DWT Based Multimodal MR Image Fusion for Tumor Detection

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Abstract -The proposed work is to present an algorithm that performs multimodal brain tumor image fusion of Magnetic Resonance Imaging (MRI) images which are taken from different sensors in different angels to locate brain tumor. The average and DWT methods are used to perform image fusion. Paper concentrates on DWT, preserves more detail in source images and further enhances the quality of fused image. The Proposed algorithm uses average method, DWT and SiDWT methods are used for fusion and the performance are compared. The Performances of fused multi-model images can be computed using PSNR (peak signal to noise ratio), and entropy. By analyzing the results, it shows that the proposed method is efficient for fusion process.

Keywords- multi-modal medical images, image fusion, DWT (Discrete Wavelet Transformation), SiDWT (Shift Invariant DWT)

I: INTRODUCTION

In recent years, Medical image fusion [1] is emerged as a new research area. This method integrates the information of several medical images of some body parts. Here a single image can store several images of information by fusion process. These images are taken from different sensors, and captured at different time intervals. Fusion of the multimodal images improves the quality of the image, storage expense, reliability and decreases uncertainty. Fusion has various applications in various fields such as, medical imaging, military applications and robotics [2]. MRI provides good contrast between the different soft tissues of the body, which make it especially useful in detecting brain tissues, and cancers [7][8]. The fused image from multiple images produce an image which contains combined complementary and redundant information provided by both the source images i.e. the size of the tumor, the location through the various pixel values of the gray scale images, hence resulting into better visibility of tumor [4].

II: DISCRETE WAVELET TRANSFORMS

Fig.1: Pyramid hierarchy of 2-D DWT

DWT decomposes an image into coarse and detailed layers, corresponding to which lower frequency and higher frequency sub bands. Presently, DWT is well familiar fusion method using multi-resolution analysis[3][6]. Wavelet transform divides the image signal into wavelets representing each pixel of the original image as coefficients. The wavelets are two types, one is Continuous Wavelet transform another one is discrete wavelet transform. The 2-D Discrete Wavelet Transformation (DWT) can change the image from spatial domain to frequency domain. The image is decomposed into four frequency components. These components are LL, LH, HL and HH as shown in the fig(1). Where the LL frequency component refers approximation coefficients.

III: METHODOLOGY

STEP 1:
Consider two source images ‘image1’ and ‘image2’ which are of same size (registered images).

STEP 2:
Image processing techniques are applied on the source images i.e. image1 and image2, scan image to increase the contrast and brightness.

STEP 3:
Wavelet transform is applied on these images by passing the processed images through the respective wavelet filters.

STEP 4:
Fusion can be performed either by taking the average of the coefficients or the minimum or maximum of the coefficients.

**STEP 5:**
The resultant image is formed by performing inverse wavelet transform.

![Flow of methodology](image)

**IV: EXPERIMENTAL RESULTS**

The proposed technique has been implemented on MATLAB. The original MRI images are taken from different angles and sensors as shown in the figure (3). The fusion is performed using three techniques, average, DWT and SiDWT. The fusion results are as shown in figure (4). The PSNR, MSE, Entropy values of DWT and SiDWT methods are compared with the average method and the values for the images in Figure (4) are mentioned in Table 1.

![Fusion images](image)

**V: CONCLUSION**

A Comparative study has been made between different fusion techniques by taking two different tumor images which are taken from different angles. Fusion images are compared with respect to the average method. The average method uses pixel level image fusion but fails to increase the reliability of fusion. This can be overcome with the DWT and IDWT methods. The proposed algorithm performed fusion of coefficients is in transform domain instead of spatial domain. Finally, the performance analysis is compared with using PSNR (peak signal noise ratio), MSE (Mean square error) and Entropy for quality evaluation. The experimental values shows that the effectiveness of the proposed work for multimodal MR images. The future work can be extendable with other advanced transforms for better fusion. And also can do the segmentation of the tumor for classifying the tumor stage (mild/sever).

**REFERENCES**


