IMAGE FUSION ON MR AND CT IMAGES USING DISCRETE WAVELET TRANSFORM

Dr.P.P.Priya[1], S.Harshita[2], M.Soujanya[3], V.Bindu[4], P.Jansi[5]
Electronics And Communication Engineering, Dadi Institute Of Engineering And Technology

[2]18U41A0438@diet.edu.in
[3]18U41A0403@diet.edu.in
[4]18U41A0419@diet.edu.in
[5]18U41A0445@diet.edu.in

Abstract— **Medical imaging has become as one of the most important tools to identify as well as diagnose various disorders. The main objective of medical imaging is to obtain high resolution image details as with as much details as possible for correct diagnosis. There are several medical imaging techniques such as MRI and CT imaging techniques. Both give special sophisticated characteristics of the organ to be imaged. So it is expected that fusion of MRI and CT images of same organ would result in an integrated image of much more details. Many algorithms and tools have been developed for fusing panchromatic and multispectral images. A Image fusion algorithm based on wavelet transform to fuse two images is presented in this project. When images are merged in wavelet space, different frequency ranges are processed differently. It can merge information from original images adequately and improve abilities of information analysis and feature extraction. Wavelet transform of two input images is taken together with fusion rule.**

Keywords: **-Diagnose, Resolution, MRI, CT, Fusion, Panchromatic, Multispectral, Wavelet Transform.**

I. INTRODUCTION

CT and MRI are the most common imaging methods for clinical disease diagnosis, the new patient image acquire by fusing the CT and MRI images will combine the advantages of two imaging techniques and make up the deficiency of single imaging pattern, the fusion image will contain more abundant, visual and comprehensive information, acquiring new diagnosis information by fusion imaging will be helpful for precisely identifying spatial location, size, geometrical shape of lesion and increasing the accuracy of disease diagnosis.

II. LITERATURE SURVEY

The main focus of this paper is first to define a hybrid Transform Domain algorithm based on the two medical Images (CT and MRI images) are fused. This algorithm provides better MSE, PSNR, Entropy and Standard Deviation than other classic algorithms and to reduce uncertain and redundancy, extracting vital information from the source images.

Medical image fusion uses effective wavelet based approach considered by human visual system (HVS) and wavelet co-efficient. Different fusion schemes are used to combining the coefficient by considering low frequency and high frequency band schemes. To avoid noise and guarantee the homogeneity we preferred to window based consistency verification process they are Guassian filter wavelet and curvelet transform filtering performed. After removing of noise through comparative analysis that means which fusion is analysis is better result based on the performance parameter which are principle component analysis (PCA) using fuzzy logic technologies for fusion and compared results by root mean square error (RMSE), signal to noise ration (PSNR) and entropy (H). In this paper, we propose a novel dictionary learning method, called Dictionary Learning with Group Sparsity and Graph Regularization (DL-GSGR). Wavelet-domain medical image denoising using bivariate Laplacian mixture model IEEE Transactions on Biomedical Engineering [11]. In this paper, we proposed novel noise reduction algorithms that can be used to enhance image quality in various medical imaging modalities such as magnetic resonance and multi-detectorcomputed tomography.

III. DISCRETE WAVELET TRANSFORM (DWT)

Unlike the DFT, DWT is invertible, so that the original signal can be completely recovered from its DWT representation. In discrete wavelet transform (DWT) it is important to note the following properties:

Wavelet functions are spatially localized.

wavelet functions are dilated, translated and scaled versions of a common mother wavelet

Each set of wavelet functions forms an orthogonal set of basis function.

For computing the two-dimensional DWT, it is of particular interest for image processing and computer vision applications, and is a relatively straightforward extension of the one-dimensional DWT

$$\boldsymbol{F}(\boldsymbol{a},\boldsymbol{b}) = \int_{-\infty}^{\infty} \boldsymbol{f}(\boldsymbol{x})\, \boldsymbol{\varphi}(\boldsymbol{x})^{*}_{(\boldsymbol{a},\boldsymbol{b})} \boldsymbol{dx}$$

First, we apply a one-level, one dimensional DWT along the rows of the image. Second, we apply a one- level, one-dimensional DWT along the columns of the transformed image from the first step. As depicted in the result of these two sets of operations is a transformed image with four distinct bands: (1) LL, (2) LH, (3) HL and (4) HH. Here, L stands for low-pass filtering, and H stands for high-pass filtering

IV. IMAGE FUSION ALGORITHM

First step in image fusion using wavelet transform consists in extracting the details present in two different resolutions. These structures are isolated into three wavelet co efficient which related to detailed images In wavelet decomposition four components are calculated from different possible combination of row and column filtering and Adding approximate components of image1 to approximate components of image2, similarly adding detail components of image1 to detail components of image2, we will get approximate and detail components of target image. Inverse wavelet transform is applied to the fused components to create the fused image

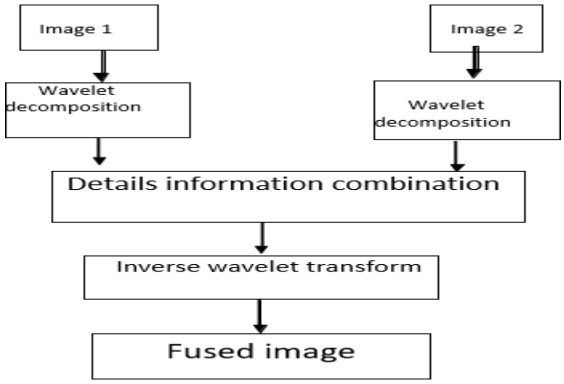

Figure (1): Algorithm for image fusion

V. EXPERIMENTAL RESULT

Fig.(1) and Fig.(2) represents the MRI and CT images of brain of same person respectively. In MRI image the inner contour is missing but it provides better information on soft tissue. In CT image, it provides best information on denser tissue with less distortion but misses soft tissue information. Fig.(3) is the result of orthogonal wavelet fusion technique which is by combining of MRI and CT images. The orthogonal wavelet fused image have information of both Images.

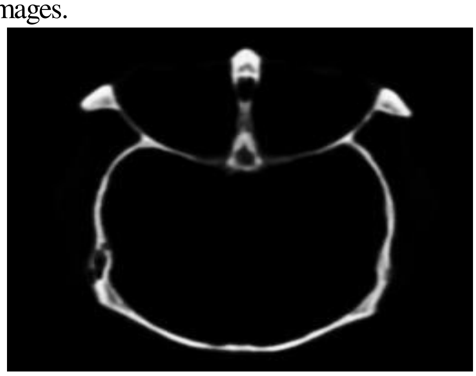

Fig. 1 MRI Image of Brain

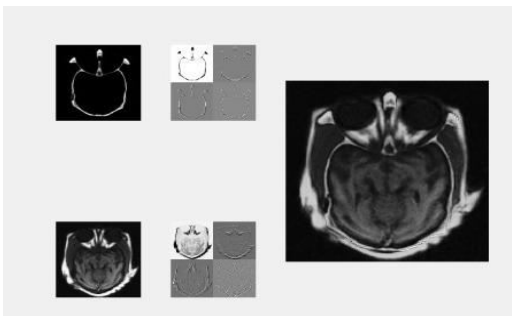

Fig. 2 CT Image of Brain

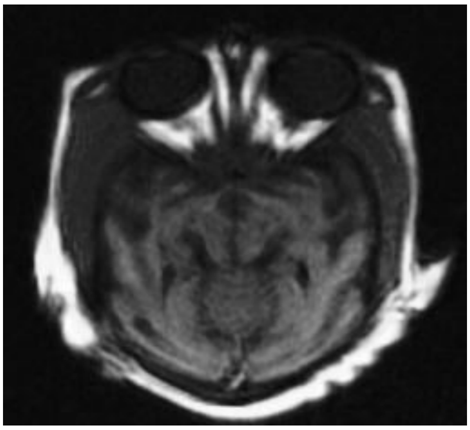

Fig. 3 Fused image

There are hundreds of mother or base wavelets available for decomposition. In practice a mother wavelet is selected from ready-made wavelets for a particular problem and different wavelets ψ. Therefore (x) have different effects. For instance, Harr wavelets are suitable for the representing a piecewise signal and Daubechies wavelets are more suitable for compressing data. The Daubechies series is the most commonly used series for wavelet decomposition. Choice of mother wavelet has an important effect on the decomposition result. Although there are no base wavelets that can give best results, the Daubechies family, in general, has the clearest detection of changes in the energy of distorted signals over the most decomposition bands. Table below gives the percentage ratio of energy of signal A to energy of reference signal at different bands. As can be seen that db6 gives the maximum energy level and best suited for image fusion in medical imaging.

VI CONCLUSION

The aim of this paper has been to fuse MRI and CT images of same organ using wavelet transform. For an effective fusion of images a technique should aim to retainimportant features from all input images. These features often appear at different positions and scales. Multi- resolution analysis tools such as the wavelet transforms are therefore ideally suited to image fusion and thus provide a powerful set of tools for image enhancement and analysis together with a common framework for various fusion tasks. Wavelet fusion method used in this paper reduces the ringing and aliasing effects and makes the image smoother.

REFERENCES

[1] Yong Yang, Dong Sun Park, and Shuying Huang, “Medical ImageFusion via an Effective Wavelet based Approach”.

[2] S. S. Bedi, Rati Khandelwal, “Comprehensive and Comparative Study of Image Fusion Techniques” International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231- 2307, Volume-3, Issue-1, March 2013.

[3] F. E. Ali, I. M. El-Dokany, A. A. Saad, and F. E. Abd ElSamie, “Fusion of MR and CT Images Using The Curvelet Transform” 25th national radio science conference (nrsc 2008) March 18-20, 2008, Faculty of Engineering, Tanta Univ., Egypt.

[4] Mrs. Jyoti S. Kulkarni, “Wavelet Transform Applications” IEEE 978-1-4244-8679-3/11/2011.

[5] A. Soma Sekhar, Dr.M.N.Giri Prasad, “A Novel Approach of Image Fusion on MR and CT Images Using Wavelet Transforms” IEEE 2011.

[6] Y. Zhang, “Understanding image fusion,” Photogramm. Eng. Remote Sens., vol. 70, no. 6, pp. 657–661, Jun. 2004.

[7] Krista Amolins, Yun Zhang, and Peter Dare, “Wavelet based image fusion techniques—an introduction, review and comparison”, ISPRS Journal of Photogrammetric and Remote Sensing, Vol. 62, pp. 249-263, 2007.

[8] Li, H., B.S. Manjunath, and S.K. Mitra, 1995. “Multisensor image fusion using the wavelet transforms”, Graphical Models and Image Processing, 57:234–245.

[9] Jan Flusser, Filip ˇSroubek, and Barbara Zitov´a, “Image Fusion: Principles, Methods, and Applications” Tutorial EUSIPCO 2007.

[10] DR. H.B. kekre, Dr. Dhirendra mishra, Rakhee saboo, “Review on image fusion techniques and performance evaluation parameters” International Journal of Engineering Science and Technology (IJEST) ISSN: 0975-5462 Vol. 5 No.04 April 2013.

[11] Kusum Rani, Reecha Sharma, “Study of Different Image fusion Algorithm” International Journal of Emerging

Technology and Advanced Engineering (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3,Issue 5, May 2013).

[12] Shih–Gu Huang, “Wavelet for Image Fusion”.

[13] Zhiming Cui, Guangming Zhang, Jian Wu, “Medical Image Fusion Based on Wavelet Transform and Independent Component Analysis” 2009 International Joint Conference on Artificial Intelligence.

[14] Sruthy S, Dr. Latha Parameswaran Ajeesh P Sasi, “Image Fusion Technique using DT-CWT” IEEE 978-1-4673-5090-7/13/2013.

[15] Peter J Burt, Edward Adelson, “Laplacian Pyramid as a Compact Image Code”, IEEE Transactions on Communications, Vol Com-31, No. 4, April 1983.

[16] C. Xydeas and V. Petrovic, Objective pixel-level image fusion performance measure, Proceedings of SPIE, Vol. 4051, April 2000, 89-99.

[17] F. Sadjadi, “Comparative Image Fusion Analysais”, IEEE Computer Society Conference on Computer Vision and Pattern Recognition, Volume 3, Issue, 20-26 June 2005 Page(s): 8 – 8.

[18] FuseTool – An Image Fusion Toolbox for Matlab 5.x, http://www.metapix.de/toolbox.htm.

[19] Chipman LJ, Orr TM, Lewis LN. Wavelets and image fusion. IEEE T Image Process 1995; 3: 248–251.

[20] S. Udomhunsakul, and P. Wongsita, “Feature extraction in medical MRI images, “Proceeding of 2004 IEEE Conference on Cybernetics and Intelligent Systems, vol.1, pp. 340- 344, Dec. 2004.

[21] Strang, G. &Nguyen, T., “Wavelets and filter banks”, Wellesley- cambridge press, 1997.

[22] Hernandez, E. &Weiss, G.A., “First course on wavelets” CRC press, 1996.

[23] Rafael c. Gonzalez, Richard E.woods, “Digital image processing”, Addison-wesley.an imprint of Pearson education, 1st edition.

[24] Dr. P.P. Priya & K. Pavan Kumar Detection of objects for autonomous cars using lane detection method. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 9, ISSUE 03, MARCH 2020.