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# Fusion of Medical Image using Wavelet Transform

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***Abstract*— Recently the huge advance in medical diagnostic has greatly improved the performance of assessment and results especially in the sensitive part of inner body. Earlier it is done by taking variousF scans like MRI (Magnetic Resonance Image), CT (Computed Tomography) and nuclear resonance instrumentation (NMRI), contributing to these methods the proposed system will give an effective output which will help in diagnosing the disease easily. In the rare cases the conventional methods may not be effective as both the test scans (MRI and CT) shows results of different tissues of body. In this proposed system two types of scanned test images (MRI and CT) will be combined to give more accurate and efficient information. MATLAB will be used for implementation of Wavelet based fusion of images. The system will be implemented on MATLAB.**

***Keywords*— Image fusion, Medical, Wavelet, CT, MRI MATLAB.**

## I. INTRODUCTION

Image fusion utilizes information obtained from a number of different sensors surveying an environment to achieve refined information for decision making. The fused images can be used at any level of the image as information source. Corresponding to other methods of information fusion, image fusion is usually performed at one of the three different processing levels such as Signal, Feature and Decision level. The Figure 1 shows input as N image sequence file. The feature extraction of the input image is done by single image process and fusion process are carried out by three levels in image fusion domain.

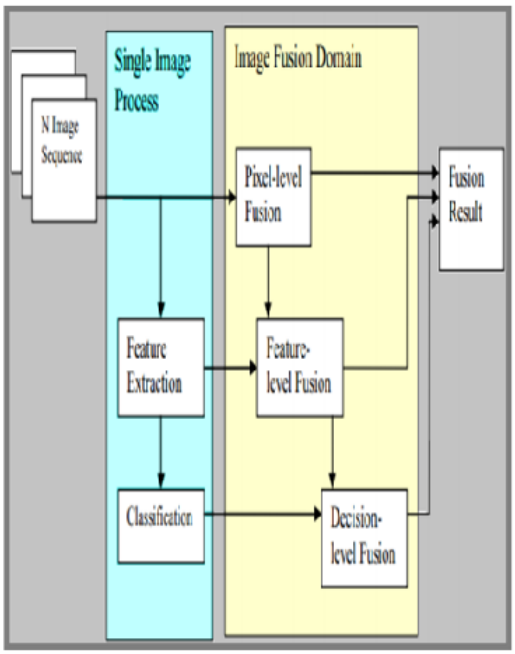


Fig. 1 Proposed system approach

Signal level image fusion can also be stated as pixel-level fusion which represents fusion at the first processing level, where a number of raw input image signals are combined to produce a single fused image signal. The second level image fusion is also known as object level image fusion where it fuses feature and object labels and property descriptor information that have already been extracted from individual input images. Decision level is also known as symbol level. Decision level is the third level, where it represents fusion of probabilistic decision information obtained by local decision makers operating on the results of feature level processing on image data produced from individual sensors (Vladimir 2001). There are many image fusion methods like averaging, principle component analysis and various types of Pyramid Transforms, Discrete cosine transform, Discrete Wavelet Transform special frequency and so on, are available and are classified according to processing level.

## II. LITERATURE SURVEY

In [1], Sankha Subhra Ghosh have detection of the inverter switch snubber circuit resistance fault (ISSCRF) in brushless direct current (BLDC) motors used for robotic applications. This has been carried out in two parts: Fast-Fourier-Transform-based analysis and wavelet-decomposition-based analysis on the stator current of the BLDC motor. The first analysis investigates the effects of different percentages of ISSCRF on direct current (DC) component, fundamental frequency component and total harmonic distortion percentage.

Prajakta Ambrale et.al [2], the application of Image fusion have grown immensely in the areas of medical science, forensic and defense departments. This system deals with the design of image fusion technique in MATLAB using Discrete Wavelet Transform (DWT) technique. The system is then interfaced on FPGA with the help of Xilinx.

Surya Prasada Rao Brora et.al [3], Magnetic Resonance Imaging (MRI) and Computer Tomography (CT) scan images are used to perform the fusion process. In brain medical image, MRI scan is used to show the brain structural information without functional data. But, CT scan image is included the functional data with brain activity. To improve the low resolution CT scan, Combined algorithm is introduced in this paper which is implemented in FPGA.

Abdalrahman Albishti et.al [4] the paper demonstrates the denoising of Medical image using multi-resolution wavelet transform and diffusion filter. Medical Image denoising is a common procedure in digital image processing aiming at the removal of noise, which may corrupt an image during its acquisition or transmission, while retaining its quality.

Yanhua Jiang et.al [5] the uses wavelet neurons instead of traditional neurons, and uses wavelet multiresolution analysis to decompose the FPGA image scan of the ship engine. Because the neural network has the ability of approximation to arbitrary functions, the wavelet transform is connected to the neural network to form a wavelet neural network.

Muhammad Ar et.al [6] Radiology is a broad subject that needs more knowledge and understanding of medical science to identify tumors accurately. -e need for a tumor detection program, thus, overcomes the lack of qualified radiologists. Using magnetic resonance imaging, biomedical image processing makes it easier to detect and locate brain tumors.

Liuhua Zhang et.al [7] Breast cancer is in the most common malignant tumor in women. It is responsible for 30% of new malignant tumor cases. Also the risk of breast cancer remains high around the world, the death rate has been continuously reduced.

Sayantam Sarkar et.al [8] Discrete Wavelet Transform (DWT) is Universally accepted in digital image and video processing due to its various advantages over other similar transform techniques. To protect the accuracy of the processed data, suitable size of intermediate bits in fractional format with the help of Q-notation is considered. The compared results show that the proposed architecture performs better than existing ones concerning both hardware utilization and data accuracy.

Varun Vasudevan et.al [9] Prior studies using graph neural networks (GNNs) for image classification have focused on the generated graph from a regular grid of pixels or similar-sized super pixels. In the latter, a single target number of super pixels is defined for an entire dataset irrespective of differences across images and their intrinsic multistate structure.

Yasmine M. Tabra et.al [10] SPIHT displays exceptional characteristics over several properties like good image quality, fast coding and decoding, a fully progressive bit stream, application in lossless compression, error protection and ability to code for exact bit rate. The new implementation has the aim to reduce the amount of data needed to be stored, this is done in various stages, and also aims to reduce the amount of time required for processing. VHDL (Very High Descriptive Language) was used on the netFPGA-1G-CLM Kintex-7 board to implement the condensation. The new implementation succeeded in reducing the complexity of the compression system and with minimized processing time.

## III. PROBLEM STATEMENT

The proposed algorithm in this project was applied to experiments of multi-focus image fusion and complementary image fusion. The algorithm will be transferred from computer to FPGA board using JTAG cable. The result will be transferred back to system to analyze hardware resource taken by FPGA using MATLAB.

## IV. PROPOSED SYSTEM

When constructing each wavelength coefficient used for the fused image. It is required 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 wavelength coefficient. Decision on each coefficient will be taken. To make the decision on any 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 algorithm is called as pixel based fusion rule. The other way is to consider not only the corresponding coefficients, but also their close neighbours, say a 3x3 or 5x5 windows. This is called window-based fusion rules. This consideration of the fact that there are high correlation among neighbouring pixels

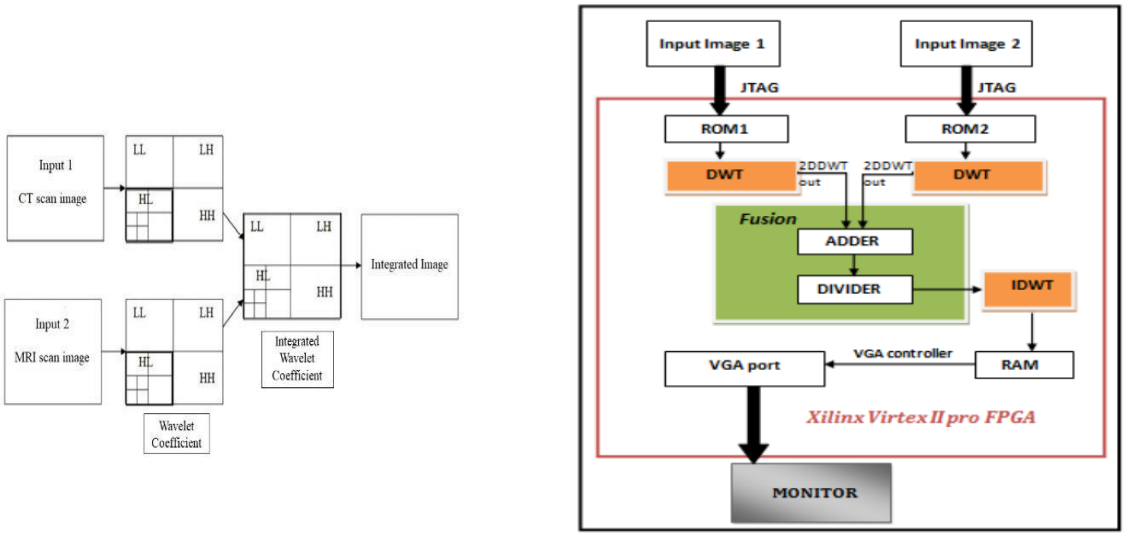


Figure 4.2 Top level block diagram of hardware implementation

The wavelet transforms of the images has been computed. The registered images have been passed as input signals through two different one-dimensional digital filters H0 and H1 respectively. H0 and H1 digital filters perform high pass and low pass filtering operations respectively for both the input images. The output of each filter is followed by sub-sampling by a factor of 2. This step is mentioned as the Row compression and resultant is called as L-low frequency component and H-high frequency component. The down sampled outputs have been further passed to two one dimensional digital filters in order to achieve Column compression. The HH-High High, HL-High Low, LH-Low High and LL-Low Low are the output frequency components obtained after two level condensation of both the input images. The Figure 10 shows the block diagram of IDWT based image fusion process which consists of two input images, IDWT block, fusion block and IIDWT block. The HH, HL, LH and LL frequency components of first input image is fused with the HH, HL, LH and LL components of second input image respectively. HH components of both images have been merged and then the output has been divided by a factor 2. Comparably, the average of HL, LL and LH components has been taken. This process is known as Image Fusion. This averaged result has been succeeding followed by the reconstruction process i.e., inverse wavelet transforms. IIDWT is the reverse process of IDWT. In IIDWT process, the HH, HL, LH and LL components have been first up-sampled and then filtering operation has been carried out. The sub-bands have been added or summed to get the resultant reconstructed image. The IDWT based image fusion technique produced the more naturally fused image even when the images to be combined have been taken from different cameras.

FPGA Board

Programmable logic technologies, such as field-programmable gate arrays (FPGAs), are an essential component of any modern circuit designer's toolkit. With their expansive capabilities uniquely suited to a wide array of applications, FPGAs are ideal for solving many of the problems facing the rapidly evolving technology sector. The key benefits of programmable logic technologies include immense flexibility, cost savings over custom silicon, and increased performance by hardware parallelism.

The Spartan6 FPGA Project Board is a digital system development board which features Xilinx Spartan6 FPGA, 4Mb of external non-volatile memory and enough I/O devices and external connector to interface variety of digital applications. The Spartan6 FPGA is an ideal platform for any engineer to gain experience with Xilinx's latest technologies, and it is perfectly suited to the classroom - new students can build logic circuits without worrying about complex external interfaces.

MATLAB

The name MATLAB stands for Matrix Laboratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It combines computation, visualization, and programming environment. MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent platform for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems.

## V. Conclusions

The proposed system will produce fused image using multispectral images for medical application. It is about combining the scanned images of computed tomography (CT) and magnetic resonance image (MRI) it is implemented on FPGA using wavelet transform. The system will provide a hardware implementation of the complex techniques used for image fusion with minimum resources and minimum delay and also provides simplicity and ease for hardware implementation.

SPIHT Colored Image Compression with Reduced Complexity and Low Memory Requirement Compatible for 5G," IEEE 2021.

## References

[1] Sankha Subhra Ghosh,Surajit Chattopadhyay, Arabinda Das, "Fast Fourier transform and wavelet-based statistical computation during fault in snubber circuit connected with robotic brushless direct current motor," in IEEE Access, vol. 7, pp. 131094-131101, 2022.
[2] Prajakta Ambrale, Nikita Mahajan, Harshada Malusare, A.G.Gaikwad, "Image Fusion Technique Implementation Using FPGA," Volume IX, Issue VI, JUNE/2020.

[3] Surya Prasada Rao Borra, Rajesh Kumar Panakala, Pullakura Rajesh Kumar, "VLSI Implementation of Image Fusion Using DWT- PCA Algorithm with Maximum Selection Rule". International Journal of Intelligent Engineering and Systems, Vol.12, No.5, 2019.
[4] Abdalrahman Albishti , "Performance Measure in Medical Image Denoising capabilities of Wavelet Transform and Diffusion Filter" IEEE,2021.
[5] Yanhua Jiang, Guanglin Lan, Zhiqing Zhang, "Ship engine detection based on wavelet neural
Network and FPGA image scanning," Received 21 December 2020; revised 7 February 2021; accepted 16 February 2021.
[6] Muhammad Arif, F. Ajesh, Shermin Shamsudheen, Oana Geman, Diana Izdrui, and Dragos Vicoveanu, "Brain Tumor Detection and Classification by MRI Using Biologically Inspired Orthogonal Wavelet Transform and Deep Learning Techniques," Journal of Healthcare Engineering Volume 2022, Article ID 2693621, 18 pages https://doi.org/10.1155/2022/2693621
[7] Liuhua Zhang, "Improving Specificity in Mammography Using Cross-correlation between Wavelet and Fourier Transform," IEEE 2022.
[8] Sayantam Sarkar, Satish S. Bhairannawar, "Efficient FPGA architecture of optimized Haar wavelet transform for image and video processing applications," Multidimensional Systems and Signal Processing (2021) 32:821–844 https://doi.org/10.1007/s11045-020-00759-4
[9] Varun Vasudevana, Maxime Bassenneb, , Md Tauhidul Islamb, and Lei Xing, "Image Classification using Graph Neural Network and Multiscale Wavelet Superpixels", Volume 23,IEEE 2022.