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AN EFFECTIVE DESIGN OF THE IMAGE FUSION ORIENTED PIXEL LEVEL CONFIGURATION

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ABSTRACT:

Image fusion is the process that matches 2 or more image datasets resulting in a single image dataset. This merged image dataset is essential in clinical interpretation of patient disease. CT, MRI, SPECT, PET, and sonography each have their own special advantages for imaging certain types of tumors. A brief overview of these imaging modality characteristics is presented to demonstrate the advantages and limitations of their use in treatment planning. In this image fusion technique is developed by using of DWT process. Here we compares the CT, MRI,etc..By using of Xilinx platform studio tool and implemented on Spartan -3 FPGA.

Keywords: Fusion oriented images, Spartan -3 FPGA, Application of computer vision, Xilinx platform studio.

1. INTRODUCTION:

The actual fusion process can take place at different levels of information representation; a generic categorization is to consider the different levels as, sorted in ascending order of abstraction: signal, pixel, feature and symbolic level. This site focuses on the so-called pixel level fusion process, where a composite image has to be built of several input images. To date, the result of pixel level image fusion is considered primarily to be presented to the human observer, especially in image sequence fusion (where the input data consists of image sequences). A possible application is the fusion of forward looking infrared (FLIR) and low light visible images (LLTV) obtained by an airborne sensor platform to aid a pilot navigates in poor weather conditions or darkness. In pixel-level image fusion, some generic requirements can be imposed on the fusion result. The fusion process should preserve all relevant information of the input imagery in the composite image (pattern conservation) The fusion scheme should not introduce any artifacts or inconsistencies which would distract the human observer or following processing stages .The fusion process should be shift and rotational invariant, i.e. the fusion result should not depend on the location or orientation of an object the input imagery .In case of image sequence fusion arises the additional problem of temporal stability and consistency of the fused image sequence. The human visual system is primarily sensitive to moving light stimuli, so moving artifacts or time depended contrast changes introduced by the fusion process are highly distracting to the human observer. So, in case of image sequence fusion the two additional requirements apply. Temporal stability: The fused image sequence should be temporal stable, i.e. gray level changes in the fused sequence must only be caused by gray level changes in the input sequences, and they must not be introduced by the fusion scheme itself.

2. METHODOLOGY

2.1 Wavelet Transform

Wavelets are mathematical functions defined over a finite interval and having an average value of zero that transform data into different frequency components, representing each component with a resolution matched to its scale.

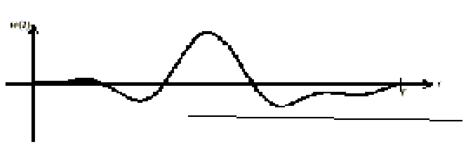


Fig 1: Mother Wavelet w(t)

2.2 Discrete Wavelet Transform

Calculating wavelet coefficients at every possible scale is a fair amount of work, and it generates an awful lot of data. If the scales and positions are chosen based on powers of two, the so-called dyadic scales and positions, then calculating wavelet coefficients are efficient and just as accurate. This is obtained from discrete wavelet transform (DWT).

$$l_i = \sum_{j=-n_l}^{n_L} s_j x_{2i+j} \quad \text{and} \quad h_i = \sum_{j=-n_H}^{n_H} t_j x_{2i+1+j}$$

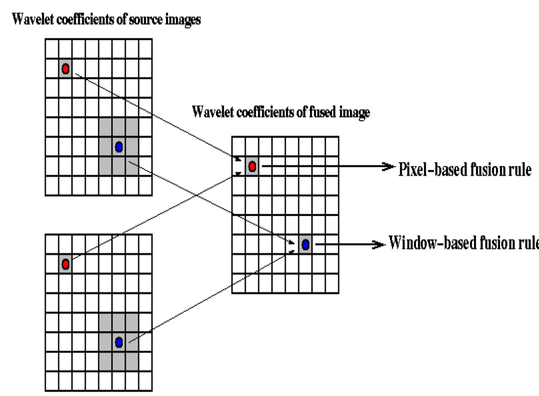


Fig 2: Wavelet Coefficient Representation

2.3 Image Fusion Process

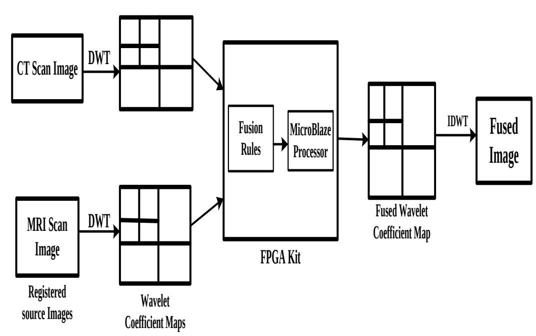


Fig 3: Block Diagram Image Fusion Process

When constructing each wavelet coefficient for the fused image. We will have to determine which source image describes this coefficient better. This information will be kept in the fusion decision map. The fusion decision map has the same size as the original image. Each value is the index of the source image which may be more informative on the corresponding wavelet coefficient. Thus, we will actually make decision on each coefficient. There are two frequently used methods in the previous research. In order to make the decision on one of the coefficients of the fused image, one way is to consider the corresponding coefficients in the source images as illustrated by the red pixels. This is called pixel-based fusion rule. The other way is to consider not only the corresponding coefficients, but also their close neighbors, say a 3x3 or 5x5 windows, as illustrated by the blue and shadowing pixels. This is called window-based fusion rules. This method considered the fact that there usually has high correlation among neighboring pixels.

In our research, we think objects carry the information of interest, each pixel or small neighboring pixels are just one part of an object. Thus, we proposed a region-based fusion scheme. When make the decision on each coefficient, we consider not only the corresponding coefficients and their closing neighborhood, but also the regions the coefficients are in. We think the regions represent the objects of interest. We will provide more details of the scheme in the following.

2.4 EDK System Design

Embedded Development Kit Xilinx Embedded Development Kit (EDK) is an integrated software tool suite for developing embedded systems with Xilinx MicroBlaze and PowerPC CPUs. EDK includes a variety of tools and applications to assist the designer to develop an embedded system right from the hardware creation to final implementation of the system on an FPGA. System design consists of the creation of the hardware and software components of the embedded processor system and the creation of a verification component is optional. A typical embedded system design project involves: hardware platform creation, hardware platform verification (simulation), software platform creation, software application creation, and software verification.

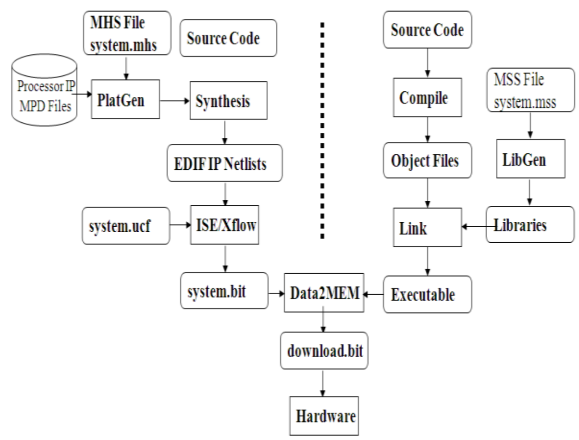
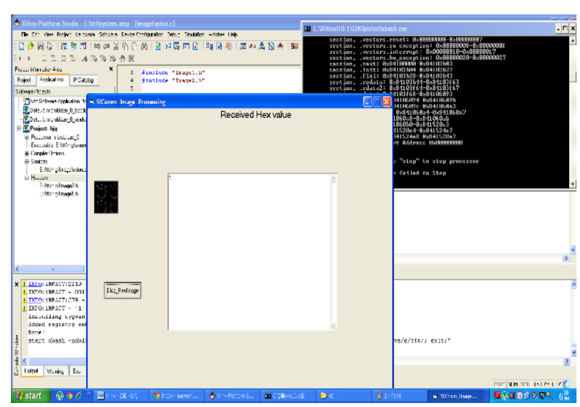
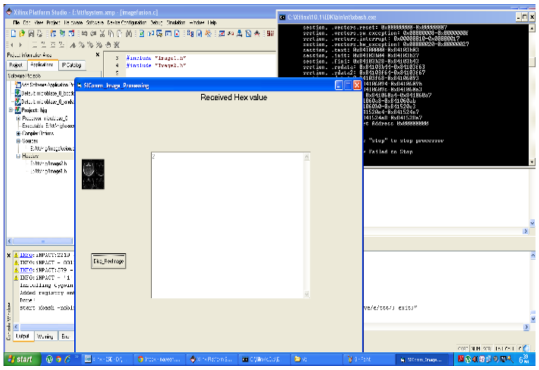


Fig 4: Hardware and Software flow

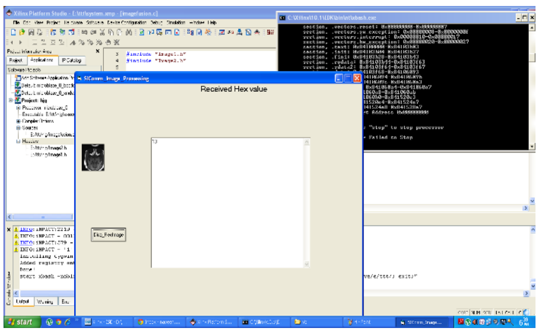
3. RESULTS



(a)



(b)



(c)

Fig 5 : (a) DWT levels of CT Scan Image

(b) DWT levels of MRI Scan Image

(c) Fused Image.

Above figure shows the fused and DWT levels of MRI Scan Images are taken from the Xilinx platform studio tool. It is implemented on Spartan -3 kit by using of XPS tool. It shown in below figure.

Fig 6: Spartan-3 kit

4. CONCLUSION

In this paper, a brief literature survey for different image fusion methods is discussed elaborately. Some of these methods suffer unnatural appearance in the fusion result. All these limitations are overcome by using DWT image fusion based on pixel level approach. Here the registered source images like CT scan and MRI scan medical images are considered in order to obtain the high quality of fused image. This image fused application is implemented on FPGA Spartan-3 kit using MicroBlaze processor, which improves the reliability and accuracy.

Future Scope:

I proposed to introduce Lifting scheme in Image fusion technique. Lifting wavelet transform has its advantages over the ordinary wavelet transform by way of reduction in memory required for its implementation. For applications that require faster encoding / decoding, this algorithm is suitable.

A new approach to 3-D image fusion using wavelet transforms. Several known 2-D DWT fusion schemes have been extended to handle 3-D images have been proposed. Wavelet transform fusion diagrams have been introduced as a convenient tool to visually describe different image fusion schemes. A very important advantage of using 3-D DWT image fusion over alternative image fusion algorithms is that it may be combined with other 3-D image processing algorithms working in the wavelet domain.

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