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Study of Image Fusion Using Discrete Wavelet and Multi Wavelet Transform with MATLAB Simulink

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ABSTRACT: image fusion is the approach in which combination of two or more images creates new informatory image. This image use in vision based analysis. Vision or picture based information is easily stored in the human brain or easily understand by human eye. In this paper, we focused on the image fusion or quantum approach in this field. Quantum approach is the future aspect for developing artificial intelligence in techno field, also shed light on discrete wavelet and multi wavelet transform method for image fusion.

KEY WORDS: image fusion, discrete wavelet transforms (DWT), multi wavelet transform (MWT), quantum approach to image processing.

I. INTRODUCTION

Vision based information is easily captured or understand by human eye, surveillance camera, sensors, etc.. at present image processing is a core field for recent trend or innovation and image fusion is trending approach. In digital image processing in the process of image fusion, a combination or fusion of two or more images creates new image this fused image is resultant image or complementary image, this image is useful for analyzing the results or extracting information from a single image, also its use less space or convenient data to store in the system. single image easily transmit over low or high transmission band.

Image fusion is the mechanism in which selective information from multiple images are fused into a single image. this process also use to improve quality of information from a set of image data. for gain of quality information a sequence process is followed by user or system.

In the image fusion analog pattern, unable to give good quality over digital image processing. Here wavelet transform define the image signal in time domain or space domain, or discrete wavelet transforms provide the platform for spatial domain transform and 16 levels of decomposition. multiwavelet transform also have 16 levels of decomposition factor which provide small unit for image fusion. In the image fusion process must have pixel to pixel alignment of images.

Quantum approach in image processing is the future of the digital image field, and improving the performance of the remote sensing satellites, security cameras, military operations or artificial intelligence. The result is prepared using by a wavelet toolbox of MATLAB (R2010a) version.

Proposed work is represent the image at the quantum stage for improving the quality of image .

II. DISCRETE WAVELET TRANSFORM (DWT)

The discrete wavelet transform (DWT) is generated by filtering the signal use of a proper series combination of digital filters and process the signals at different scales. The scaling process happens by changing the resolution factor of the signal using the process of subsampling.

The DWT follow either convolution based and lifting based procedure. In both operations the input image data are decomposed into a low - pass, band or high-pass sub band, each band dividing of half the number of sample images in the original sequence.

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The DWT operate for an entire image without imposing block buildings, thereby its reducing blocking artifact. implementation of the discrete wavelet can be done by (i) filter bank scheme and (ii) lifting scheme.

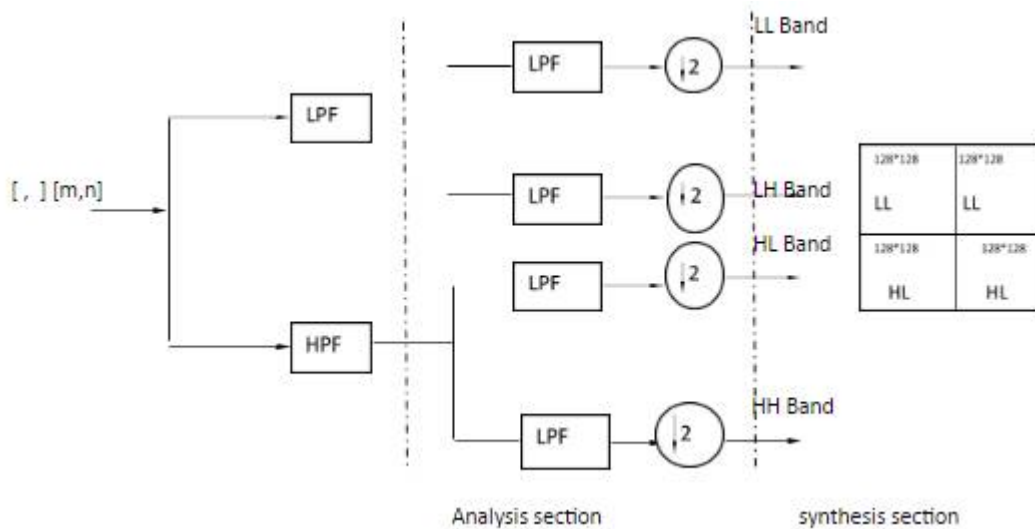


Fig.1. Filter bank scheme of discrete wavelet transform (1) first level decomposition of image.

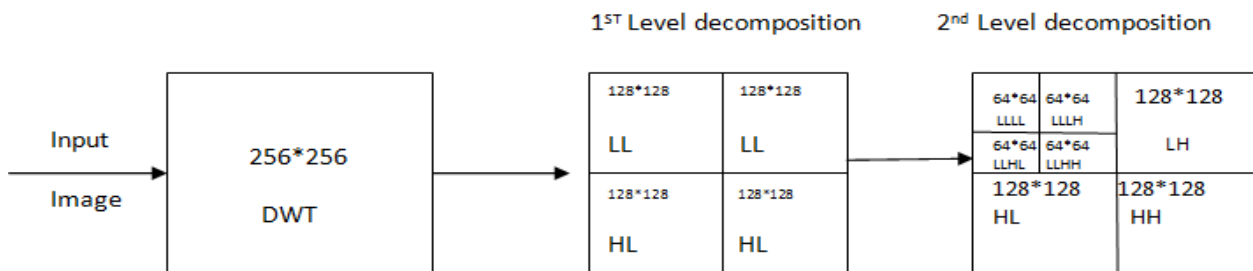


Fig.1.2. (2) DWT second level decomposition of input image.process of image fusion.

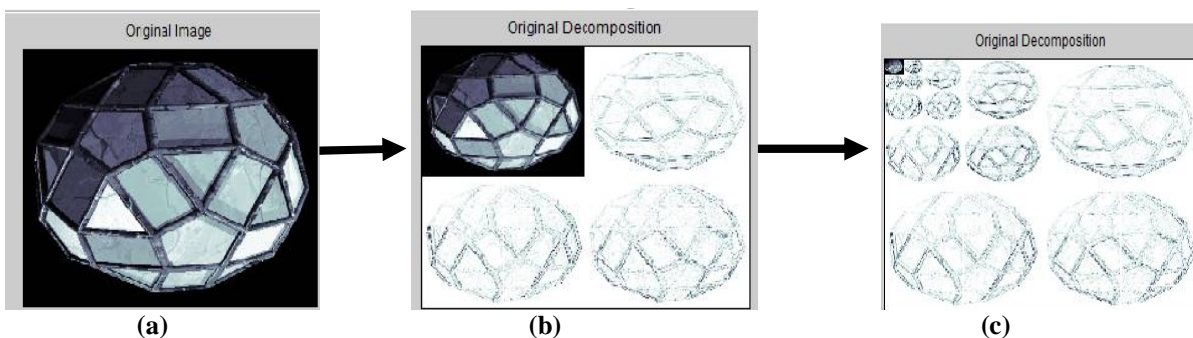


Fig.2 (a) original image (b) first level decomposition (c) second level decomposition

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III. MULTI WAVELET TRANSFORM (MWT)

The word 'multi' definition is more than one. multi wavelet present more than one wavelet. multi wavelet use two or more wavelet or scaling operation. Its scaling function is present by a vector function.

$$\phi(t) = [\phi_1(t), \phi_2(t) \dots \dots \dots \phi_r(t)]^T \dots (1)$$

Where $\phi(t)$ Is called multi-scaling function

The multi-wavelet function is present by

$$\varphi(t) = [\varphi_1(t), \varphi_2(t) \dots \dots \dots \varphi_r(t)]^T \dots (2)$$

Where $\varphi(t)$ Is called scalar wavelet

The multiwavelet transform are produced by more than one scaling function. its matrix formation provides many degrees of freedom. The matrix formation allows features like as orthogonality, symmetry, and high order vanishing moments to create multi wavelet transform and provide the platform to construct multi wavelet filters for different image processing applications.

Its multi channel nature is different from scalar wavelet its split image into vector and preprocessed element before the multi-wavelet decomposition.

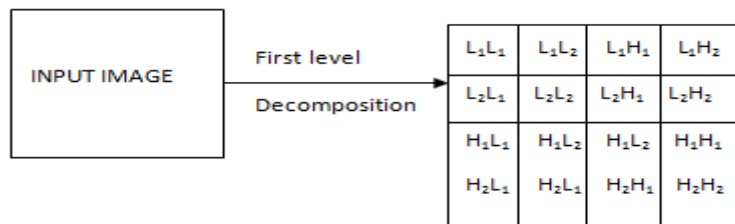


Fig3. Representation of multiwavelet transforms of input image. Following figure shows multi focused image.

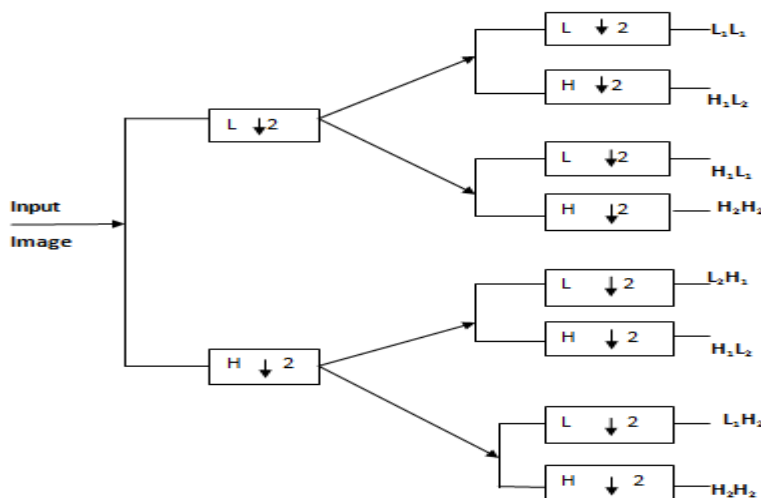


Fig3.1. 1-Level multiwavelet decomposition of image following figure shows the decomposition level of transformation.



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IV. METHODOLOGY

Image fusion operation performs in the matrix environment which is provided by MATLAB software. MATLAB (R2010a) version is used for gain good result and quality.

Step1. Run MATLAB (R2010a) toolbox for performing image fusion operation.

Step2. Give command for wavelet processing toolbox in the command window. Ex. 'wavemenu'.

Step3. open image fusion workplace.

Step4. load image signals or set filters, level of decomposition, select fusion method and apply operation for image fusion.

V. QUANTUM REPRESENTATION OF IMAGE

The classical bit has two states, either 0 or 1, and a qubit also has two possible states which are represented by $|0\rangle$ and $|1\rangle$, notation like ' $|i\rangle$ ' is called Dirac notation. it is the standard notation for quantum mechanics. The 2-D image represent by row-location and column-location vector.its generating by M-length row-location and N-length column-location, where m-qubit is $m = \log_2 M$ and n-qubit is $n = \log_2 N$.

$$|I\rangle_p = |i\rangle^{\otimes m} \quad \dots\dots\dots(1)$$

$|I\rangle_p$ is the row-location vector or the quantum state of m-qubit at p^{th} row.

$$\langle J|_q = \langle j|_q^{\otimes n} \quad \dots\dots\dots(2)$$

$\langle J|_q$ is the column-location vector or the quantum state of n-qubit at q^{th} column.

$$L_{p,q} = |i\rangle_p \otimes \langle j|_q \quad \dots\dots\dots(3)$$

Where $L_{p,q}$ is the 2-D quantum state of a pixel at $p^{\text{th row}}$ and q^{th} column using m-qubits and n-qubits, respectively.

$$L_{p,q} \in \begin{pmatrix} |00\rangle \otimes \langle 00| & |00\rangle \otimes \langle 01| & |00\rangle \otimes \langle 10| \\ |10\rangle \otimes \langle 00| & |01\rangle \otimes \langle 01| & |01\rangle \otimes \langle 01| \\ |10\rangle \otimes \langle 00| & |10\rangle \otimes \langle 01| & |10\rangle \otimes \langle 10| \end{pmatrix}$$

2D quantum state of the image represented by 3x3 matrix row-location and column-location vector.

VI. RESULT AND ANALYSIS

DWT image fusion follows the dyadic scales, its translate every integer point of the image, its transform image orthogonally and biorthogonally. it's covers application like compression, de-noising, transmission, characterization.

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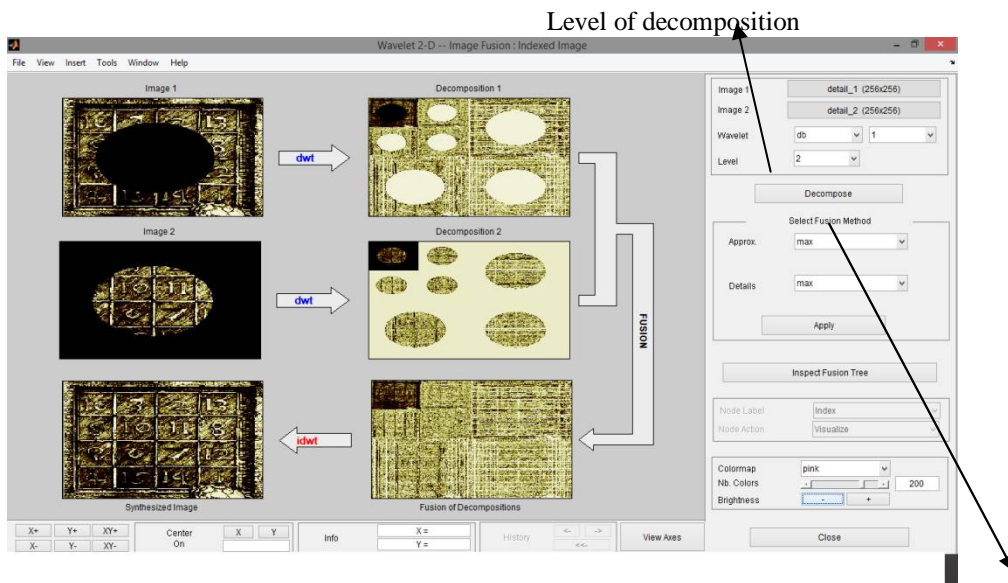


Fig. 4. example of an image fusion method.. (max-max operation),this figure shows the process of image fusion.

Multiwavelet transform provide many degrees of freedom.These allowed orthogonality, symmetry, and high-order vanishing moment. its enable more than one filter to suit different image processing.

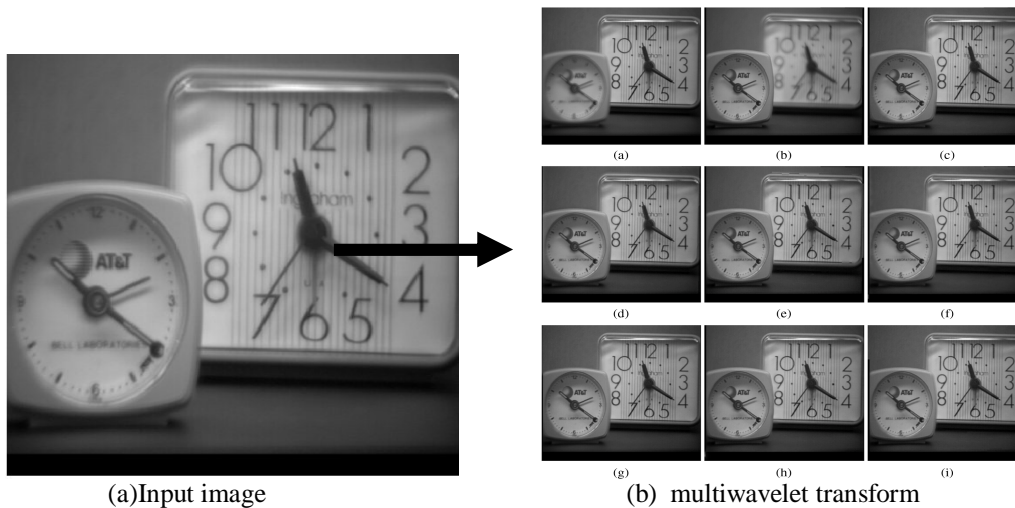


Fig.5. The result of multiwavelet transform,this image shows multifocused view of single image.

VII. CONCLUSION

The DWT image fusion allows the filter bank or lifting scheme for performing a fusion operation which has given good quality and low noise image.
The MWT image fusion allows more than one multi focus and multi resolution image which gives more than one degree of freedom.



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Quantum approaches give a good performance of image representation its provide a better environment for image mapping at every pixel level.

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