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Microblaze Architecture Development for Medical Image Fusion Using Wavelet Transform

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Abstract
Now-a-days, almost all areas of medical diagnosis are impacted by the digital image processing. . For medical diagnosis, Computed Tomography (CT) provides the best information on denser tissue with less distortion. Magnetic Resonance Image (MRI) provides better information on soft tissue . With more available multimodality medical images in clinical applications, the idea of fusing images from different modalities become very important and medical image fusion has emerged as a new promising research field .In this paper two input images i.e. CT and MRI medical images are converted to header files containing pixel values using mat lab . header file of image are taken as input to D WT algorithm using lifting scheme . we will take average value of both input image pixel values for final fusion. We will apply IDWT to get the original fused output of input images.finally we will get the fused image of input CT and MRI for medical diagnosis .In this paper hardware implementation of a real-time image fusion is performed. The system is based on an Xilinx Spartan 3 EDK FPGA and implements a configurable linear pixel level D WT algorithm which is able to result in color fused images using System C language.
Keywords- Fusion, Wavelets Transform

I. INTRODUCTION

Image fusion is a technique used to integrate a high resolution panchromatic image with low-resolution multispectral image to produce a high-resolution multispectral image, which contains both the high-resolution spatial infossssrmation of the panchromatic image and the color information of the multispectral image [4]. Although an increasing numbers of high-resolution images are available along with sensor technology development, image fusion is still a popular and important method to interpret the image data for obtaining a more suitable image for a variety of applications, such as visual interpretation and digital classification [3].

The main objective of medical imaging is to obtain a high resolution image with as much details as possible for the sake of diagnosis [7]. MR and CT imaging are of main concern for diagnostic purposes [6]. Both techniques give special sophisticated characteristics of the organ to be imaged. So, it is expected that fusion of MR and CT images of the same organ would result in an integrated image of much more details [10].Wavelet transform fusion is defined as considering the wavelet transforms of the two registered input images together with the fusion rule .Then, the inverse wavelet transform is computed, and the fused image is reconstructed.

The actual fusion process can be carried out at various levels. Under this, in the pixel-level image fusion the fused images provided all relevant information present in original images with no artifacts or inconsistencies. The pixel-level image fusions were classified into spatial domain fusion and transform domain fusion. Spatial domain fusion is directly applied on the source images which in turn reduce the

signal to-noise ratio of the resultant image with simple averaging technique but the spatial distortion still persists in the fused image. To improve on that in transform domain fusion, firstly the input images are decomposed based on transform coefficients. Then the fusion technique is applied and the fusion decision map is obtained. Inverse transformation on this decision map yields the fused image. The fused image carries all the details of the source images and reduces the spatial distortion. So, majority of the earlier fusion techniques were based on wavelet transformation.

II. WAVELET BASED IMAGE FUSION TECHNIQUES

1. Wavelet based image fusion method

The process can be divided into four steps.

a) Wavelet decomposition
b) Details information combination
c) Inverse wavelet transforms

- Use the wavelet transform to decompose new panchromatic images and different bands of multispectral image twice, respectively.
- Add the detail images of the decomposed panchromatic images at different levels to the corresponding details of different bands in the multispectral image and obtain the new details component in the different bands of the multispectral image and obtain the new details

component in the different bands of the multispectral image.

- Perform the wavelet transform on the bands of multi spectral images, respectively and obtain the fused image.

2.Integration of substitution method

The integration of substitution method is divided in two parts.

a. Refers to substitution fusion method.

b. Refers to the wavelet passed fusion method.

- The process consists of following steps Transform the multispectral image into the PCA components.
- Apply histogram match between panchromatic image and intensity component and obtain new panchromatic image.
- Decompose the histogram matched panchromatic image and intensity component to wavelet planes respectively. Replace the LL^P in the panchromatic decomposition with the LL^1 of the intensity decomposition, add the detail images in the panchromatic decomposition to the corresponding detail image in the panchromatic decomposition to the corresponding detail images of the intensity and obtain LL^1, LH^P , HH^P and HL. Perform an inverse wavelet transform, and generate a new intensity. Transform the new intensity together with hue, saturation components or PC1, PC2, PC3 back. Into RGB space.

III. IMPLEMENTATION PROCESS

In our project first going to create a header file of the images by using MATLAB. In mat lab we are creating the header files using GUI window. By using that header files as supporting file, fusing the two images by using DWT technique.

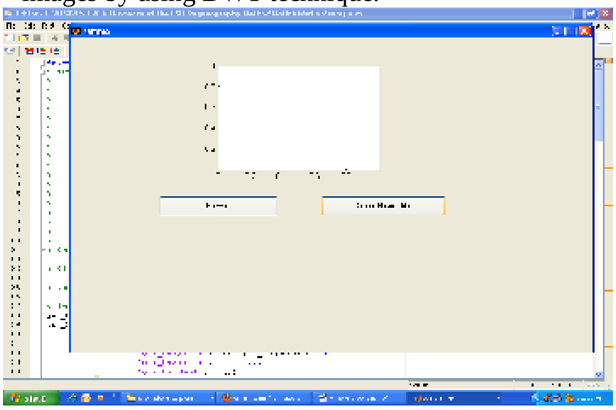

Fig1: GUI window to create header file

IV. RESULTS

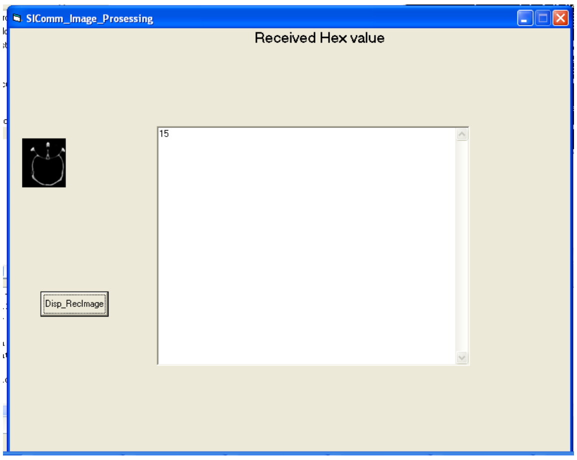

Fig2: MRI Image of Brain

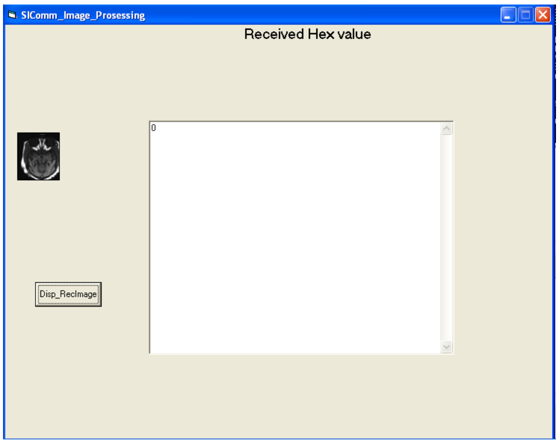

Fig3: CT Image of Brain

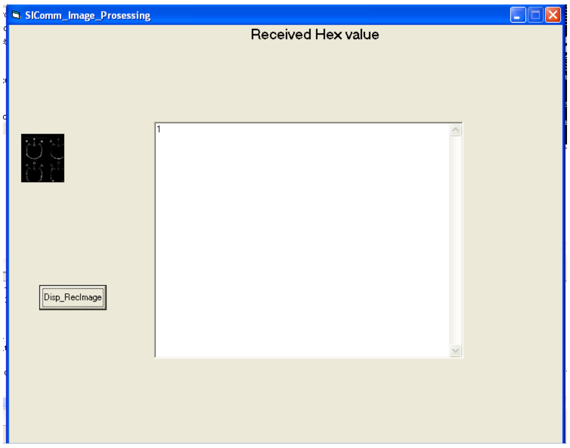

Fig4: DWT MRI Image of Brain

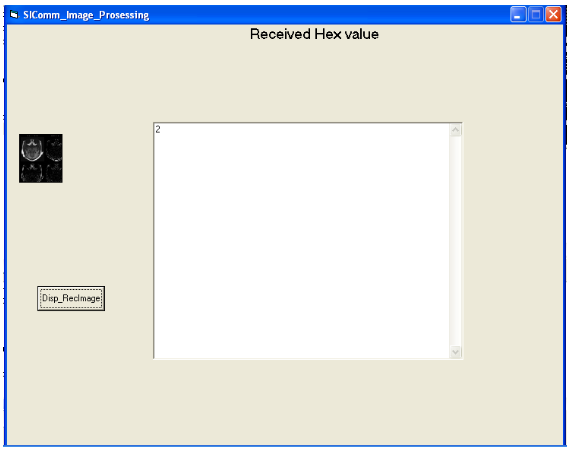

Fig5: DWT CT Image of Brain

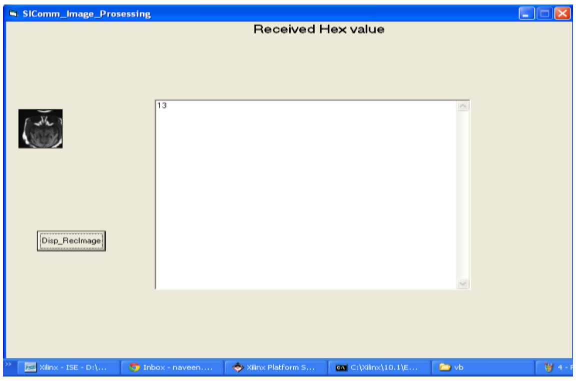

Fig6: Fused image of brain

V. Conclusion

A hardware implementation of a real-time fusion system is done based on an Xilinx Spartan 3 EDK FPGA and implements a configurable linear pixel level algorithm which is able to result in color fused images using System C language.

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