Fusion" International Conference on Wavelet Analysis Pattern Recognition,IEEE,2007
[5] Hari Om Shankar Mishra,Smriti Bhatnagar,Amit Shukla,Amit Tiwari "Medical Image Fusion Based on Wavelet Transform" International Journal of Scientific & Engineering Research, IJSER,2014
[6] Shutao Li, Bin Yang, "Hybrid Multiresoltion Method For Multisensor Multimodal Image Fusion", IEEE Sensor Journal,IEEE,2010
[7] Anjali A.Pure, Neelesh Gupta, Meha Shrivastava, "Wavelet and Fast Descrete Curvelet Transform for Medical Application", IEEE, 2013
[8] Sudeb Das, Malay Kumar Kundu, "Fusion of Multimodality Medical Images Using Combined Activity Level Measurement and Counterlet Transform.
[9] Deepak Kumar Sahu, M.P. Parsai, "Different image fusion –A Critical review", International Journallof Modern Engineering Resarch,IJMER, 2012
[10] A, Soma Sekhar, Dr. M. N. Giri Prasad, " A Novel approach of Image Fusion on MRI and CT images using Wavelet Transform",IEEE,2011
[11] http:/en.wikipedia.org/wiki/Medical_Image_Fusion_information

