Implementation of Circuit for Medical Image Fusion

Sanjeev Kumar
Department of Computer Science Engineering
GVIET, Ramnagar,Banur, Punjab, India

Girish
Department of Computer Science Engineering
GVIET, Ramnagar,Banur, Punjab, India

Abstract- Image fusion is the process of combining relevant information from two or more images into a single informative image containing the complementary information from the source images. The objective of image fusion is to keep maximum spectral information from the original multispectral image while increasing the spatial resolution. In this thesis two different modality images are fused using the maximum fusion rules based on the five level wavelet and three level wavelet transforms. Qualitatively five level multiwavelet transform give better performance than three level wavelet.

Keywords – Image, Fusion, MRI , CT.

I. INTRODUCTION

The term fusion means to combine the information acquired in several domains. Image fusion has become a popular technique used within medical diagnosis and treatment. The satellite images fusion[1] is one of the subjects that kept away from studying in Iraq since the availability of different satellite images for same scene taken in different wave bands is the main obstacle among such researches, beside that many of the tools ,decisions that found in this subject literatures are taken without any explanations, from that and in order to provide a base knowledge for that area and to add a contribution to the field of satellite images fusion this thesis was prepared. Earth observation satellite provides data employing different portions of the electromagnetic spectrum at different spatial, temporal and spectral resolutions. For the full exploitation of increasingly sophisticated multisource data, advanced analytical or numerical data fusion techniques are being developed. Fused images may provide increased interpretation capabilities and more reliable results since data with different characteristics are combined. The images vary in spectral, spatial and temporal resolution and therefore give a more complete view of the observed objects. Data fusion is a process that deals with data and information originated from multiple sources to achieve refined /improved information for decision making. A general definition of image fusion is given us "the combination of two or more different images to form a new image by using certain algorithm".

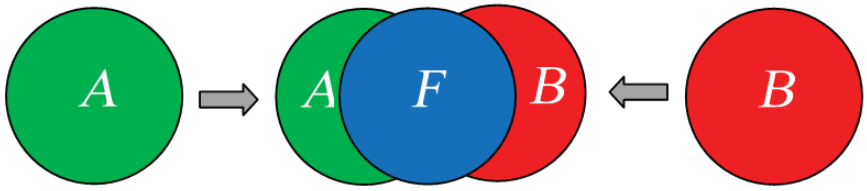

Figure 1. Graphical representation of the image information fusion process

During the process of fusion, the input images A and B are combined into a new fused image F by transferring, ideally all of their information into F. This is illustrated graphically using a simple Venn diagram in figure 1.1.

II. NEED OF IMAGE FUSION

The need for better diagnosis and clear interpretation of the obtained images give rise to image fusion. Image fusion is the process of integrating information from two or more images of an object into a single image. The integrated image is more informative for explanation and analysis. It is possible that several images of same object provide different information based on different resolution and viewing angle, to merge the different information and obtain a new and improved image we have a fusion technique. Fused images can be created by combining information from multiple modalities [2] such as magnetic resonance image (MRI),computed tomography (CT), positron emission tomography (PET) and single positron emission computed tomography (SPECT).

III. LITERATURE REVIEW

Sicong Zheng, (2010) [3], motivated by the potential and promise of image fusion technologies in the multi sensor image fusion system and applications. With specific focus on pixel level image fusion, the process after the image registration is processed, we develop graphic user interface for multi-sensor image fusion software using Microsoft visual studio and Microsoft Foundation Class library.

Wencheng and Faliang, (2011)[4], presented a simple and efficient algorithm for multi-focus image fusion, which used a multi resolution signal decomposition scheme called Laplacian pyramid method. The principle of Laplacian pyramid transform is introduced, and based on it the fusion strategy is described in detail.

VPS Naidu, (2012) [5], used Six different types of image fusion algorithms based on discrete cosine transform. Fusion performance is not good while using the algorithms with block size less than 8×8 and also the block size equivalent to the image size itself. DCTe and DCTmx based image fusion algorithms performed well.

Mirajkar Pradnya P. et al.(2013)[6] discussed that the fusion of images is the process of combining two or more images into a single image retaining important features from each. Fusion is an important technique within many disparate fields such as remote sensing, robotics and medical applications. The result of image fusion is a single image which is more suitable for human and machine perception or further image-processing tasks. The image fusion algorithm based on wavelet transform is proposed to prove the geometric resolution of the images, in which two images to be processed are firstly decomposed into sub images and then the information is performed using these images under the certain criteria and finally these sub images are reconstructed into result image with plentiful information. In this paper three different image fusion methods based wavelet transform are implemented. And the results are compared and best method is found.

Zakaria et al., (2013)[7], in this research is presented a new symmetrical encryption system based on the binary extension of the symmetric encryption system SEC, which transforms the encryption issue into a combinatorial optimization problem using basic tools such as evolutionary algorithms. Their main objective is to change the appearance frequencies of plaintext binary blocks, to make statistical cryptanalysis impossible.

Kusum Rani et al. (2013)[8] discussed that Image fusion is a technique that integrate complimentary details from multiple input images such that the new image give more information and more suitable for the purpose of human visual perception. This paper presents a review on some of the image fusion techniques (simple average, simple minimum, simple maximum, PCA, DWT). Comparison of all the techniques concludes the better approach for its future research.

IV. EXPERIMENT AND RESULT

To see the qualitatively as well as quantitatively performance of the proposed algorithm, some experiments are conducted on several medical images. The effectiveness of the approach has been justified using different images. The results are computed qualitatively (visually) as well as quantitatively using quality measures.
The figures from Figure 2 to Figure 12 are the images of the proposed work which shows the different images which consists of input images and output fused images.
Use a pair of medical images, one Magnetic Resonance Image (MRI) and other is Computed Tomography (CT) image as shown in figure 2 and figure 3 respectively. The MRI, having higher spatial resolution than the CT image, provides anatomical information but without functional activity.

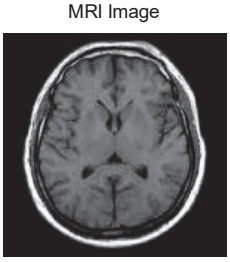

Figure 2 Input image 1

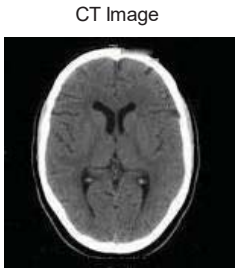

Figure 3 Input image 2

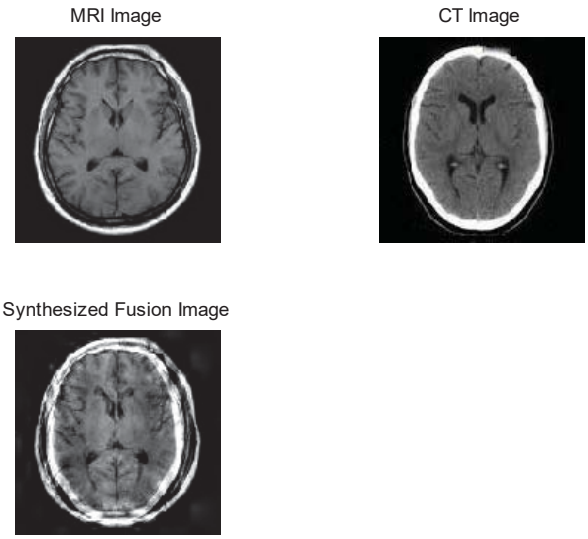

Figure 4 Image fusion at level 5 with max parameters

Figure 4 shows Image fusion at level 5 with max parameters i.e MRI image and CT image are merged using discrete wavelet transform(DWT) at level 5 with maximum parameters which gives the highest quality image.

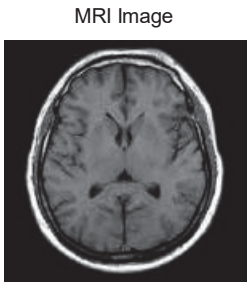

Figure 5. Input image 1

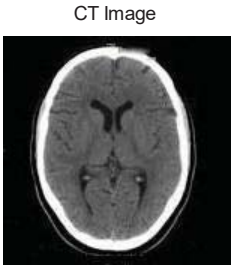

Figure 6. Input image 2

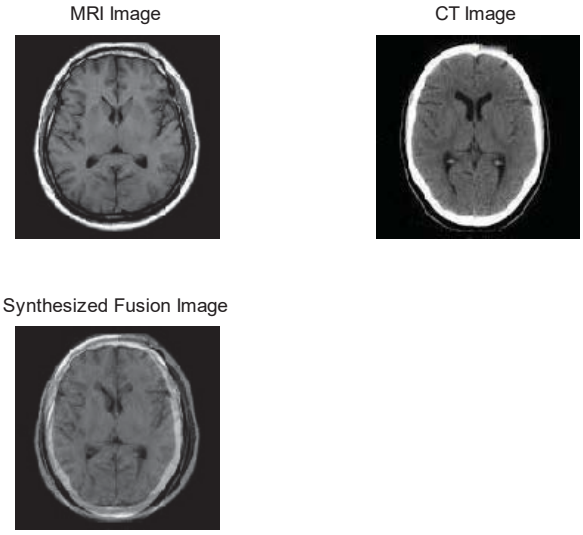

Figure 7. Image fusion at level 5 with mean parameters

Figure 7. shows Image fusion at level 5 with min parameters i.e MRI image and CT image are merged using discrete wavelet transform(DWT) at level 5 with mean parameters which gives the high quality image.

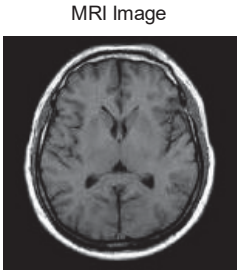

Figure 8. MRI input image 1

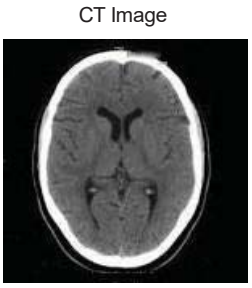

Figure 9. CT input Image 2

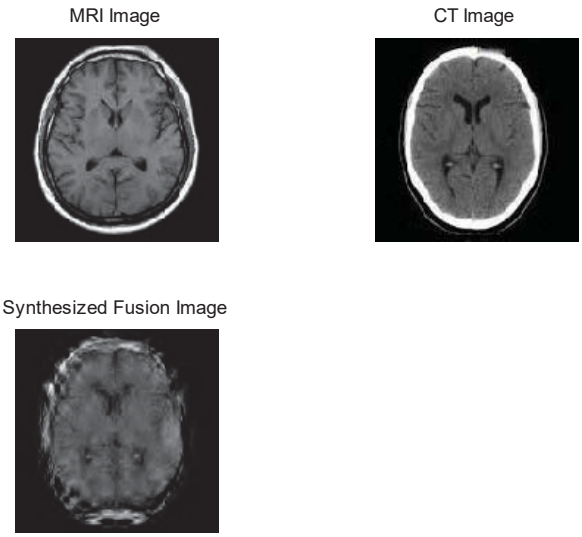

Figure 10. Image fusion at level 3

Figure 10 shows Image fusion at level 3 with max parameters i.e MRI image and CT image are merged using discrete wavelet transform(DWT) at level 3 with maximum parameters which gives the low quality image as compared to images which are shown in figure 4 and figure 7.

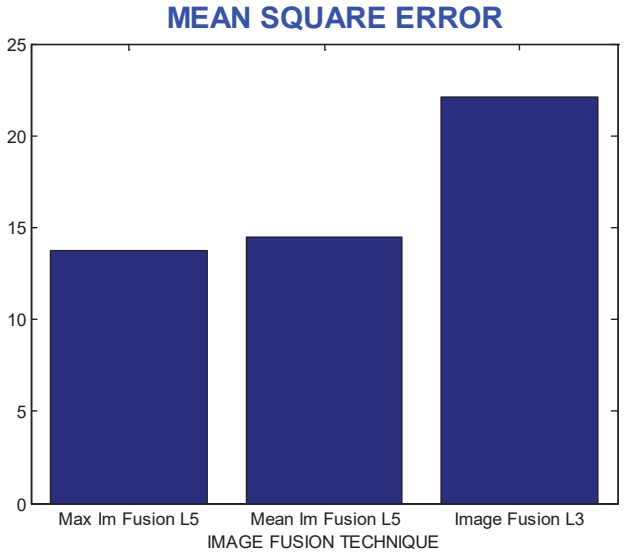

Figure 11. MSE of three fused images

Figure 4.11 shows the Mean square error of three fused images which shows that image fused at level 5 with max parameters give the lowest MSE as compared to other two fused images and image fused at level 3 gives the highest MSE.

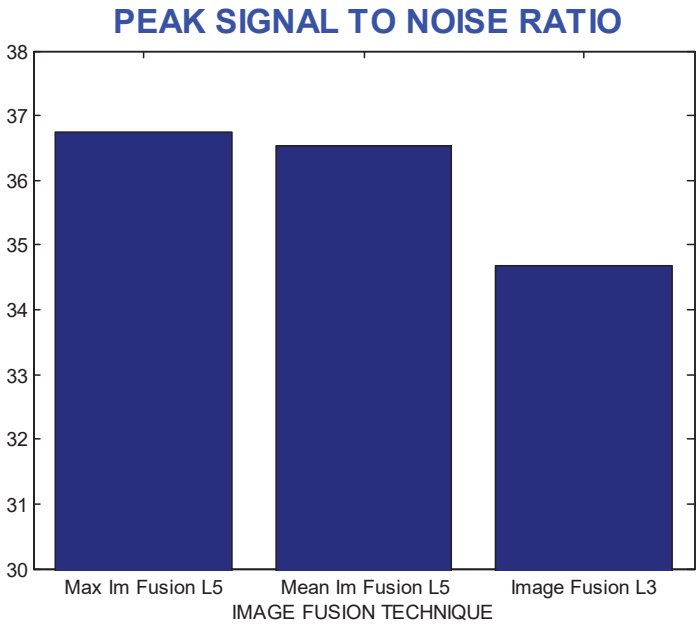

Figure 4.12 PSNR of three fused images

Figure 4.12 shows the Peak Signal to Noise Ratio of three fused images which shows that image fused at level 5 with max parameters give the highest PSNR as compared to other two fused images and image fused at level 3 gives the lowest PSNR.

V.CONCLUSION

Image fusion using wavelet transform are implemented in PC MATLAB and different performance parameters have been evaluated and compared. In this thesis two different modality images are fused using the maximum fusion rules based on the 5 level Wavelet and 3 level wavelet transforms. Qualitatively 5 level multiwavelet transform give better performance than 3 level wavelet.Five level Multiwavelet gives fine edge and boundary details. With proper selection of multiwavelet transform and coefficient may help to improve the quality of the image fusion results.

REFERENCES

[1] Heba Khudhair Abass(2013), “A Study of Digital Image Fusion Techniques Based on Contrast and Correlation Measures”.

[2] Ge Wen , Gao Liqun, “Multi-modality medical image fusion algorithm based on non-separable wavelet,” App lication Research of Computers, Vol. 26, No. 5, May, 2009.

[3] Sicong Zheng," Pixel-level Image Fusion Algorithms for Multi-camera Imaging System", M.Sc. Thesis, Collage of Science, Tennessee University,Knoxville, August 2010.

[4] Wencheng Wang, Faliang Chang, "A Multi-focus Image Fusion Method Based on Laplacian Pyramid ", Journal of Computers, Vol. 6, No. 12, School of Control Science and Engineering, China Dept. of Information and Control Engineering, Shandong University, China, 2011.

[5] VPS Naidu, "Discrete Cosine Transform based Image Fusion Techniques ", Journal of Communication, Navigation and Signal Processing, Vol. 1, No. 1, pp. 35-45, January 2012.

[6] Mirajkar Pradnya P. & Ruikar Sachin D., “Wavelet based Image Fusion Techniques”, International Conference on Intelligent Systems and Signal Processing (ISSP), 2013.

[7] Zakaria K., Fouzia O. and Abdollah A.," Binary Fusion Process to the Ciphering System “Sec Extension To Binary Blocks”", Journal of Theoretical and Applied Information Technology. Vol. 48, No.1, pp.122-130,10th February 2013.

[8] Kusum Rani and Reecha Sharma(2013), “Study of Different Image fusion Algorithm”, International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 5.