Oriental Journal of Computer Science & Technology Vol. **4**(1), 195-199 (2011)

Hybrid Multi Resolution Method of Image Fusion for Medical Image Processing

P. SELVAPERUMAL

ME CSE, VELTECH Dr. RR & Dr. SR Technical University, Chennai (India).

(Received: February 03, 2011; Accepted: March 14, 2011)

ABSTRACT

Image fusion is a process of combining multiple input images of the same scene into a single fused image, which preserves relevant information and also retains the important features from each of the original images and makes it more suitable for human and machine perception. The reason for going onto image fusion is that, in the medical image processing, different sources of images produce complementary information and so one has to fuse all the sources of images to get more details required for the diagnosis of the patients. In this method the raw data is the MR scan image of a patient's brain which is observed at different angles or resolutions. The images possess both different as well as common information with respect to each other. Thus when these images are fused together the redundant images are neglected and the complementary images are added thereby producing an accurate diagnosis with a single image.

Key words: Image Fusion, Transform, Segmentation, Filter Bank, NSCT

INTRODUCTION

The aim of this project is to detect all the information needed for the perfect diagnosis of brain tumor which is scientifically named as "Ewing Sarcoma". The main principle that is used behind this detection is the Region Based Image Fusion. This image fusion algorithm is applied on the Magnetic Resonance (MR) scan image the human brain.

The objective of the multimodality image fusion is to combine the complementary and redundant information from multiple images and generate one image which contains all the information which is present in all the source images so the resultant fused image has a better description than any other individual image. All the complementary information which is not present simultaneously in the single MR image can be observed in one image simultaneously which is a fused image using our proposed algorithm.

Problem defenition

Image fusion is the combination of two or more different images to form a new image by using a certain algorithm. The combination of sensory data from multiple sensors can provide more reliable and accurate information. It forms a rapidly developing area of research in remote sensing and computer vision. Most of fusion approaches were based on combining the multi scale decompositions (MSD's) of the source images. MSD-based fusion schemes provide much better performance than the simple methods studied previously. Due to joint information representation at the spatial-spectral domain, the wavelet transform becomes the most popular approximation in image fusion. However, wavelet will not "see" the smoothness along the contours and separable wavelets can capture only limited directional information.

Existing sytem

A number of image processing tasks are efficiently carried out in a domain other than the

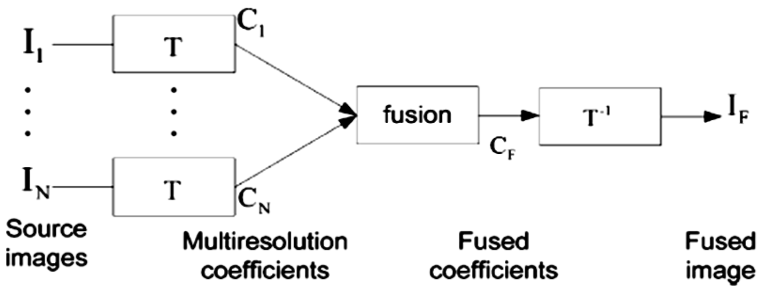

Fig. 1: Basic structure of Image fusion method

pixel domain, often by means of an invertible linear transformation. This linear transformation can be redundant or not, depending on whether the set of basic functions is linear independent. By allowing redundancy, it is possible to enrich the set of basic functions so that the representation is more efficient in capturing some signal behaviour. Imaging applications such as edge detection, contour detection, de-noising and image restoration can greatly benefit from redundant representations.

In the context of multi scale expansions implemented with filter banks, dropping the basis requirement offers the possibility of an expansion that is shift-invariant, a crucial property in a number of applications. For instance, in image de-noising via thresholding in the wavelet domain, the lack of shift-invariance causes pseudo-Gibbs phenomena around singularities. As a result, most of the state-of-the-art wavelet de-noising routines use an expansion with less shift sensitivity than the standard maximally decimated wavelet decomposition.

Demerits

- Pixel based technique, leads to loss of image information i.e., even some small part can contain very important information.
- It produces many coefficients with larger significant coefficient.
- A single fusion technique only used for both high and low coefficient.
- Possibilities of data loss
- Time consuming

Proposed system

The usage of the proposed system will be effective when compared to the existing system. The proposed system is designed in such a way that any one with a little knowledge of computers can easily work with it. It also provides the best and effective results out of less complexity and in a very short time. Therefore, the project will help the system to store and retrieve the image proficiently. First, source images are decomposed into sub images via NSCT.

The source images are decomposed by the NSCT in to low frequency NSCT $^{(L)}$ and high frequency coefficients NSCT$^{(s, d)}$

$$E^{\mathrm{NSCT}}(i,j) = \sum_{s=1}^{S}\sum_{d=1}^{D}\left(\mathrm{NSCT}^{(s,d)}(i,j)\right)^2$$

Secondly, salience measure is computed. Thirdly, salience measure-maximum-based rule and average rule are employed to obtain high-frequency and low-frequency coefficients, respectively. Finally, fused image is reconstructed by inverse NSCT.

Any region based algorithm has many advantages over pixel base algorithm like it is less sensitive to noise, better contrast, less affected by mis-registration but at the cost of complexity. In the pixel based algorithm we treat all the pixels independently but more or less in the practical application, we are interested into regions or objects rather than individual pixels. To overcome the above mention problem of pixel based fusion scheme, proposed a method considers region information of image for fusion process. The merits of the proposed system includes the following

- Contourlet Transform produces few significant coefficients for the signals.

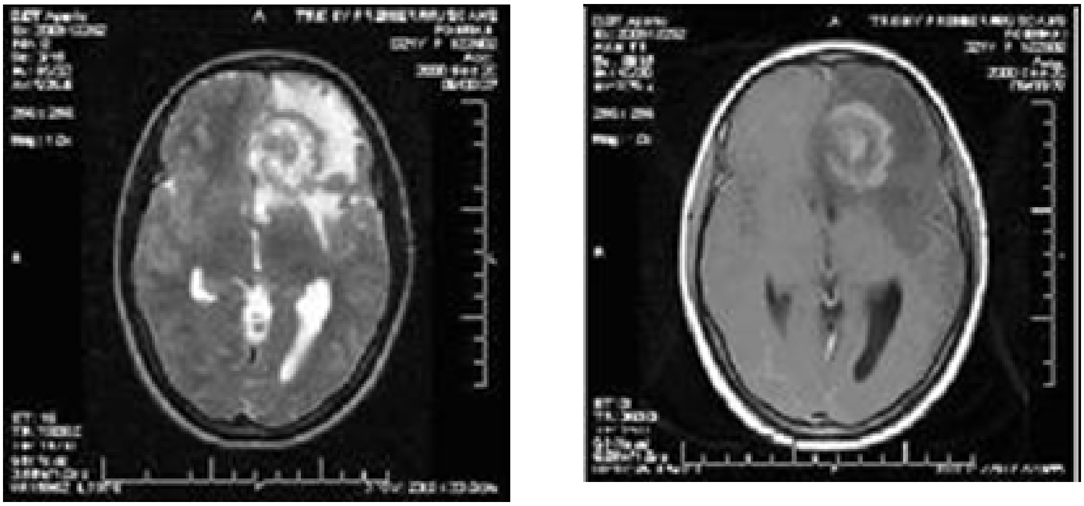

Fig. 2: Input MRI scan Images

- Fusing low frequency and high frequency coefficient using different suitable multiresolution method can improve the performance of image fusion.
- Fused output image is better for human and machine interpretation.
- Region based image fusion technique gives fastest and efficient processing, and then it reduces the Blurring and Noise effects.
- It minimizes the consumption of time

System process

The two images are given as input to NSCT filter banks and are transformed to the required format using the transform and fed as input to the segmentation block. This segmentation block is the responsible one for separating the images into regions required for processing. The reason for K-Mean Clustering segmentation, out of many methods present is that it provides an unsupervised segmentation and ensures maximum severability of the gray levels of the image

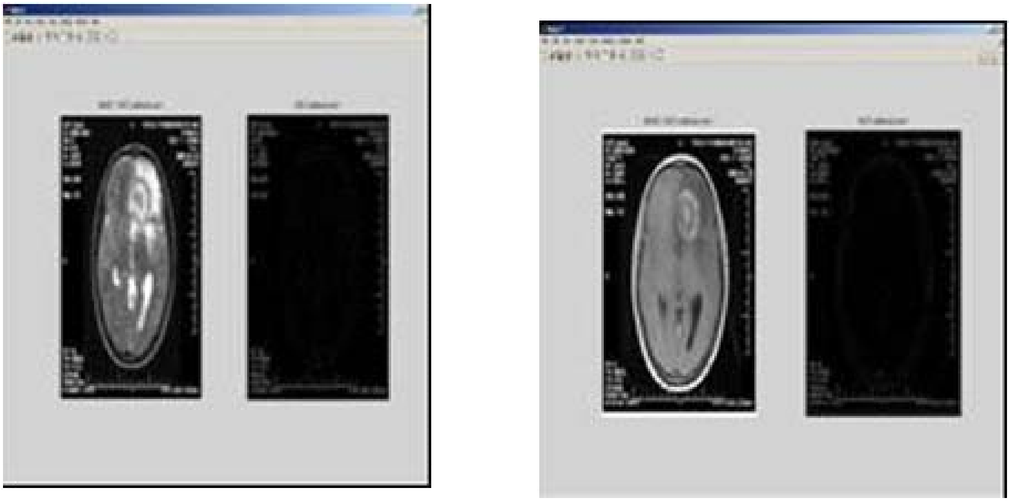

Fig. 3: Low frequency and high frequency scanned input images

The next step is the activity level measurement. It is the study of useful information in an image by splitting the images into different regions of small size. It is denoted by R. This is calculated for each region and the results are observed for next phase or step.

The next phase in this project is the Decision Mapping. This step is based on the activity level of the split regions. Based upon the value got as output the regions are named as white region or black region or in simple words ‘image’ or the ‘background.’ Then this image is being sent on for Inverse Transform. It is the final step of the whole process where the image is reconstructed back to its original form but has only desired components and devoid of any harmonics or noises present earlier.

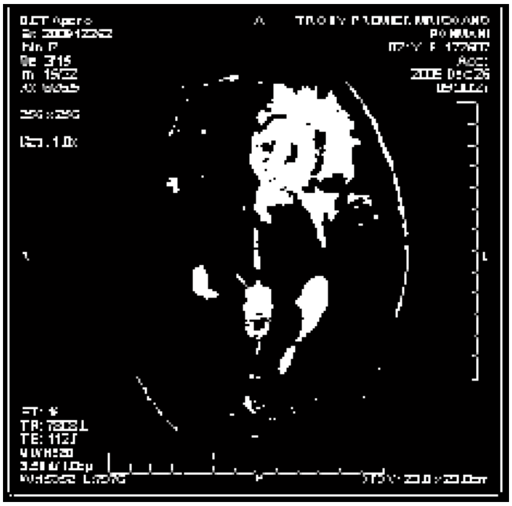

Fig. 4: Decision mapping of MRI scan Images

The stepwise description of project is stated as follows:

Step1

Take NonSubsampled contourlet transform of the source images A &B.

Step2

Then images are fused based on the coefficient images form NSCT.

Step2

Select the threshold level to apply the segmentation method on the coefficient fused images and find segmented image IsegL and IsegH.

Step3

As per the regions of the extracted from the segmented image, the corresponding regions of detail coefficients are taken into consideration to find out activity.

Step4

The regions with maximum activity are selected from the corresponding coefficients and decision map is constructed.

Step5

Choose max or averaging is done on the coefficient images.

Step 6

All the coefficients of the fused image are given to inverse NSCT transform

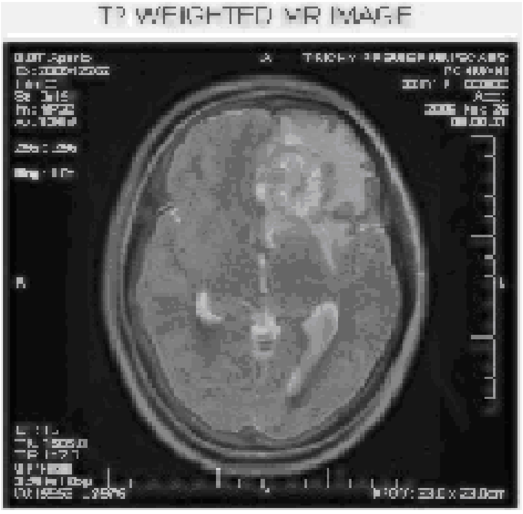

Fig. 5: Final fused MRI scan Images

All the complementary information which is not present simultaneously in the single MR image can be observed in one image simultaneously which is a fused image using our proposed algorithm. The usage of the proposed system will be effective when compared to the existing system. It also provides the best and effective results out of less complexity and in a very short time. It has been observed that simulation results of our proposed algorithm is consistent and preserves more information.

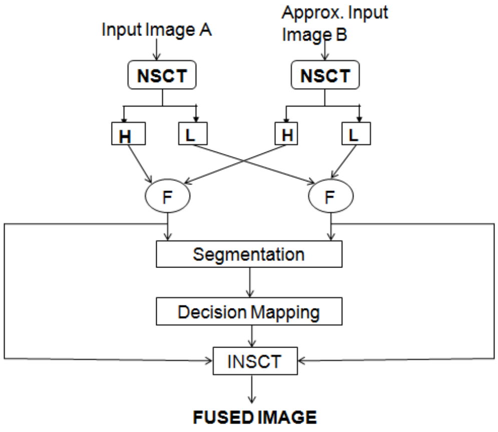

Fig. 6: Overview of system process

CONCLUSIONS

The NonSubsampled Contourlet transform built upon nonSubsampled pyramids and nonSubsampled directional filter banks can provide a shift invariant directional multi resolution image representation. These two images are efficient in high and low frequency images, these frequency images are fusion. The final fusion image is more informative.

REFERENCES

1. Bin Yang & Shutao Li, 'Multifocus Image Fusion and Restoration with Sparse representation', *IEEE Transaction on Instrument and Measurement*, **59**(4): 884-892 (2009).
2. M.A. Balafar, A. R. Ramli and S. Mashohor 'Edge-preserving Clustering Algorithms and Their Application for MRI Image Segmentation', *International MultiConference of Engineers and Computer Scientists*, 1: 103-105 (2010).
3. Tanish & Mukesh Zaveri,"Region Based Image Fusion for Detection of Ewing Sarcoma', *International Conference on Advances in Pattern Recognition*, **7:** 240-243 (2009).
4. X.li, M.he, M.Roux 'Multifocus image Fusion based on redundant Wavelet Transform', *IET Image Process*, 2010, **4**(4): 283-293 (2009).
5. Shutao Li, *Member, IEEE*, and Bin Yang 'Hybrid multiresolution method for multisensor multimodal image fusion', IEEE sensor journal, **10**: 1519-1526 (2010).