Applying The Computer Technique to Sharp The Edges of The Medical Images

Sadiq Hassan Lefta

College of Science for Women, Babylon university

Abstract

Science of digital images processing and analysis is regarded as an important and modern science, because of its wide applications. It is considered as an important branch in the information science. Perhaps from the significant image analysis techniques is the enhancement of image. Sharpen the edges image classification as one of type of enhancement of digital image.

This project is directed to understand the relationship between characterization of some images and the sharpen the edges of these images processes efficiency that is achievable over each class.

Two medical images are using to test the performance of the system (Tissue, Vessels).

Key word (Computer, Medical images, program for analysis Haar wavelet transform)

The Goal

The goals with this job is to design system by using wavelet transform to use it for enhancement of medical images.

الخلاصة

علم تحليل ومعالجة الصور الرقمية يعتبر من العلوم المهمة والمعاصرة، بسبب كثرة تطبيقاته. حيث يعتبر احد اهم فروع علم المعلومات. ربما من اهم تقنيات التحليل، هو تحسين الصور الرقمية. ان زيادة حدة حواف الصورة يصنف كاحد انواع تحسين الصور الرقمية. ان هذا المشروع موّجه لفهم العلاقة بين خواص بعض الصور و كفاءة عملية زيادة حدة هذه الصور المنجزة على كل صنف.

لقد تم استخدام صورتين طبيتين لفحص كفاءة المنظومة هما (نسيج، شرايين)

Introduction

It is quite clear that image-processing techniques are always the first stage of computer vision. One of the major topics within the field of computer vision is, in fact, image analysis. Image analysis involves the examination of the image data to facilitate solving a vision problem. With the massive sizes of image and volumetric datasets, compression becomes increasingly important to support efficient storage, transmission and processing. practical data sequences normally contain a substantial amount of redundancy. Redundancy in signals can appear in form of smoothness of the signal or in other words correlation between the neighboring signal values. A data sequence, which embeds redundancy, can be presented more compactly if the redundancy is removed by means of a suitable transform. An appropriate transform should match the statistical characteristic of the data. Applying the transform on the data results in less correlated transform coefficients, which can be encoded with fewer bits. A popular transform that has been used for years for compression of digital still images and image sequences, is the Discrete Cosine Transform (DCT) (Niel, 1992; Wihelm , 2007) .

Wavelet Transform

The wavelet transform was born out of a need for further developments from Fourier transforms. Wavelets transform signals in the time domain (rather, assumed to be in the time domain) to a joint time-frequency domain. The main weakness that was found in Fourier transforms was their lack of localized support, this means that we could get information about the frequencies present in a signal, but not where and when the frequencies occurred. Wavelets, on the other hand, are not anywhere as subject to it. A wavelet is a little piece of a wave. Where a sinusoidal wave as is used by Fourier transforms carries on repeating itself for infinity, a wavelet exists only within a finite domain, and is zero-valued elsewhere (Orchared, 2008). A wavelet transform involves convolving the signal against auricular instances of the wavelet at various time scales and positions. Since we can model changes in frequency by changing the time scale, and model time changes by shifting the position of the wavelet, we can model both frequency and location of frequency. Hence, the dubbing of the WT's resulting domain as a joint time-frequency domain. What we do is take a lowpass (scaling function) and a highpass (wavelet function) version of the curve and separate the highpass and lowpass information. In short, we treat the wavelet transform as if it is a filter bank, and we iterate downward along the lowpass subband. The lowpass data is treated as a signal in its own right and is subdivided into its own low and high subbands .(Kristan , 2000); Bahman ,2002 ; Parashar ,2004). The method of the wavelet transform can be achieve, clarified in figure-1-

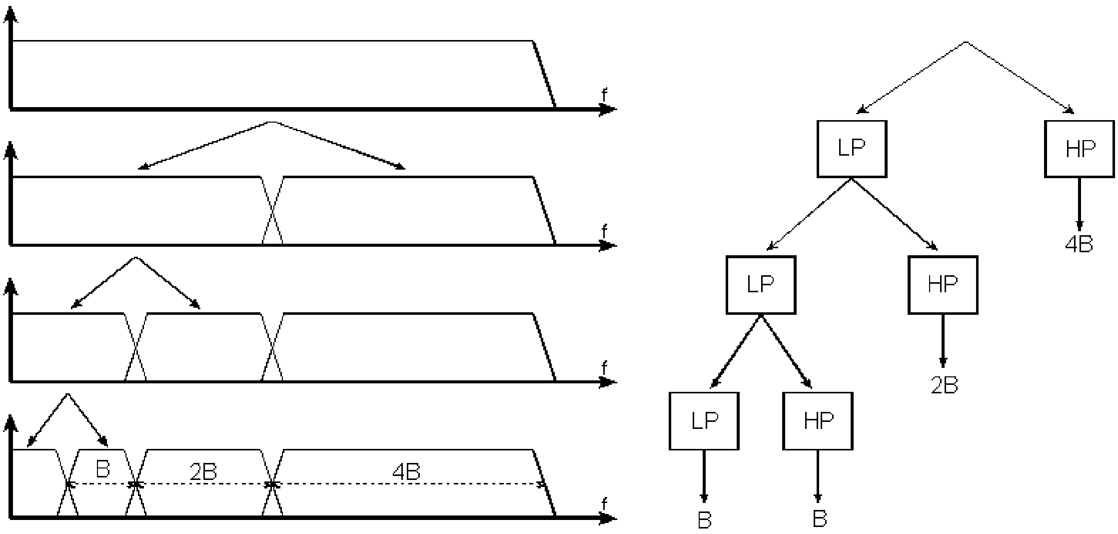


Figure-1- The stages of wavelet analysis (Parashar , 2004)

Note: LP: Low pass filter.
Hp: High pass filter.
B: Band

Image processing

Interesting in digital image processing methods comes from two principal application areas: improvement of pictorial information, and processing of scene data for autonomous machine perception ([Donlad ,2000).

The major topics within the field of image processing include; image enhancement and restoration; image enhancement involves taking an image and improving it visually, typically by taking advantage of the human visual system's response, while the image restoration is the process of taking an image with some known, or estimated, degradation, and restoring it to its original appearance (Rabi , 2004) .

Image coding (compression); involves coding of an image and reducing the typically massive amount of data needed to represent an image.

Image segmentation and description parting of an image into the components which image consists of them, and describes an image (Henk (2001; Bach ,2002).

The digital image

In general an image has to be represented in away that computers can understand it. Computers understand numbers, and numbers have to be used. An image, therefore, is a two-dimensional array of elements, each of which carries a number that indicates how bright the corresponding analogue picture is at that point. The elements of the image array are called pixels, and the values they carry are usually restricted by convention to vary between 0 for black and 255 for white.

A digital image I[x,y] which is described in a Two dimensions (2D) discrete space is derived from an analog image I[x,y] in a 2D continuous space through a sampling process that is frequently referred to as digitization. The 2D continuous image I[x, y] is divided into N rows and M columns. The intersection of a row and a column is termed a pixel. The value assigned to the integer coordinates I[x,y] with {x=0,1,2,…,M–1} and {y=0,1,2,…,N–1} is I[x,y]. A grayscale image is formed by assigning each of the 0 to 255 values to varying shades of gray[Jelena (2001) Ahmed (200)].

Material and method

Sharpening method is one kind computer vision. This process can be utilize to sharp the edges of the image, edges describe the changing of gray tones in neighboring regions and are pixel oriented.

In the current research there are common steps must implemented when using wavelet transform to enhance the image:

1-Transform the image into wavelet domain using Haar transform.

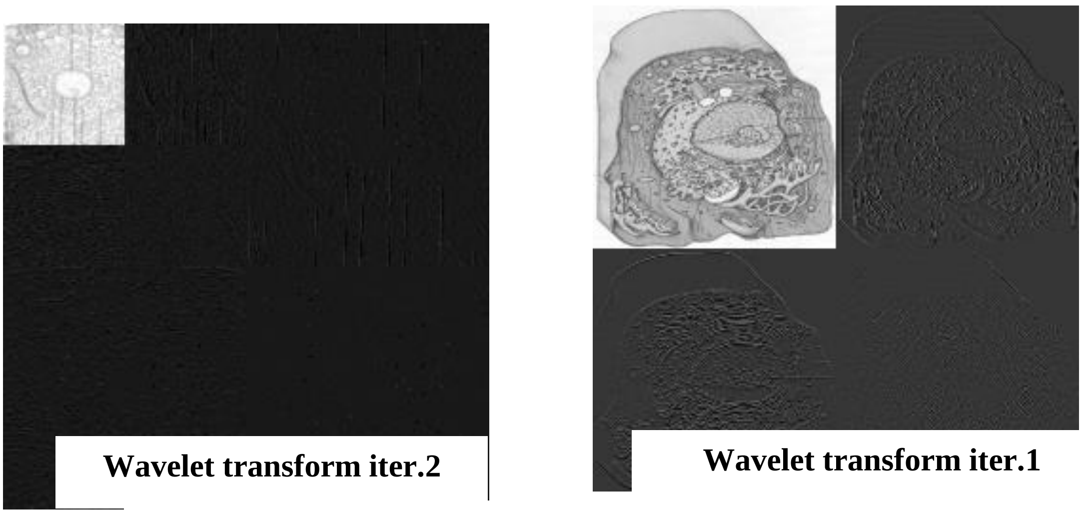
2-Inverse transform the processed image to reproduce the enhanced image.

3-Calculate the values of root mean esquire error (RMSE), and peak signal to noise ratio (PSNR), of the enhanced image by comparing it with the original image.

4-Comparisons must be done between the values of (RMSE), (PSNR) of enhanced image and original image to measure the performance of the applied smoothed method.

So that the procedure of this project must be consist of the following steps:-

A-Transform the medical and astronomical images to wavelet transform by using first and second wavelet transform. As shown in fig-2.



Wavelet transform iter.2 **Wavelet transform iter.1**

Figure -2-

B-Transform medical image to forward wavelet by using following algorithm:

1.Load source file (SFIL) in Temp l.
2.Set I= l
3.l n put w = Image width: H= Image height and decomposition levels (Iter.)
4. Set W = W/2 : H= H/2.
5. SET Y=0.
6.Read tow rows from Temp 1.
7.Input the first row into matrix A1, and the second row into matrix A2.
8.SetX=0.
9.Let K=2*x; j=k+I.
10. Input BI (x)= 0.25{AI(k)+AI(j)+A2(k)+A2(j)}.
BI(x+w)=0.25{AI(k)-AI(j)+A2(k)-A2(j)}
B2 (x) =0.25{ AI(k)+AI(j)-A(k)-A2(j)}.
B2(x+w)=0.25{AI(k)-A(j)-A2(k)+A2(j)}.
11.Set X=X+1.
12.If(X=W-1) write matruices B1, B2 into Temp2.
13.Y=Y+1
14.If(Y=H-1) copy Temp2 to Temp 1.
15. Set=I+1
16.IfI=Iter. Copy Temp 2 to output file (TFIL).
17.END.

(Algorithm for Forward wavelet Transform)

C-Inverse transforms upon the processed image to obtain the reconstructed image as the following algorithm.

The out put of forward Haar transform are scaling coefficients (LL) band and wavelet coefficients (LH, HL, HH) bands, each wavelet coefficient represent the amplitude of corresponding wavelet, these wavelet are the basis functions which the image analyzed to them, so the summation of these basis functions reproduce the original image.

1.Load source file (SFIL) in Templ.
2.Set I = l
3.l n put w = image width: H= Image height and decomposition levels (Iter.)
4. Set W = W/2 : H= H/2.
5. SET Y=0.
6.Read tow rows from Temp 1.
7.Input the first row into matrix A1, and the second row into matrix A2.
8.Set X=0.
9.Let K=2*x; j=K+I.
10. Input B1 (k)= 0.25{AI(x)+AI(j)+A2(k)+A2(j)}.
BI(k+1)=0.25{AI(x)-AI(J)+A2(K)-A2(j)}
B2 (k) =0.25{ AI(x)+AI(j)-A(K)-A2(j)}.
B2(k+1)=0.25{AI(x)-A(j)-A2(K)+A2(j)}.
11.Set X=X+1.
12.If(X=W-1) write matrices BI, B2 into Temp2.
13.Y=Y+1
14.If(Y=H-1) copy Temp2 to Temp1.
15. Set=I+1
16.If I=Iter. Copy Temp 2 to output file (TFIL).

17.END. **(Algorithm for Inverse wavelet Transform)**

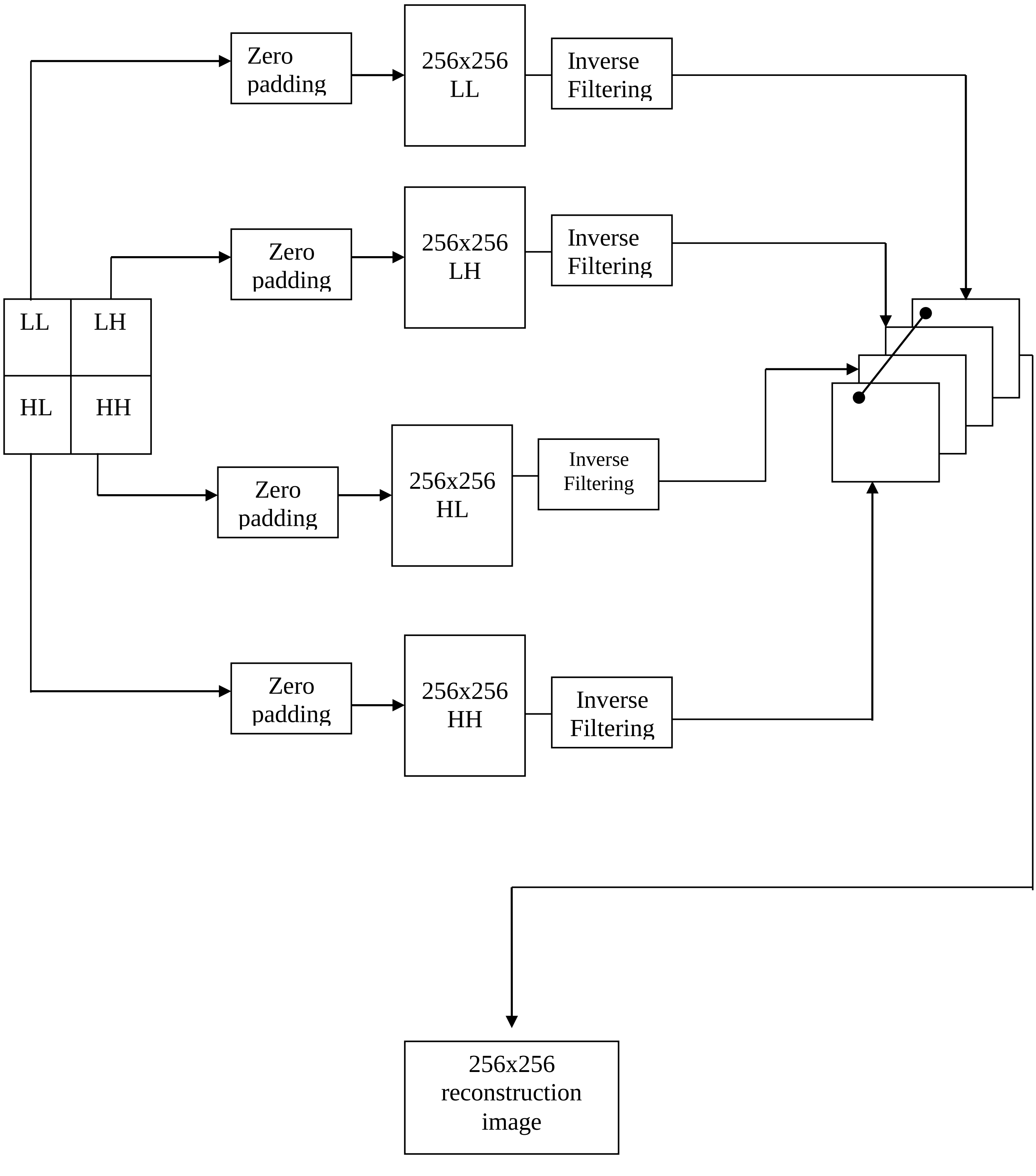


Figure -3-Inverse wavelet transform image 256x256

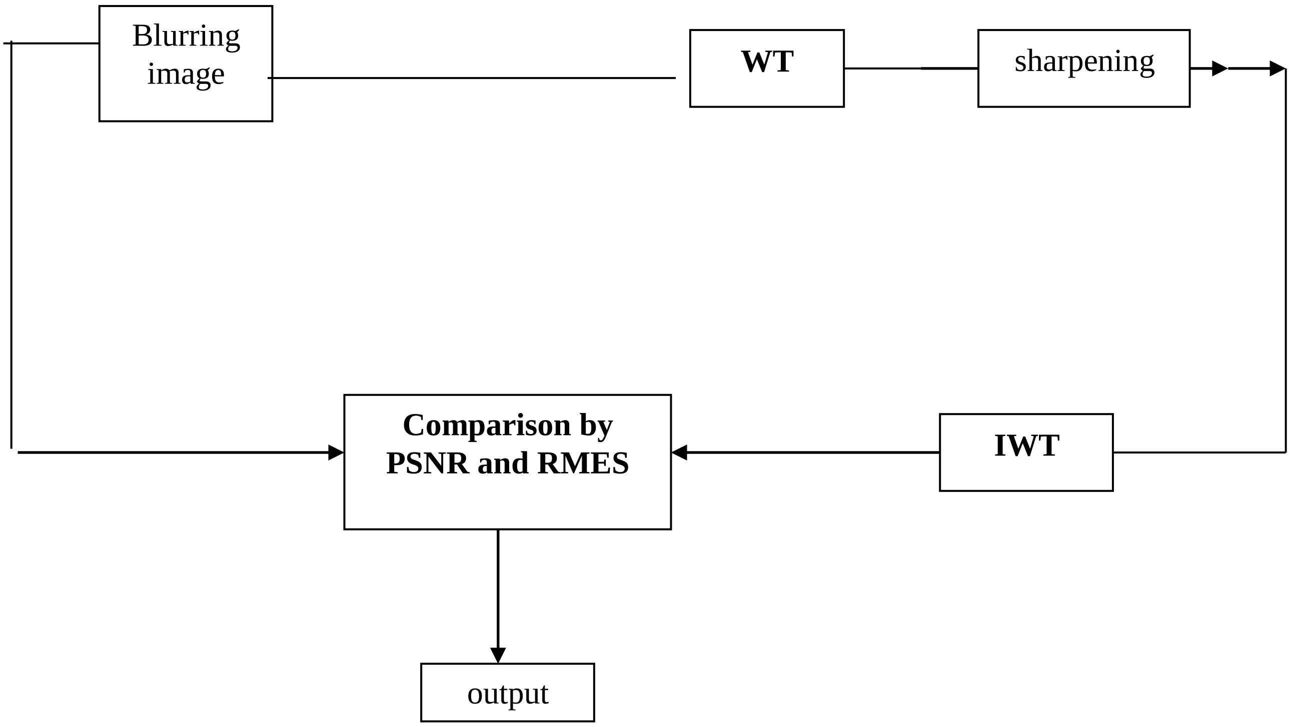


Figure –4- The Wavelet Domain image to sharp the edges system

Conclusion and discussion

The results of the current research demonstrated in the following tablets, where these suggested methods are applied on gray level images, we used five images to test the efficiency of enhancement (sharpening) method. These images are (tissue, vessels)

The fidelity of the quality of the original and sharpening image depend upon the values of the (PSNR: peak signal to noise ratio) and (RMSE: root mean square error). So can be show from the results which in the above tablet the following conclusion:-

1-When the values of the fidelity (PSNR) was high, that is meaning the sharpening image have best quality and vice versa for the values of the fidelity (RMSE).

2- The sharpening image process can be down by massive the coarse levels (LH, HL, and HH) by multiblying with the factor ratio, which represent the amplification factor, for amplification the features of the image, the value of the factor more than one and can be make the image blurred by using the value of the amplification factor less than one (see fig -5- tissue) and see (fig-6- vessels). The obtaining result illustrated in the tables [1,2] .

3-The values of the coefficients of the wavelet transform image viruses from one band level to another. To solve this problem, method have been design by using variable decreasing factor for each band from analyzing bands called decay factor (Dec. Fac.).

4-The sharpening image as show in the results from the tables (1,3), the best quality image can be obtain in case first analytical level image of wavelet transform the values of the (PSNR) in case of the iter.2 Is less than of the values of the first iter.1.The reason belong to that the second iteration may be separate the large coefficients restricted it in the roughen levels, which have been less important in reproduced image, this was causing reduction the number of coefficients in the

(LL) level which plays the important role in the quality of reproduced image (See Fig-5,7).

Tablet-1- The coefficients of sharpening image [tissue1] by using the wavelet transform iter.1 where:-

RMSE: root mean square error.
PSNR: peak signal to noise ratio.
Dec. Fac.: decay factor

image	ratio	Dec. Fac.	RMSR	PSNR	Iter.
Y1	5	3	47.65	14.569	1
Y2	3	5	30.22	16.4	1
Y3	7	4	38	16	1
Y4	5	3	33	44.569	2
Y5	1	2	9.6	28.48	2

Tablet-2- The coefficients of sharpening image [tissue1} by using the wavelet transform iter.1 where:-

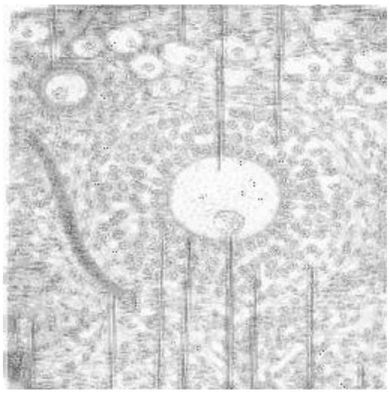
RMSE: root mean square error.
PSNR: peak signal to noise ratio.
Dec. Fac.: decay factor

Image	ratio	Dec. Fac	RMSR	PSNR
C1	2	1.2	19.6	22.26

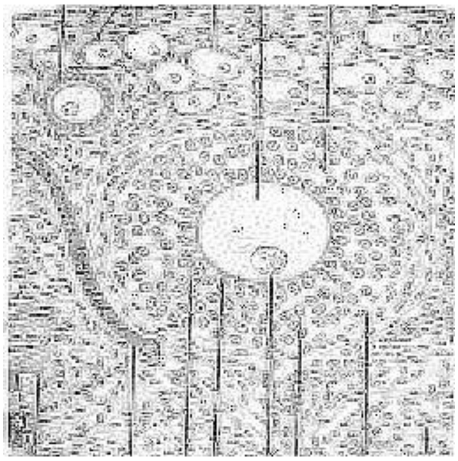
Table-3- The coefficients of sharpening image [tissue1] by using the wavelet transform iter.2 where:-

RMSE: root mean square error.
PSNR: peak signal to noise ratio.
Dec. Fac.: decay factor

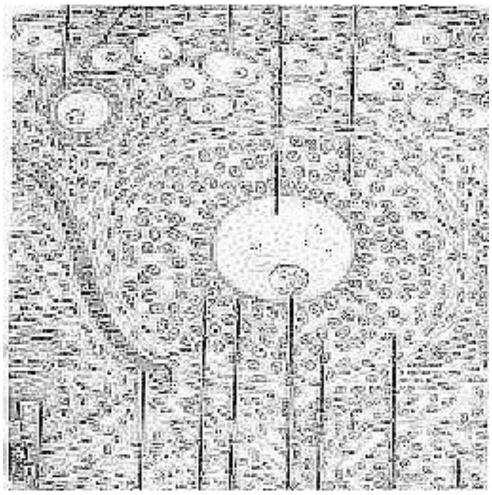
image	ratio	Dec. Fac.	RMSR	PSNR	Iter.
Y11	5	3	50.65	10.569	2
Y22	3	5	28.22	16.4	2



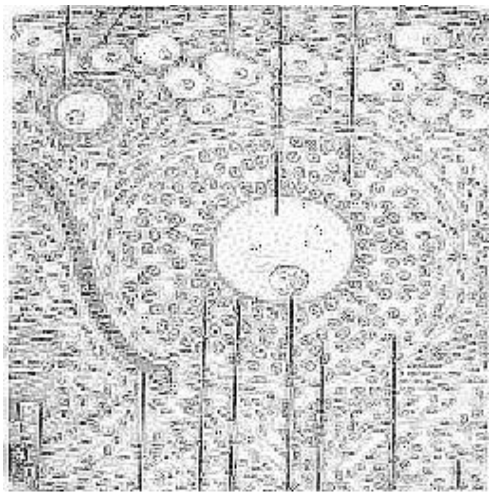
Tissue



Y2

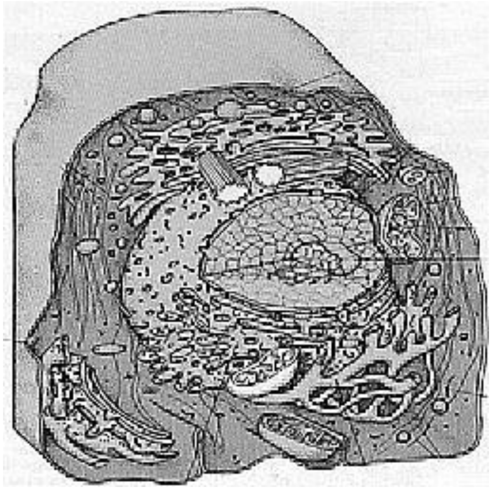


Y1

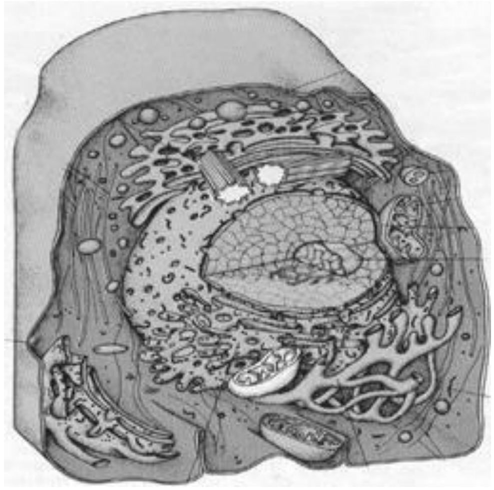


Y3

Fig -5-Sharpening image using wavelet transform itr.1



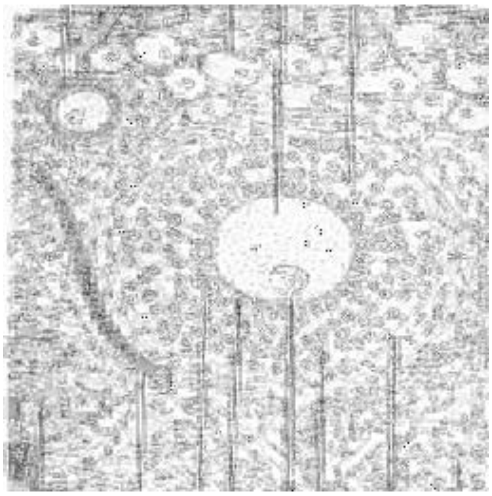
C1



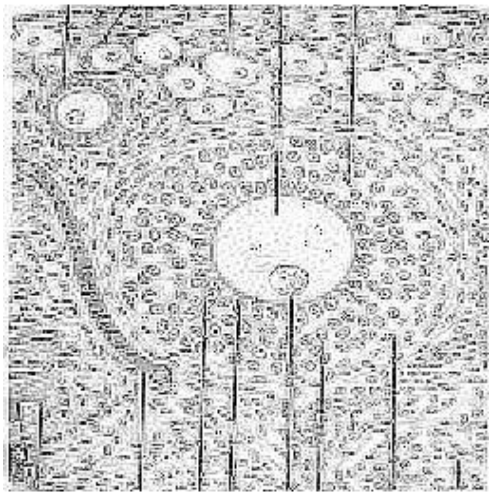
Vessels

Figure –6- sharpening image using wavelet transform (tissue2) images

YY



YY2



YY1

Fig -7– sharpening image using Wavelet transform (iter.2)

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