International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 25 Issue 5 – APRIL 2018 (SPECIAL ISSUE).

IMAGE DE-NOISING IN MEDICAL IMAGE WITH DYADIC WAVELET TRANSFORM FOR ACCURATE DIAGNOSIS

M. Mohammed Siddiq Ali[*1], R. Sankar[*2], Prof. S. B. Mohan[#3]
UG Scholars[1,2], Dhaanish Ahmed College of Engineering*
Associate Professor#[3], Dhaanish Ahmed College of Engineering

***ABSTRACT*-Study of medical image processing plays a vital role in the field of research and development. Obviously, researchers continue to concentrate on the betterment of output to the current state-of-the-art. As a part of study, noise level estimation in medical images and removal of noises are performed by various techniques and methodologies. We propose an algorithm for removal of noises using Dyadic Wavelet transform which significantly results us improved output performances. The proposed transformation is very redundant and part of disturbance of image Dyadic wavelet co-efficients in transform domain will notd lead to serious distortion. Therefore, the work is extended with the same error decision probability in expectation to better reconstruction of the input medical image by Dyadic wavelet based image de-noising (DWID). The experimental output shows significantly improved results in terms of PSNR which shows the obtained medical image after denoising is upto the level of state-of-the-start.**

***Key words*: DWT, DWID, PSNR, DICOM, PDF.**

I INTRODUCTION

The areas of application of digital image processing are so varied that some form of organization is desirable in attempting to capture the breadth of this field. One of the simplest ways to develop a basic understanding of the extent of image processing applications is to categorize images according to their source (e.g.,visual,X-ray,and so on),Gonzalez et al (2000) comment in their work. AlZubi et al (2010) comment their work by ShadiAlZubi et al (2010) the use of 3D image processing has been increased especially for medical applications; this leads to increase the

qualified radiologists' number who navigate, view, analyze, segment, and interpret medical images.
An efficiently method was needed for object detection in image data for decision maker presented by Rajakumar et al (2013) [1] and Khalil etal (2014) [2]. The field of digital image processing refers to processing digital images by means of a digital computer. Note that a digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements, pels and pixels. Pixel is the term most widely used to denote the elements of a digital image Johnson et al (2004) [3].

Identifying and visualizing meaningful features in large volume datasets remains a significant challenge.

Digital Image Processing (DIP) focuses on two major tasks such as improvement of pictorial information for human interpretation and processing of image data for storage, transmission and representation for autonomous machine perception.Applications of DIP include Industry (Digital camera, camcorder, and scanner), Medical imaging & image analysis (CT, MRI, and X-ray) and others (Satellite imaging, resource analysis, and national defense).

Image processing plays a vital role in diagnosis and analysis of various medical imaging modalities such as X-rays, PET, CT and MRI by Tamilselvan et al (2012)[4]. Quantification by manual tracing of outlines of structures is tedious and time consuming. The analysis and visualization of the image stack received from the acquisition devices are difficult to evaluate due to the quantity of clinical data and the amount of noise existing in medical images due to the scanners itself. Computerized analysis and automated information systems can offer help dealing with the large amounts of data, and new image processing techniques may help to denoise those images stated by AlZubi et al (2010) [5]. The fundamental steps of Image processing include Image acquisition, Image enhancement, Image restoration, Color image processing, Wavelets and multiresolution processing, Compression, Morphological processing, Segmentation, Representation & description and Object recognition.

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement. One of the forms of image acquisition in image processing is known as real-time image acquisition. This usually involves retrieving images from a source that is automatically

capturing images. Real-time image acquisition creates a stream of files that can be automatically processed, queued for later work, or stitched into a single media format. One common technology that is used with real-time image processing is known as background image acquisition, which describes both software and hardware that can quickly preserve the images flooding into a system. There are some advanced methods of image acquisition in image processing that actually use customized hardware.
In this work, we have made an algorithm for the detailed analysis on noisy image to noise free image.

II. IMAGE ACQUISITION AND NOISE MODEL

Medical images are pictures of distributions of physical attributes captured byan image acquisition system. Most of today's images are digital. They may be post processed for analysis by a computer-assisted method.

Medical images come in one of two varieties: Projection images project a physical parameter in the human body on a 2D image, while slice images produce a one-to-one mapping of the measured value.
Medical images may show anatomy including the pathological variation of anatomy if the measured value is related to it or physiology when the distribution of substances is traced.

A major difference between most digital medical images and pictures acquired from photography is that the depicted physical parameters in medical images are usually inaccessible for inspection . Features or quantities determined by computer-assisted analysis cannot easily be compared with true features or quantities. The development of efficient analysis techniques often uses this knowledge as part of the domain knowledge to make up for the inaccessibility of the measured property. There are different major and minor techniques to satisfy the requirements of physical properties of image measuring devices.

The measuring devices may include noises along with the image which may result in undesirable effects such as unseen lines, unseen edges, blurred objects etc., The intruded noise can not be stopped but can be reduced by performing prior learning of noise model. Several methods were suggested for quantitative analysis of noise models like Point spreading function (PSF) and Modulation transfer function (MTF). To design and characterize the noise model Probability Density Function (PDF) or Histogram may be used.

III. PROPOSED WORK

In our work we have consider an image with Speckle noise and Dyadic Transform is implemented for the noised image processing. The speckle noise is a multiplicative noise. Their appearance is seen in coherent imaging systems such as Laser, Radar and Acoustics etc., Speckle noise can exist similar in an image as Gaussian noise. Its probability density function follows gamma distribution:

$$F(g) = \frac{g^{\alpha-1} e^{\frac{-g}{a}}}{\alpha-1!\,a^{\alpha}} \qquad (1)$$

The proposed block diagram is shown below.

BLOCK DIAGRAM:

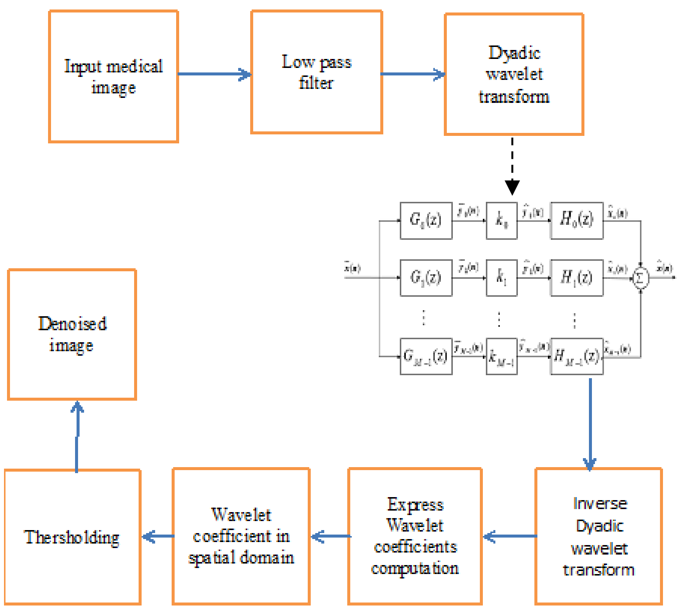


Fig – 1 Block Diagram of the proposed method

a.Input Medical Image

Digital Imaging and Communications in Medicine (**DICOM**) is a standard for storing and transmitting medical images enabling the integration of medical imaging devices such as scanners, servers, workstations, printers, network hardware, and picture archiving and communication systems (PACS) from multiple manufacturers. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format.
A low-pass filter is a filter that passes low-frequency signals and attenuates signals with frequencies higher than the cut-off frequency. The actual amount of attenuation for each frequency varies depending on specific filter design. Smoothing is fundamentally a lowpass operation in the frequency domain. There are several standard forms of lowpass filters are Ideal, Butterworth and Gaussian lowpass filter. The specified distance D from the origin of the Transform.

The transfer function of an ideal lowpass filter

$$H(u,v) = \begin{cases} 1 & if\ D(u,v) \le D0 \\ 0 & if\ D(u,v) > D0 \end{cases} \quad (2)$$

where D(u,v) : the distance from point (u,v) to the center of their frequency

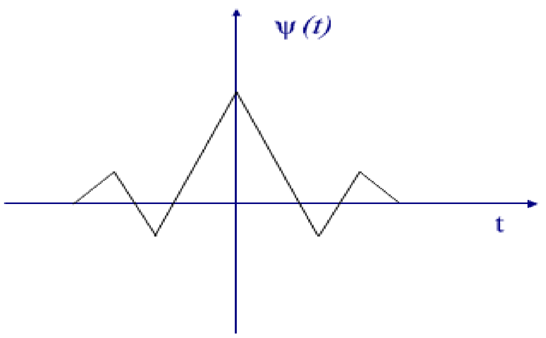
$$D(u,v) = \left[\left(u - \frac{M}{2}\right)^2 + \left(v - \frac{N}{2}\right)^2\right]^{\frac{1}{2}} \quad (3)$$

Transformation based extraction was considered where features of pre-processed images were extracted to different classifiers for different classifications.

Wavelet Transform is a powerful mathematical tool with CAD system on images processing The Wavelet analysis carried out by using a mother wavelet ψ(x) to an image which can decompose the image into four quadrants with interpretations denoted as LL, LH, HL, HH blocks carrying coefficients. Due to the local similarities between neighbouring pixels many coefficients in the LH, HL, HH subbands at different scales will be small and LL concentrate most of the image energy, used for further decomposition. But the overall process finds difficult in searching the best block to fill to implement edge orientation. Due to this PSNR value is low and the tumour below 2mm is hard to find.

b. Dyadic transformation

The dyadic transformation also known as the dyadic map, bit shift map or doubling map is the map which can give the recurrence relation produced by the rule. The dyadic transformation can also be defined as the iterated function map of the piecewise linear function. The Wavelet base function has the characteristics of narrow band pass filter which also can conserve energy before and after transformation. Dyadic transform is continuous in time and space domain but the scales are discrete.

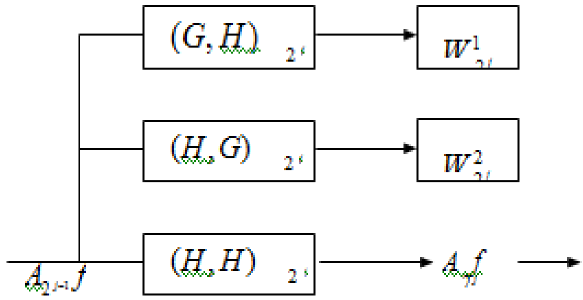


Basic Dyadic wavelet function

The above function can be represented as

$$Wf(x,y) = \{W^1_{2j}\ f(x,y)\ W^2_{2j}\ f(x,y)\} j \in Z \quad (4)$$

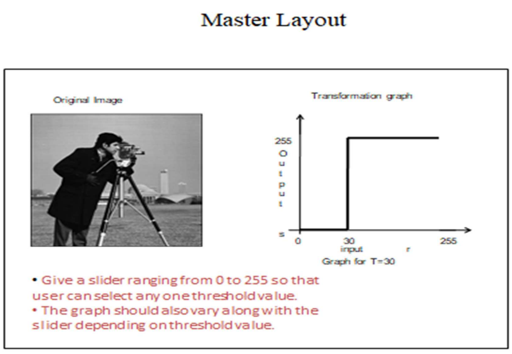
Where $W^1_{2j}\ f(x,y) = f(x,y) * \psi^{-1}_{2j}(x,y)$
$W^2_{2j}\ f(x,y) = f(x,y) * \psi^{-2}_{2j}(x,y)$ and
ψ^{-K}_{2j} (x,y) = (-x, -y) , K = 1,2



c. Dyadic Wavelet decomposition

Where W- wavelet function
H-High pass filter
G – low pass filter

The dyadic wavelet transform decomposes the analyzed function on finite lasting components ψ(t) called wavelets . The DWT of the function f(t) generates WT coefficients W(a,b) according to the relation:



$W(a, l$ (5)

Where

$\psi_{a,b}(t)$

is a wavelet function of time scale (dilation)equal a and time shift (translation) described by b, and $\psi^{*}_{a,b}$ denotes complex conjugation. For a=1 and b=0 ψ1,0(t) = ψ(t) is called the mother wavelet. The wavelet transformation is reversible and the original function can be reconstructed on the basis of the values of W(a,b) coefficients .

It turns out that it is not necessary to take into account all possible values of variables a and b. Instead it is possible to choose finite set of their values satisfying following conditions: a = 2^k, b = 2^kn where k and n are integer (dyadic series). In this case the original function f(t) can be represented as the superposition of dilated and translated wavelets with the weights

International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 25 Issue 5 – APRIL 2018 (SPECIAL ISSUE).

d(k,n) denoting the dyadic wavelet transform (DWT) coefficients

$$f(t) = \sum_{k=-\infty}^{\infty} \sum_{n=-\infty}^{\infty} d(k,n) 2^{-k/2} \psi(2^{-k} t - n) \qquad (6)$$

d. Wavelet coefficient computation

The dwt2 command performs a single-level two-dimensional wavelet decomposition. Compare this function to wavedec2, which may be more useful for denoising application. The decomposition is done with respect to either a particular wavelet or particular wavelet decomposition filters.

The wavelet coefficients of a function in a biorthogonal wavelet system. We denote by ϕ ande ϕ the dual scaling functions, by ψ and e ψ the corresponding dual wavelets, and by N the order of the wavelet system. For any f ∈ L2(R), we denote by fj,k the function

f_j,k(t) = 2j/2f(2jt−k) (7)

e. Thresholding

The procedure of the signal denoising based on DWT is consist of three steps; decomposition of the signal, thresholding and reconstruction of the signal. Several methods use this idea proposed and implements it in
different ways. When attempting to decrease the influence of noise wavelets coefficient, it is possible to do this in particular ways, also the need of information of the underlying signal leads to different statistical treatments of the available information.

During the thresholding process , individual pixels in an image are marked as “object” pixels if their value is greater then some threshold value (assuming an object to be brighter then the background) and as “back ground” pixels if their value is less then threshold value. Typically, an object pixel is given a value of ‘1’ while a background pixel is given a value of ‘0’. The key parameter in the thresholding process is the choice of the threshold value between 0 to 75
For different threshold values, the layout may get us the final response for different steps, at step 4 the response as shown below.

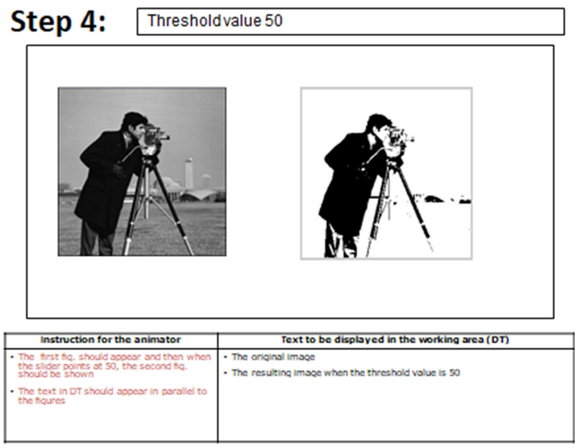


Fig - 3 Threshold Value 50

IV PERFORMANCE ANALYSIS AND RESULTS

We have considered different pixel values of the input image and the performance are obtained to show effectiveness of the process that has introduced. The following figures and the results shows the projections of processed medical image. This may be extended for group of medical images (nearly 50 medical images).

a. 256*256 Pixels formats images

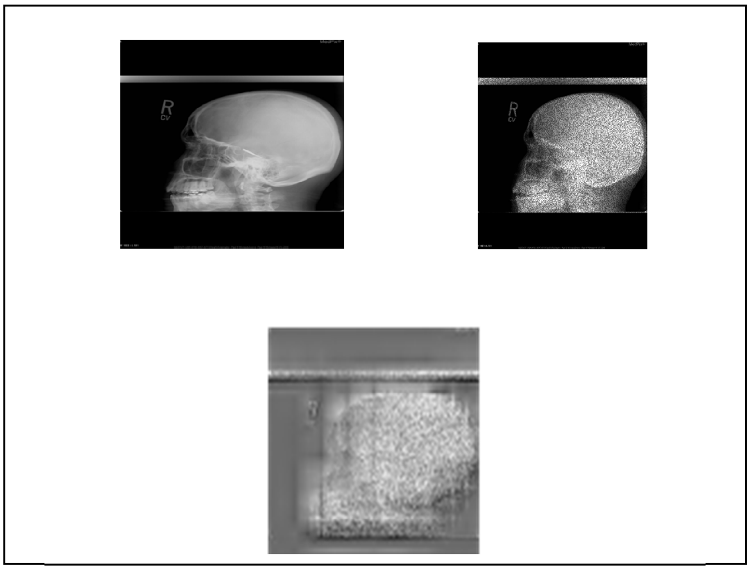


Fig – 4 Input Image, Noisy Image, Denoised Image

b. 512*512 Pixels formats images

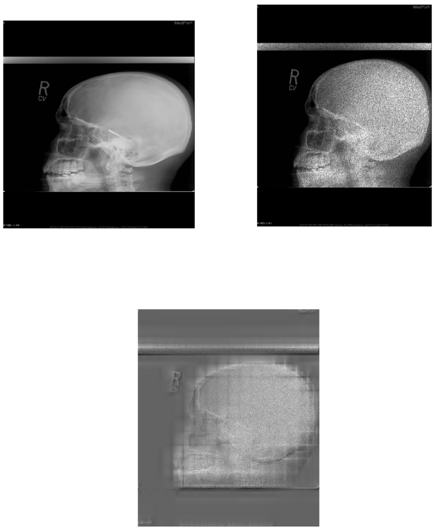


Fig –5 Input Image, Noisy Image, Denoised Image

c. ***1024 * 1024 Pixels formats images***

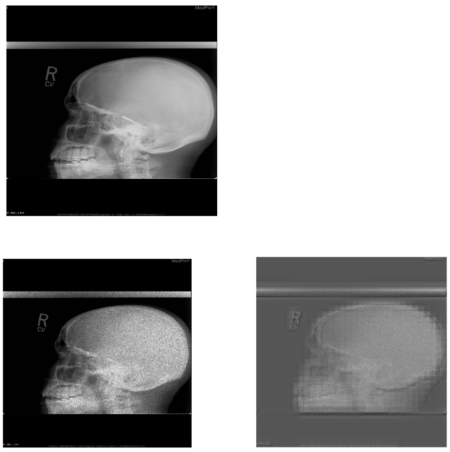


Fig – 6 Input Image, Noisy Image, Denoised Image

The estimated values for the input image of different order is shown below table which were restricted to mean, standard deviation and entropy which helps to study the medical image in its contrast, edges and clarity.

Tabulation:

Pixe lsize	Pixel properties								
	Mean			Standard deviation			Entropy		
	Input image	Noise image	Denoised image	Input image	Noise image	Denoised image	Input image	Noise image	Denoised image
256	57.6245	57.5344	0.5266	72.6237	75.3561	0.1340	4.9247	5.1409	6.6566
512	57.5924	57.6607	0.0847	72.8611	75.8564	0.1214	4.8980	5.0975	6.0530
1024	57.5848	57.5734	0.4104	73.0026	75.8357	0.0981	4.8744	50724	5.2169

Table – 1 Results and Performance Analysis

V CONCLUSION

Based on the characteristics of dyadic wavelet transform, this paper presents an selfadjusted threshold method to improve image denoising performance. Experimental results show that the important indexes of standard deviation and signal-noise ratio of layered threshold denoising are obviously superior to the fixed threshold responsing indexes. Denoising effect of our method is demonstrated to be superior to the hard and soft threshold methods. Artificial noise in the process of reconstruction can be reduced due to invariability of parallel movement of dyadic wavelet. In addition, layered threshold can adjust threshold function automatically to improve the precision of image reconstruction.

VI REFERENCES:

[1] D. L Donoho, “De-noising by soft-thresholding”, *IEEE Trans,Information Theory*, 1995, vol.41, no.3, 613-627.

[2] S. G. Chang, B. Yu and M. Vetterli, “Adaptive wavelet thresholdingfor image denoising and compression”, *IEEE Trans. on Image Proc.*, 2000, vol. 9, no. 9, 1532-1546.

[3] M.C. Motwani, M.C. Gadiya and R.C. Motwani, “Survey of ImageDenoising Techniques”, p*roceedings of GSPx,* Santa Clara, CA, 2004.

[4] L. Kaur, S. Gupta, and R.C. Chauhan, “Image denoising using wavelet thresholding”, *Indian Conference on computer Vision, Graphics and Image Processing,* Ahmedabad, 2002.

[5] S. D. Ruikar, & D. D. Doe, “Wavelet Based Image Denoising Technique”, *International Journal of Advanced Computer Science and Applications*, 2011, Vol. 2.

[6] R. C. Gonzalez, and R. E. Woods, “Digital Image Processing”, *Prentice-Hall, India, second edition*, 2007.

[7] A.K. Jain, “Fundamentals of digital image processing”, *Prentice-Hall*, 1989.