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Fusion Technique for Medical Images Using Hybrid Transforms

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ABSTRACT: The increased accuracy level in all the present systems is making tremendous changes in the newly developed modules. In this paper we have developed a system for medical image fusion with greater accuracy as compared other methods. This is achieved by combining two transform levels in the proposed method. We have combined Discrete Wavelet Transform (DWT) and Discrete Hartley Transform (DHT) for the purpose of efficient Accuracy in terms of entropy and PSNR. Magnetic Resonance imaging (MRI) and Computed Tomography (CT) image database is used for the fusion. Mean based fusion rule is used for the fusion process. Parametric comparison is provided between these calculated Parameters of proposed method and previously developed methods.

KEYWORDS: Discrete Wavelet Transform (DWT), Discrete Hartley Transform (DHT), Mean based fusion rule, PSNR, entropy level.

I.INTRODUCTION

Present century has come up with various machineries which are playing an important role in all the fields. In medical environment huge intensification is taking place with newer trends. One of the fields is magnetic Resonance imaging (MRI) and Computed Tomography. As we know every system has its own specification and limitations. MRI and CT are used in diagnosis of human body related diseases. MRI consists of information about, organs of the body and tissues. On the other hand CT images goes with internal fabric representation. Both stand good at their own way. But in medical abode applications occur where in, one data should contain structural formation as well as Organs and tissue statistics. In such case a system is required which can deal with both sorts of images.

We do have many structures of image fusion: 1.Fusion of multiview: it lies under fusion of two medical images taken at same time, but from different angles 2.Multi Temporal fusion: it is a type where in two images are amalgamated which are taken at different time slots, based on the difference the disease will be diagnosed. 3. Multi focus based fusion: this is a 3D level fusion. 4. Multimodal based fusion: this is consolidation process for images taken from sensors of different types. Multi modal based consolidation is a process where in two different sensors results are combined to get necessitated outcomes for the conclusion parameters about the diagnosis. Here images from different sensors means, MRI system and CT system sensors. The artefacts of the images are underdamped before the processing. Many more developed methods are introduced till today.

II.LITERATURE SURVEY

In [03] author has given a discussion for integration of images using PCA and wavelet. Image co-efficient are calculated for synthesis purpose. Mathematically proved algorithms are used here to make proper fusing of outlets of medical instruments. To represent results in fundamental way, author has displayed structural similarity index and fusion factors in results section for the betterment of the topic clarification. Quadtree based fusion technique [04] is also been considered as enhanced performance, for the fusion of image based on the focused regions in the fields. In [06] superimposed method for integrity of images is given. Here spare representation and multi scale transform are unified for the merging purpose of high pass bands and low pass band. Process is done by following six different sets of MS transforms and comparison on parameters is provided. Keeping the accuracy and execution time in the consideration reference [07] has added a methodology which is working with images of different sectors and fused together with less CPU time. Here work is developed for multispectral (MS) sensors and hyperspectral sensors with

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low resolution. Dimensionality is reduced in this method to make efficient results with better PSNR value. Integrity of different combination is given in this paper and every fusion has given parametric comparison in the result part. In [08] multilayer images are consolidated with each other. Here pixel to pixel consideration is done for the higher accuracy. Representing signal sparse information, generated co – efficient are merged with each other at cases where in the pixels are over lapping.

This conserved the performance time by fusion only relevant blocks in the image. Huge range of comparison is plotted by considering around six parameters which are concluding towards the result that: proposed method suits for the pixel level fusion development. Multi resolution Biorthogonal transforms are also been used in the fusion techniques with some suitable fusion rules [09]. Fusion rules are the part where in some mathematical equations are applied on the image for the generation of one set of results using two variables. In this proposed method accuracy is maintained by using some wavelet symmetry and BWT based linear phase, this will maintain the edge information and reduces the distortion of the resultant images. Gaussian noise verification is also performed in this method. By calculating Gaussian effects in the image, fusion quality is increased in the resulted images. For the higher efficiency than this deviation calculation scan also be added to existing system.

III.PROPOSED SYSTEM

In the proposed system, we are using hybrid fusion technique by combining two transform performances into one block. Every transform has its own convincing factors; by combining two we are able to generate better performance. We have selected Discrete Wavelet Transform (DWT) and Discrete Hartley Transform (DHT).

Discrete Wavelet transform is the co-efficient generator based on loss pass and high pass value for rows and colons individually, resulting co-efficient will be containing the information of the original image. Similarly Discrete Hartley Transform is generating co-efficient based on the multiplication of vectors of matrix. Matrix here maintains N x N dimensions. Applying some fusion rules on this co-efficient image integrity is performed.

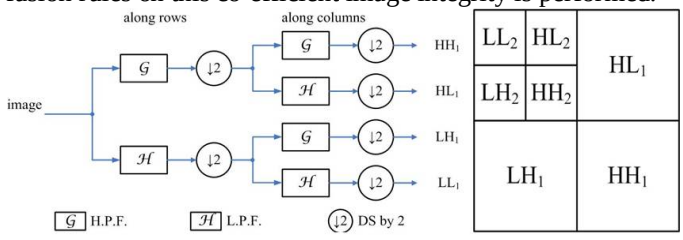

Figure 1: Basic Block of DWT

IV.IMPLEMENTATION

The proposed system is developed for the fusion of MRI and CT images. Images integration is not a straight forward work, as technically we can't simply merge two images. Hence images have to transform from one format to another for the proper fusion. We have used two transforms for the transformation of images from one form to another: specifically from time to frequency domain. Here co-efficient are developed for the image information. These co-efficient are nothing but the relevant information about the images. DWT generates four bands i.e. LL, LH, HL and HH band. In these four bands LL has the exorbitant amount of information. Most of the work can be directly implemented by using this one band. LL band is the coefficient generated by applying low pass filter to the rows and then resultant values are passed through the high pass and low pass filter which finally will generate LL band. This information is used and processed for the fusion purpose.

To perform Computed Tomography image and magnetic Resonance imaging integrity we have considered images of both kinds. Individual processing begins with consideration of the images. Both kinds of inputs have to be brought to same size that can be processed easily. Initially DWT is applied on both sorts of images. This transform will generate co-efficient in four bands i.e. LL, LH, HL, HH. As LL band has higher information we consider LL among all four. This informatics passed to DHT transform. Applying two transform in this way makes hybrid combination of the system that in turn will increase the accuracy of the fused results. Fusion of the image is done by considering co-efficient value; we are going with mean value of both co-efficient values. That means; mean calculation is performed for the individual values in the co-efficient. Mean value is replaced as a new value in the matrix. In this way new

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matrix is formed by calculating mean of all the elements in the matrix of both kinds. Resulted matrix is in the form of frequency, frequency is not the original format for the image or any input. Hence inverse of transforms has to be applied for the reconstruction of the image with new matrix value. Once the inverted matrix is generated the fused image can be displayed. Visually we can't give performance verification. For this reason we are doing some parametric calculations in the proposed method. We are dealing with entropy and PSNR calculations. The flow of the proposed method is given in the figure 1 below.

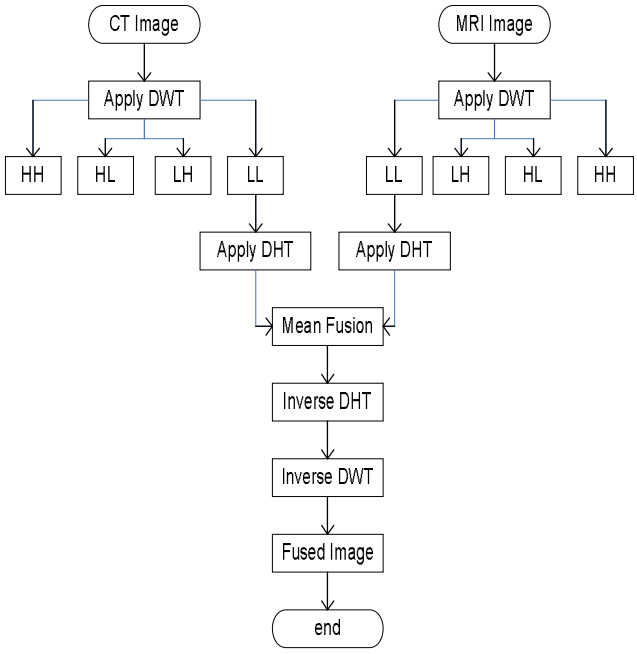

Figure 2: Flowchart of the Proposed System

Discrete Wavelet Transform (DWT)

Image is formation of pixels. Here each pixel carries a digital equivalent intensity level. We get highly correlated information between adjacent pixels. These pixels with information are transformed to frequency domain in the form of bands using DWT. Discrete wavelet transform is a form of transforms, that generates LL band, LH band HL band and HH band. A general block of DWT can be given as follows.

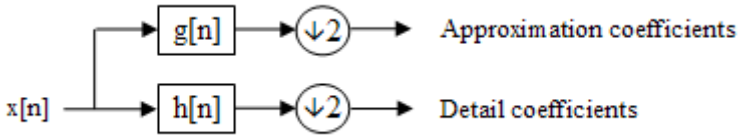

Figure 3: Basic Model of Dwt

For the given input Approximate and detail co-efficient are generated. Number of levels for DWT is not fixed. We can proceed with any number of levels for DWT. Decomposing of the input is done by the use of filters. Approximate and detailed results are generated by low pass and high pass filters respectively. Down sampling of result is performed according to Nyquist's rule.

Discrete Hartley Transform (DHT)

DHT is the algorithm that calculates the Discrete Hartley Transform of a real sequence. Time and frequency indices run from 0 to N-1 in this algorithm. Its invertible factor makes this transform more stable property that can be applied on images for the transformation. Here vector multiplication is performed between two vectors of the matrix. Considering factors here are; matrix has to be a square matrix i.e. N x N must be the dimensions of the matrix. Multiplication has

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to be performed for vectors of matrix, individually for rows and colons. Following is the equation followed for the implementation of DHT.

$$H_K = \sum_{i=0}^{N-1} g_n \left[\cos\left(\frac{2pi}{N} iK\right) \sin\left(\frac{2pi}{N} iK\right)\right] \quad (1)$$

Where K = 0, 1… (N-1) Real and complex values are formed which are having relevant information about the input image. Combining the result for rows and colons into one single matrix at final iteration we will be generating final matrix.

V. RESULTS

Proposed method is implemented with given specifications. Successfully fusion of two images i.e. MRI image and CT image is performed. The resulted image is fused one that contains both the information of MRI and CT image. Fused image has cumulative information which reduces the analysis time.
Resulted image parameter calculation is done for the verification of the final output. We have done PSNR and entropy calculations for the proposed method and comparison between existing systems PSNR and entropy vs. proposed system is done. The comparison has given the outcome as, our proposed method is giving better performance than the previously developed methods.

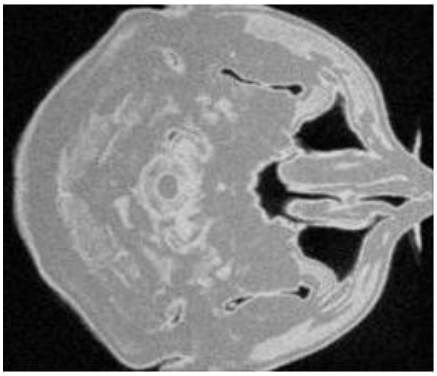

Figure 4: Input CT Image

Above figure is the input CT image. That contains the information about the structures of the targeted part. CT dataset is collected for the fixed targeted part for the fusion purpose.

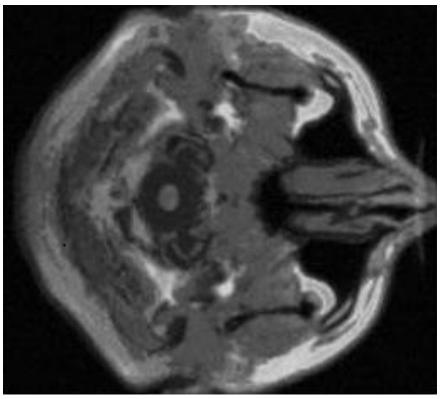

Figure 5: Input Image of MRI

Above figure is the input MRI image. That contains the information about the internal organs of the targeted part. As CT dataset MRI dataset is also collected for the same target element.

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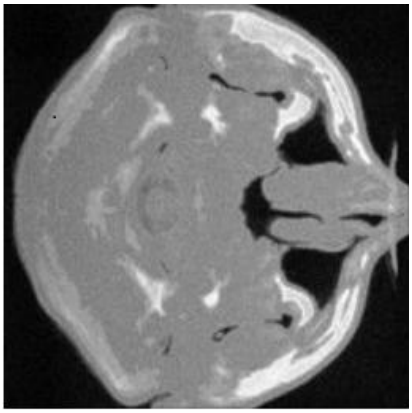

Figure 6: Fused Image

The resulted integrated image is show in the figure 3. Which has structural as well as organ based information of the targeted particle.
Table is given below which is doing comparison between proposed method and existing systems. Comparison is done for the PSNR values. The better the value of PSNR efficient is the system.

Parameters	Entropy	PSNR
Select maximum	6.63	29.56
Select minimum	2.89	23.25
Simple average	4.23	27.32
Principle compnt	6.34	36.12
Laplace transform	7.45	39.24
Wavelet transform	7.77	29.33
Curvelet transform	8.54	38.77
Proposed		45.6

TABLE 1
PARAMETER COMPARISON FOR ENTROPY AND PSNR

VI.CONCLUSION

The proposed method is integration of two different parametric images. Transforms are used for the transformation of the form from one type to other. This changed form will help to do the variations with the inputs. Changes here mean that, we have applied fusion rule to the co-efficient. Mean value based fusion is done. To check the performance of the system parameters of the fused image are calculated. PSNR of fused image is 45.6. That is better than previously developed values. Hence hybrid fusion technique is best suitable form for the image fusion. Here advantages of two transforms make the system more stable and reliable.

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