Hybrid Filtration Technique For The Enhancement Of Image

A Dissertation Proposal
submitted

By

Aarti

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Department of Computer Science and Engineering

In partial fulfilment of the Requirement for the

Award of the Degree of

Master of Technology in Computer Science and Engineering

Under the guidance of

Mr. Gaurav Pushkarna (11057)

(May 2014)

DECLARATION

I hereby declare that the dissertation Proposal entitled, **Hybrid filtration technique for the enhancement of the image** submitted for the M.Tech Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

Date: ________________ Investigator

Regd. No. 41100071

ABSTRACT

Image enhancement is the improvement of digital image quality (wanted e.g. for visual inspection or for machine analysis), without knowledge about the source of degradation. If the source of degradation is known, one calls the process image restoration. Both are conical processes, viz. input and output are images. Many different, often elementary and heuristic methods are used to improve images in some sense. The problem is, of course, not well defined, as there is no objective measure for image quality. Here, we discuss a few recipes that have shown to be useful both for the human observer and/or for machine recognition. These methods are very problem-oriented: a method that works fine in one case may be completely inadequate for another problem. In our research work we are going to present the hybrid method of filtration in spatial domain to enhance the image.

CERTIFICATE

This is to certify that Ms. Aarti has completed M.tech dissertation proposal titled Public key infrastructure based digital signature for controlling intrusion in Wireless Ad-Hoc Networks under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the dissertation proposal has ever been submitted for any other degree or diploma. The dissertation proposal is fit for the submission and the partial fulfillment of the conditions for the award of M.Tech Computer Science & Engg.

Date: ____________________

Signature of Advisor

Name: Mr. Gaurav Pushkarna

UID:11057

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I would also like to thank my parents, two elder sisters, and brother. They were always supporting me and encouraging me with their best wishes.

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LIST OF ABBREVIATIONS

- SURE - Stein Unbiased Risk Estimator
- BAMS - Bayesian Adaptive Multiresolution Shrinkers
- GIF - General image fusion
- MRAIM - Multi resolution analysis-based intensity modulation
- MS - Multispectral
- SSIM - Structural Similarity Image Metric

CHAPTER 1
INTRODUCTION

Digital image processing is the branch of science which is related to the image. It further divided in many classes. Which is shown in the figure 1.1.This dissertation is based on the filtration technique. there are many filtration techniques but this Dissertation is based on hybrid filtration technique. The filtration technique is used when image get corrupted or in other words image get noise in it and its visualization is get effected with formation of false edges.so here we discuss the different algorithm and technique to remove the noise from image.

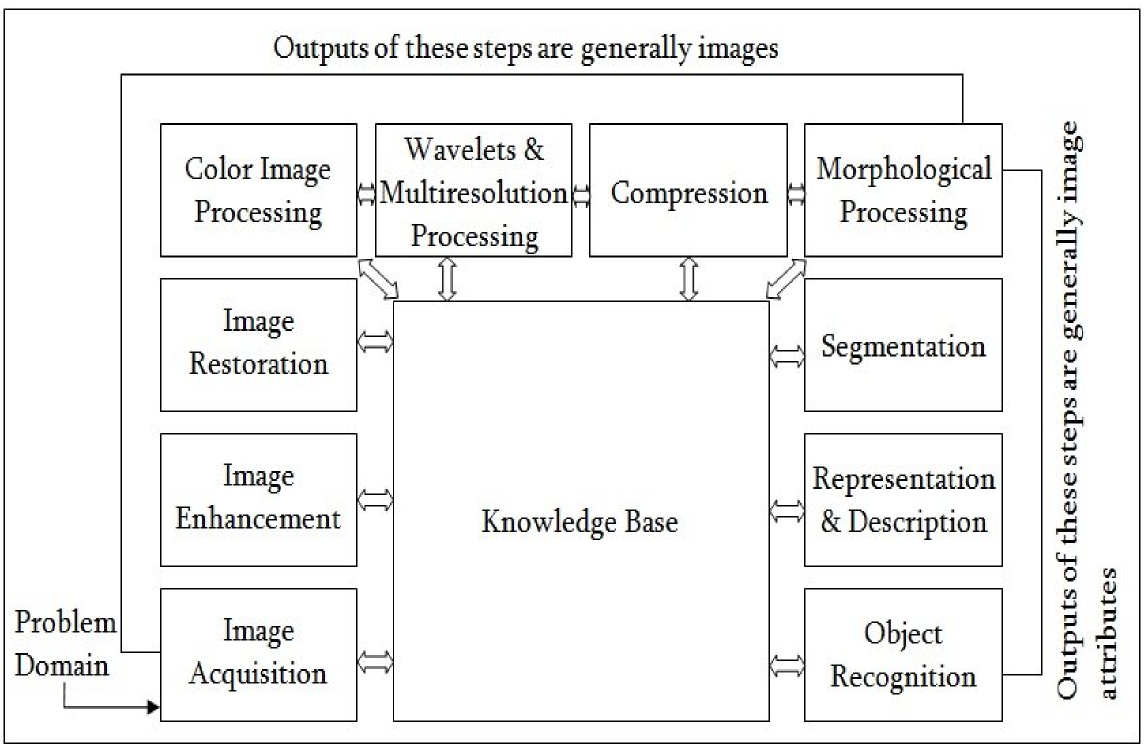


Figure (1.1) Different studies in digital image processing.

SOURCE("tanmayonrun.blogspot.in/2011/10/describe-fundamental-steps-of-digital.html")

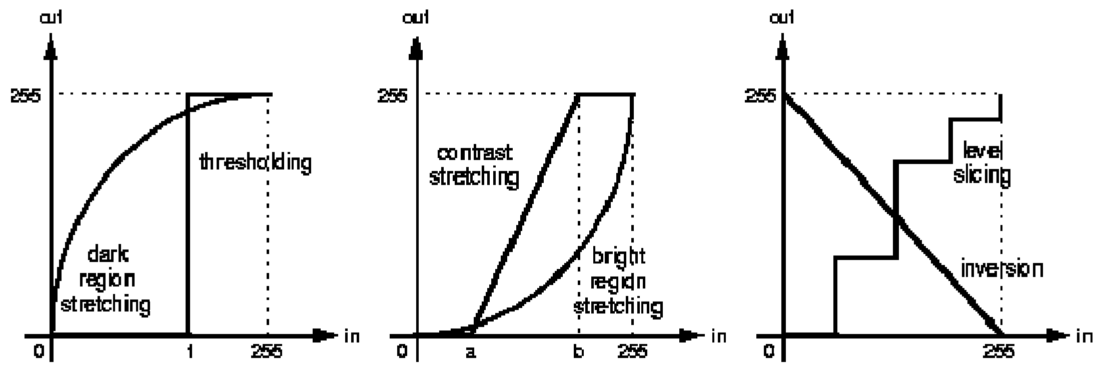


Figure (1.2) Simple greylevel transformations

Source (“http://rd11.web.cern.ch/RD11/rkb/AN16pp/node127.html”)

Grey values can also be modified such that their histogram has any desired shape, e.g. flat (every grey value has the same probability).

1.1 IMAGE DENOISING ALGORITHMS

The implementation of various image denoising algorithm based on wavelet transform have been described in this chapter for gray scale image.

1.1.1 IMAGE DENOISING ALGORITHMS FOR GRAY-SCALE IMAGE

Image denoising by using different thresholding techniques are described under the section given below. These all algorithms are based on wavelets and thresholding schemes.

1.1.2 Universal Thresholding.

$$Tc= \sigma \sqrt{(2 \log M)} \tag{1.1}$$

Where Tc is threshold value, M is the data length, σ is the noise variance of data estimated according to Equation Universal thresholding is non-data dependent because it is not inspecting each data statistically. However it is certainly an adaptive threshold method due to parameters such as M and σ in its expression.

1.1.3 Visu Shrink Method

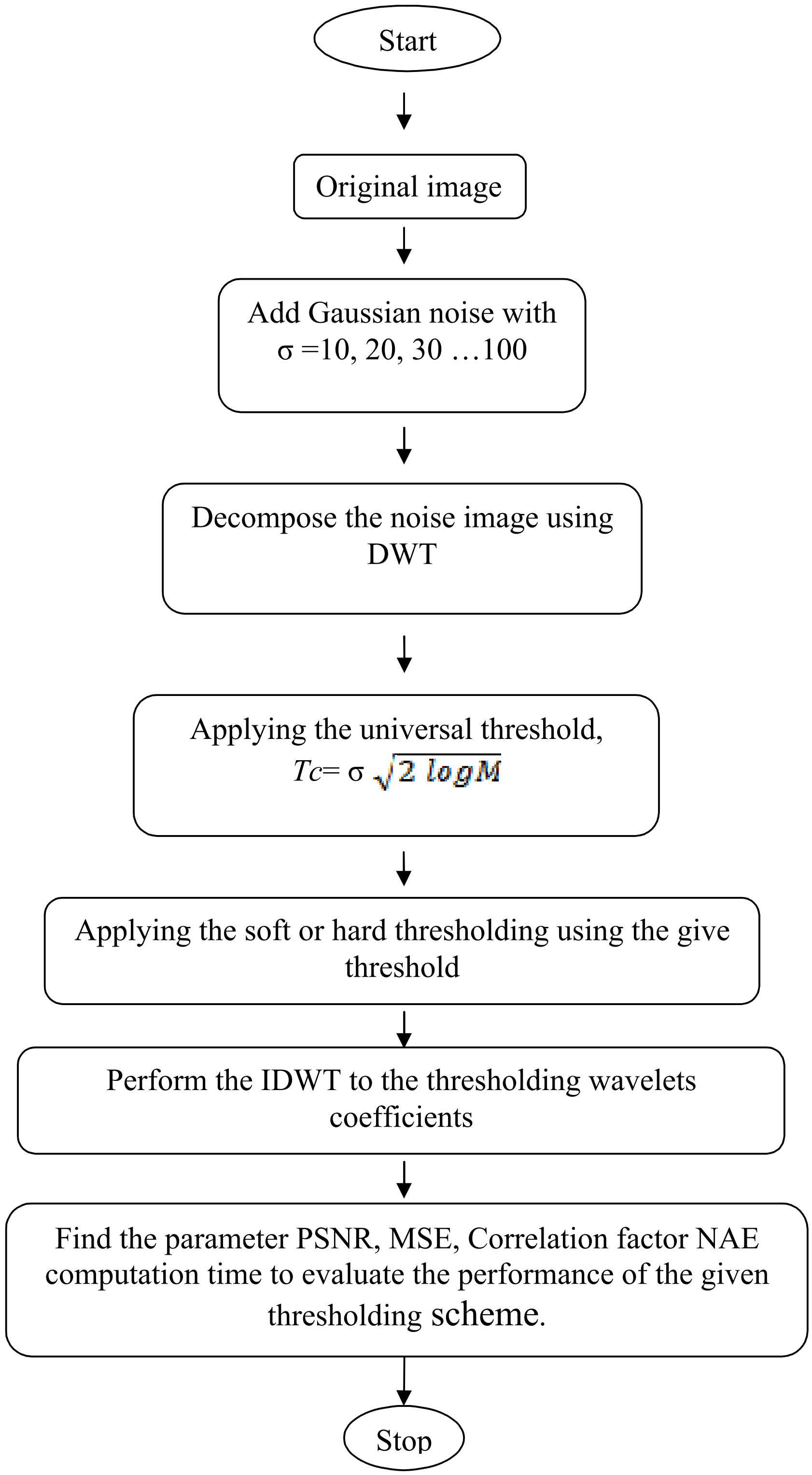


Figure (1.3) Flow chart of VisuShrink method

Then soft and hard thresholding is applied to the wavelet detail coefficient using the given threshold. The denoised image is obtained by performing IDWT to the thresholded wavelet coefficients.

1.1.4 Sure Shrink

Sure shrink is an estimate method drive by data. The estimate threshold is than lower that of VisuShrink and regressively optimal D.L.Donoho suggested choosing the optimal threshold value T by minimizing Sure [6]. The significance of this is that it is possible to transform the original data into its WC, and then attempt to minimize risk in the wavelet domain; doing so will automatically minimize risk in the original domain. In practical situation the risk $R(\hat{f}, f)$ must be estimated from the data. This method employs an unbiased estimate of risk that is due to Stein called Stein Unbiased Risk Estimator (SURE) [31]. Minimization of estimated risk is done by choosing a threshold value for each wavelet scale. This method is illustrated by considering the following equivalent problem.

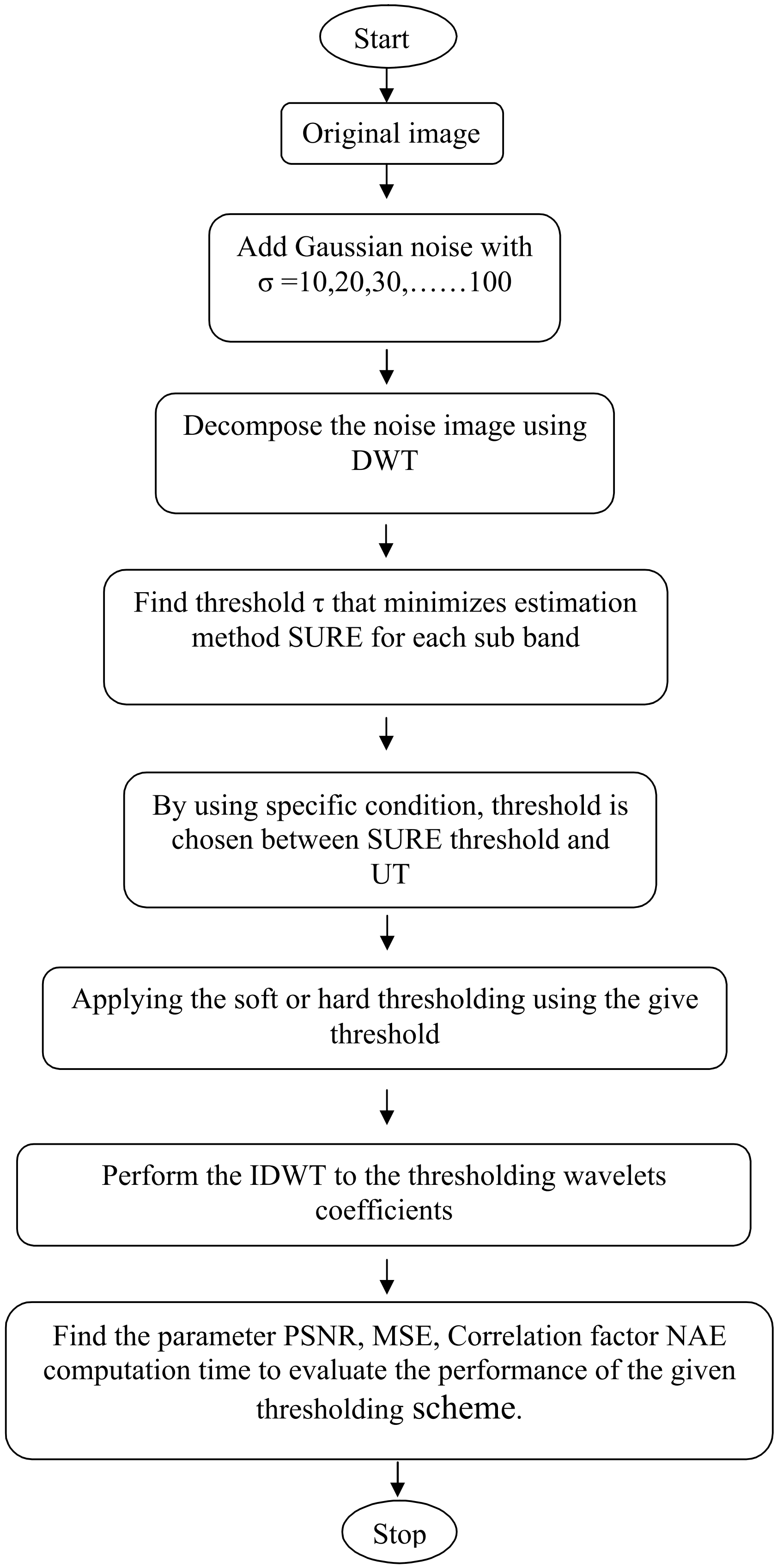


Figure (1.4) Flow chart of Sure Shrink method

T_d^F in dense situation and to T_s in space situation

$$\hat{\mu}(x_i) = \begin{cases} {}^{\eta}T_d^{F(x_i)} & S_d^2 \le \eta_d \\ {}^{\eta}T_d^{F(x_i)} & S_d^2 \le \eta_d \end{cases} \quad (1.2)$$

Where

$$S_d^2 = d^{-1}\sum_i \left(x^2{}_i - 1\right) \quad (1.3)$$

And, $$\eta_d = \log_2(d)^{3/2} \quad (1.4)$$

η being the thresholding operator.

Sure applied to image denoising are First step is to perform WT on the noisy image which corrupted by AWGN. Then SURE thresholding method is applied to wavelet coefficient. The SURE is determined for each sub-band using the equation (1.2), (1.3) and (1.4). Then SureShrink method applied to between SURE threshold and UT. The denoised image is obtained by performing IDWT to the threshold wavelet coefficients.

- Advantages
  - Its minimization over a set of denoising automatically provides a near optimal solution.
  - SURE based give best result as a output PSNR for images.
  - The quality image is moreover characterized by fewer artifacts that the other methods.
- Disadvantage
  - Computational time is more than other denoising methods.

1.1.5 Base Shrink Method

Bayesian methods for function estimation with wavelets are different then simple threshold selection, in the sense that new shrinkage functions result from the Bayesian approach, different from either the soft or hard thresholding functions discussed previously. It is seen that Bayesian rule is not a threshold estimator only. It is directly estimating γ k without using soft or hard thresholding for a specific level. The thresholding is driven in a Bayesian framework, and GDD is assumed for the wavelets coefficients in each detail sub-band. The GDD is given by

$$GG_{\sigma_X,\beta}(x) = C(\sigma_x,\beta)\exp\left\{-\left[\alpha(\sigma_{x,}\beta)|x|\right]^{\beta}\right\} \qquad (1.5)$$

Where

$$-\infty < x < \infty, \sigma_x \rangle 0, \beta \rangle 0$$

$$\alpha(\sigma_x,\beta) = \sigma^{-1}{}_x\left[\frac{\Gamma(3/\beta)}{\Gamma(3/\beta)}\right]^{1/2} \qquad (1.6)$$

$$C(\sigma_x,\beta) = \frac{\beta.\alpha(\sigma_x,\beta)}{2\Gamma(1/\beta)} \qquad (1.7)$$

$\Gamma(t) = \int_0^{\infty} e^{-u}u^{t-1}du$ is the gamma function

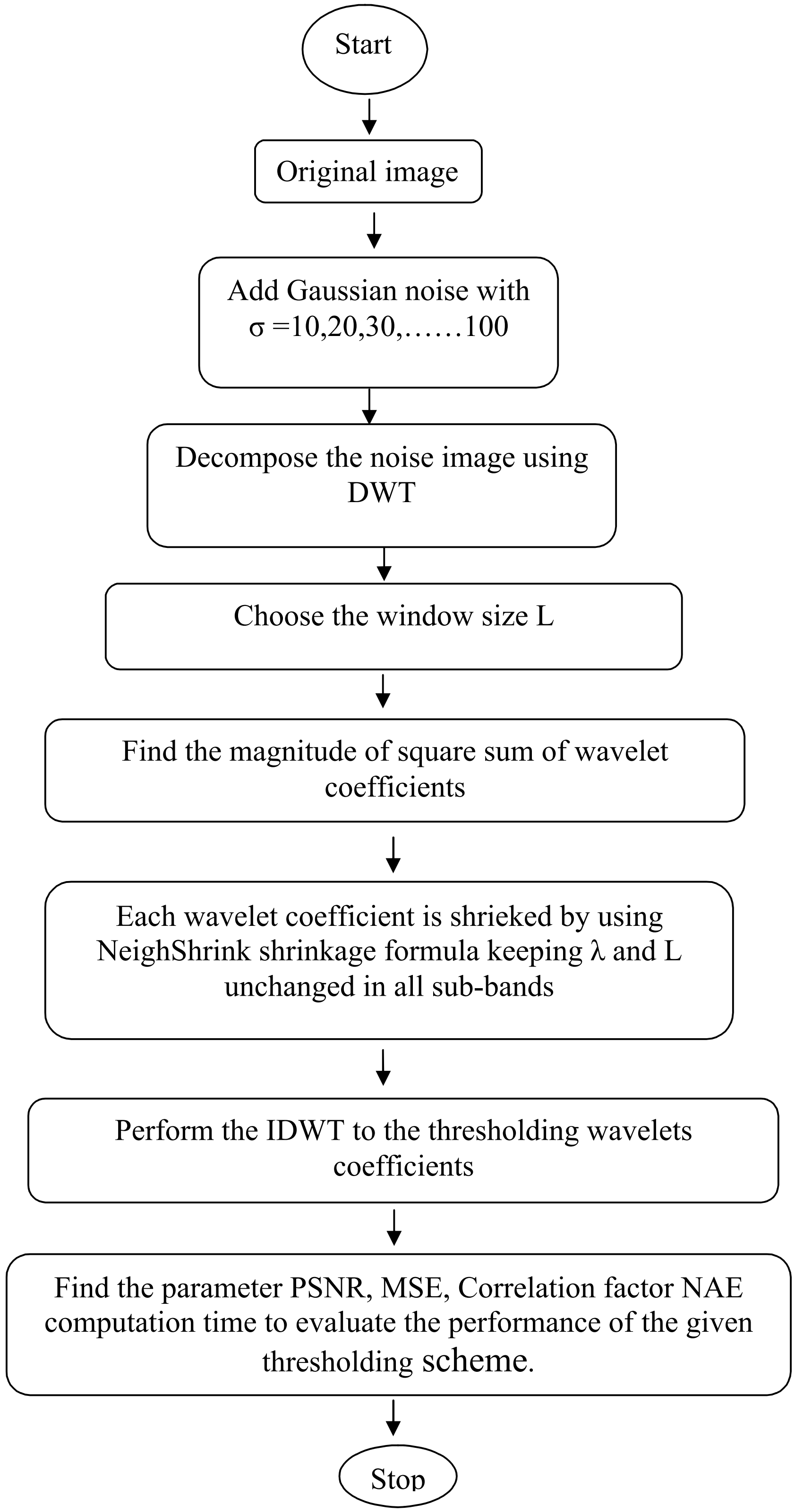


Figure (1.5) Flow chart of BaseShrink thresholding method

The GDD parameters and β needs to be estimated to compute data- driven estimate of( ).

$$\sigma^2{}_Y = \sigma^2{}_x + \sigma^2 \tag{1.8}$$

Where   is the variance of Y.? Since Y is modeled as zero-mean, is found as

$$\sigma^2{}_Y = \frac{1}{n^2 i, \sum_{j=1}^{n} Y_{ij}{}^2} \tag{1.9}$$

n × n =size of sub domain. Also, is defined as

$$\sigma^2{}_X = \max\left(\sigma^2{}_Y - \sigma^2, 0\right) \tag{1.10}$$

Therefore the data driven, sub band-dependent Bayes threshold is given as

$$T_B = \frac{\sigma^2}{\sigma_X} \tag{1.11}$$

First step is obtained wavelet decomposition on the noise image which is corrupted by AWGN. Then BaseShrink thresholding method is applied to the wavelet coefficient. The threshold is determined using the equation (1.11). The denoised image is obtained by performing IDWT to the thresholded wavelet coefficients. It is found that the BaseShrink perform well.

1.1.6 Neigh Shrink method

The WT accomplished by applying the low pass and high pass filter on the same set on low frequency coefficient recursively. That means wavelet is correlated in a small neighborhood.

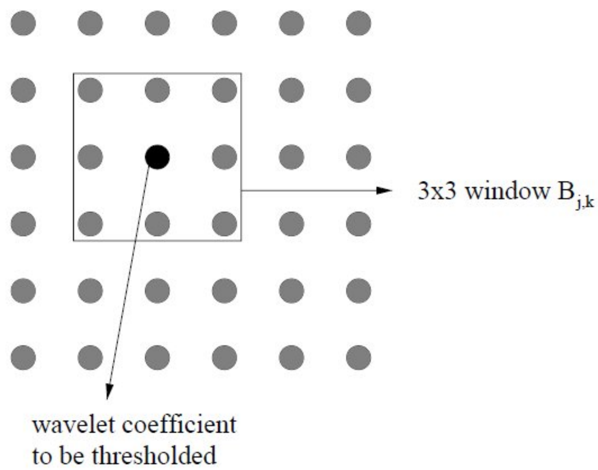


Figure (1.6) An example of the neighborhood window with size 3 × 3.

1.2 IMAGE DENOISING TECHNIQUE

In this chapter, the wavelet transformation is introduced, wavelet models are classified, multiresolution wavelet transformation on images is examined using the computational point of view. Features of different wavelet transform filters are examined on different image types.

1.2.1 WAVELET TRANSFORM

Different signal and image processing techniques having important contributions in wavelet transform. Some important factor contribution to this area can be listed as: multi-resolution signal processing, wavelet series expansion in applied mathematics, sub-band coding used in image and voice compression [2, 3, 4]. It is very complicated process to develop best wavelet function.

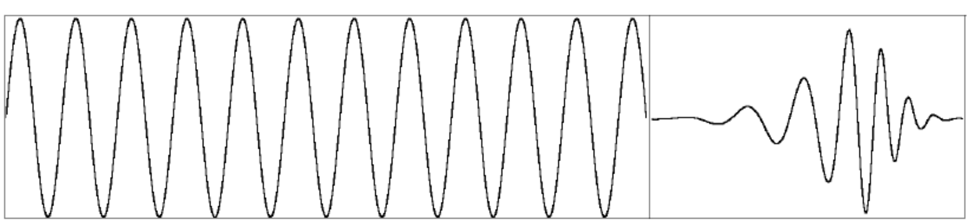


Figure .(1.7) Comparison of a wave and a wavelet.[2]

Continuous wavelet transform or CWT is written as:

$$\gamma(s,\tau) = \int f(t)\psi_{s,\tau}(t)dt \tag{2.1}$$

TheTran Inverse wavelet transformation can be expressed as:

$$f(t)=\int\int\gamma(s,\tau)\psi_{s,\tau}(t)\, d\tau ds \tag{2.2}$$

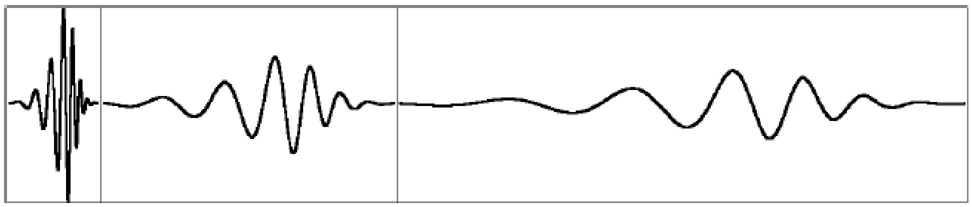


Figure.1.6 Mother Wavelet and its two different scaled versions

1.2.2 Wavelets Analysis

Original wavelet is break into a signal in wavelets Analysis. Local features can be described better with wavelets that have local extend. Windowing technique is used in anylysis wavelet with variable sized regions. At high frequency WT gives poor frequency and good time resolution.

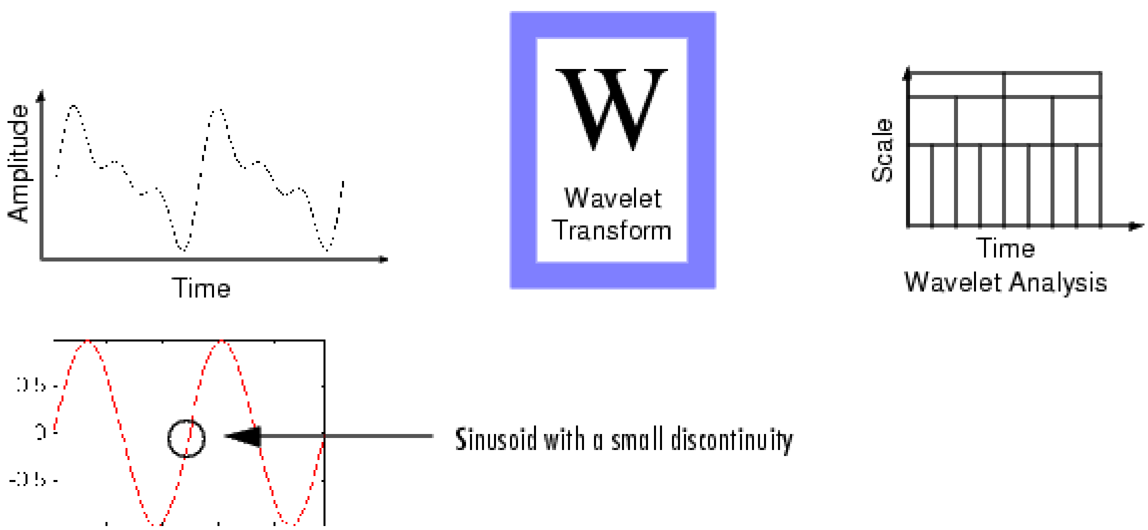
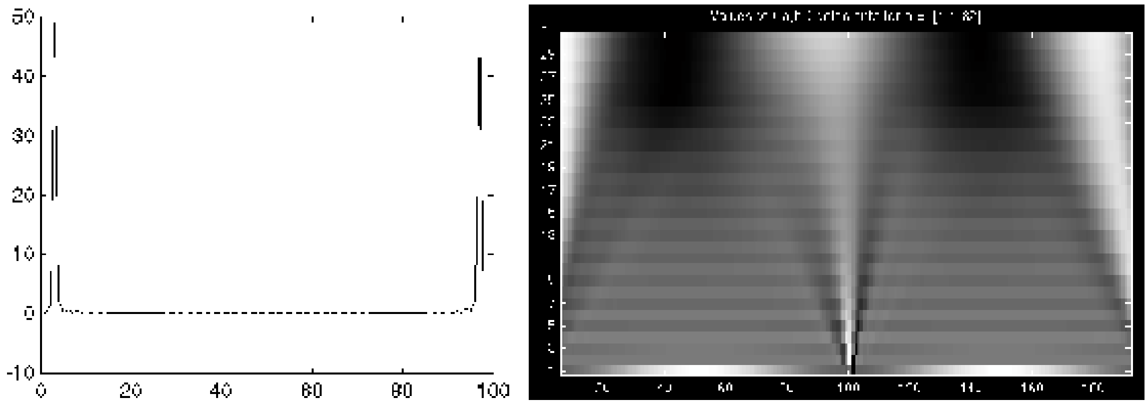


Figure (1.8) Discontinuous sine wave

Fig 1.8 shows the plot of the Fourier coefficient of discontinuous sine wave. It shows a flat spectrum with two peaks representing a signal frequency. However a plot of wavelet coefficient clearly shows that exact location in time of discontinuity.



Fourier Coefficients Wavelet Coefficients

Figure (1.9) Fourier coefficient vs. wavelet coefficient

1.3 WAVELET FAMILIE

the mother wavelet use no. Of function for WT. mother wavelet generate different wavelet functions which used in the transformation through translation and scaling.for using the WT effectively the mother wavelet should be appropriate usen.

Figure illustrates some of the commonly used wavelet functions. Haar (a), Daubechies-4 (b), and Coiflets-1 (c) are finite orthogonal wavelets. Haar wavelet is the starting point because it is an oldest wavelet.

1.3.1 Haar Wavelets

The Haar wavelet taking function values 1 and -1. It expressed as following

 (t) = 1 : 0 ≤ t < 1 (2.3)

 (t) = 0 : otherwise (2.4)

*Ψ(t)=:*0≤t<½ (2.5)

(t) =-1: ≤ t < 1 (2.6)

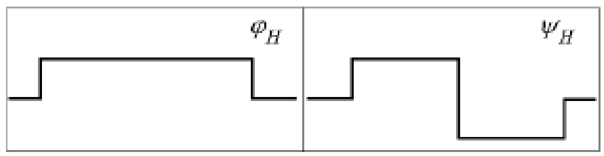


Figure (1.10) Haar scaling function (left) and Haar mother wavelet

1.3.2 Daubechies Wavelets

In Daubechies wavelets the number of zero moments for *ψ (t)* is maximized. Daubechies wavelets have the property of orthogonalityand having the maximum regularity that is:

< *i* , *j* > = *0, for i ≠ j,*

(2.7)

$< \Psi_i , \Psi_j > = 0, for\ i \neq j,$ (2.8)

< *Ψ i* , *j* > = *0, for i ≠ j,*

(2.9)

Daubechies wavelets gives good compression property for wavelet coefficients but not for approximation coefficients.

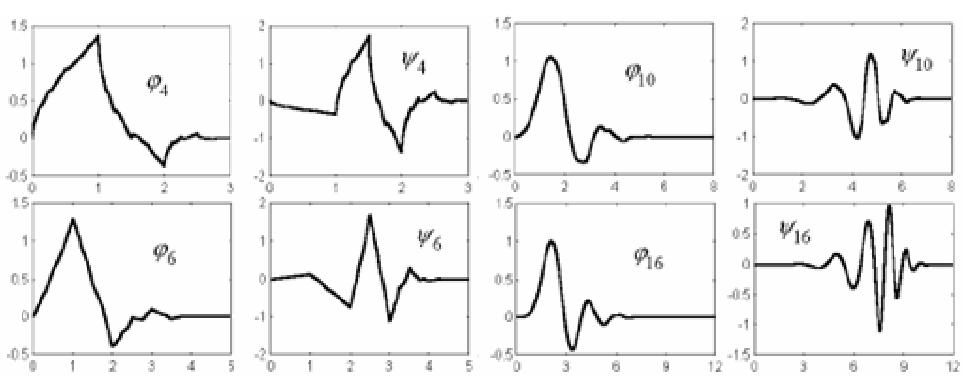


Figure .(1.11) Examples of Daubechies scaling and wavelet functions

Source(“http://www.math.cornell.edu/~numb3rs/spulido/Numb3rs_season5/Numb3rs _520.html”)

1.3.3 Coifman Wavelets (Coiflets)

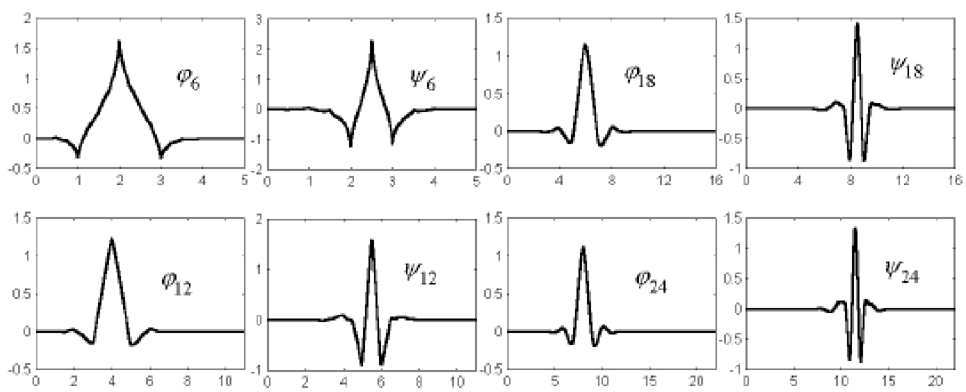
The Coifman wavelets were proposed by R. Coifman in 1989 [23]. This wavelet having the symmetric scaling function and vanishes fast as t goes to infinity. The following relations exist:

∫□ (t) dt = 1, (2.10)

∫ t a□ (t) dt = 0, a = 1,....,N-1; (2.11)

∫ t aψ (t)dt = 0, a = 1,....,N-1; (2.12)

where N is called the order of the Coifman wavelets. Figure 3.7 shows several of the examples in this case. The order of each wavelet filter is shown by the indices used on the corresponding □ (*t*) and ψ (*t*) functions.



Figure(1.12) Examples of Coiflets scaling and wavelet functions

Source (“http://cnx.org/content/m45098/latest/”)

1.3.4 Burt Adelson

Burt Adelson wavelet is one of the well-known biorthogonal wavelets in wavelet literature. Because of its biorthogonal feature, it has two scaling and two wavelet functions where □ □~ and ψ ,ψ~ respectively.

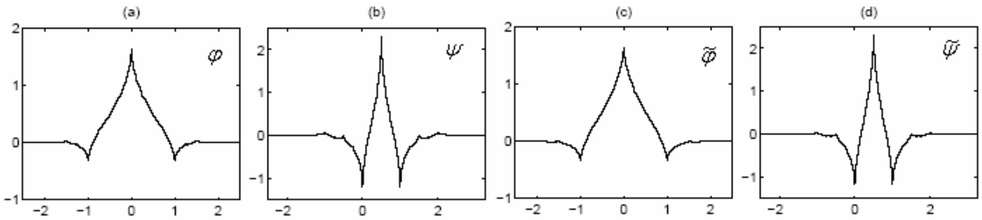


Figure (1.12) Example of two bands Burt Adelson biorthogonal wavelet

Burt Adelson wavelets are generated by a one "real" parameter familiy of symetric filters with small support but enough regularity and vanishing moments.

1.3.5 Spline Wavelets

In Spline cases wavelet ψ (*t*) and scaling □ (*t*) functions are polynomial splines of degree *n* [9]. Spline wavelets can be classified to different types regarding to their orthogonality properties: orthogonal, shift-orthogonal and biorthogonal are well known types.

Orthogonal spline wavelets:

The wavelets in this category were constructed independently by Battle and Lemarie . Battle-Lemaire wavelet is an example of orthogonal spline case. Wavelet and scaling functions of orthogonal spline wavelet represented in Figure 3.10 are the same due to orthogonality feature.

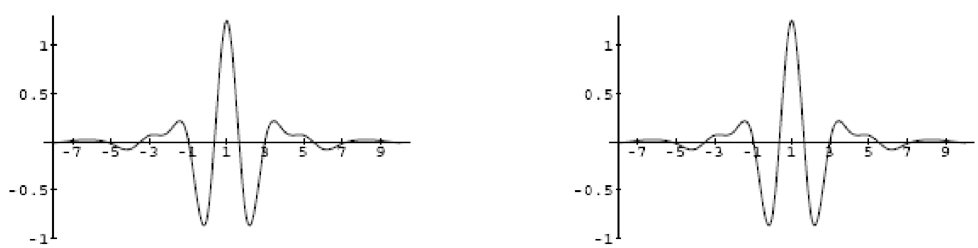


Figure (1.14) Wavelet (left) and scaling (right) functions of orthogonal spline wavelet.

Shift-orthogonal spline wavelets:

Wavelet and scaling functions of shift-orthogonal spline wavelet are represented in Figure 1.14

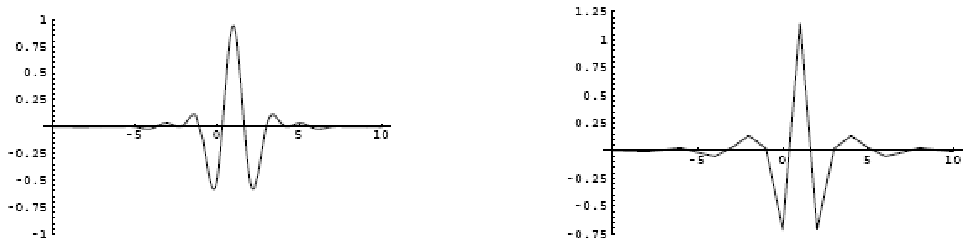


Figure (1.15) Wavelet (left) and scaling (right) functions of shift-orthogonal spline with (*n* =3, *n*~ = 1)

where *n* represents the degree of synthesis and analysis spline.

Shift-orthogonal splines wavelets are shorter synthesis filters. According to Lemarié this is advantageous for reducing reconstruction artifacts e.g., spreading of coding errors, ringing around sharp transitions [28].

1.4 FOURIER TRANSFORM VS. WAVELET TRANSFORM

1.4.1 Fourier Transform

Th Fourier Transform Represents the frequency, phase and varying magnitude. The Fourier transform plays a vital role in any phase of image it may be restoration compression processing applications, enhancement and analysis.

Mathematically, the process of Fourier analysis is represented by the *Fourier transform*:

$$F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-j\omega t} dt \qquad (2.13)$$

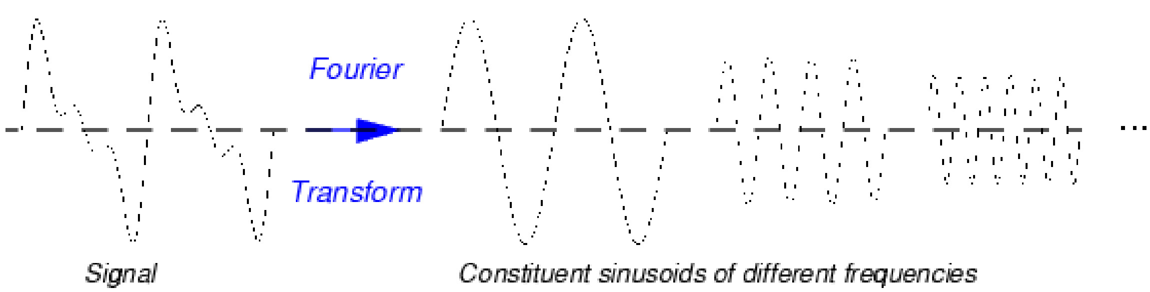


Figure (1.16) Fourier Transform producing sinusoidal with different frequency

1.4.2 Wavelet Transform

The sum over all time of the signal multiplied by scaled is CWT, shifted versions of The results of the CWT are many *wavelet coefficients* C, C is a function of scale and position.

$$C(scale, position) = \int_{-\infty}^{\infty} f(t)\psi(scale, position, t)dt \qquad (2.14)$$

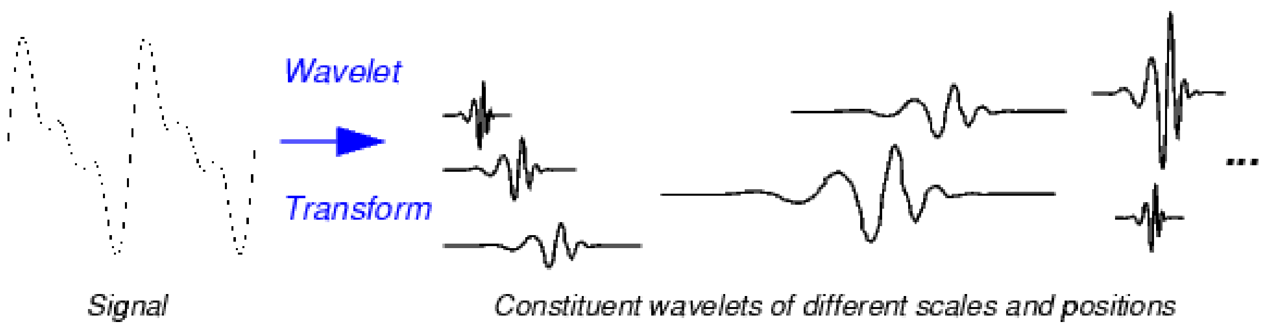


Figure (1.17) Wavelet Transform producing wavelet with different scale position

1.5 DISCRETE WAVELETS

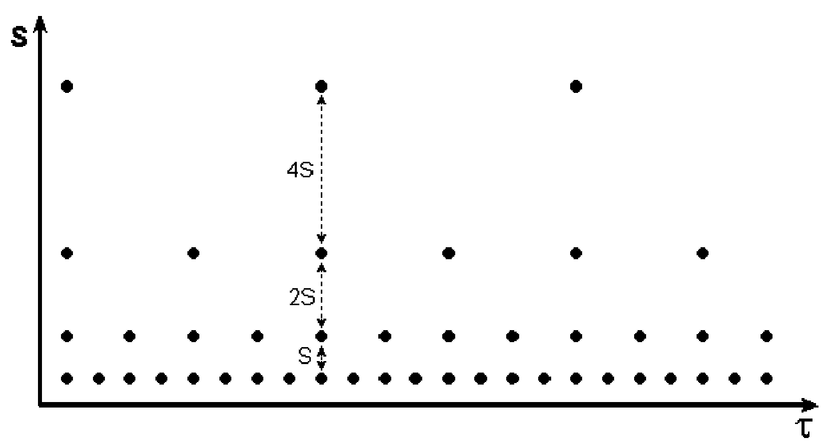


Figure (1.18) The discrete wavelets on a dyadic grid

Source ("http://www.polyvalens.com/blog/wavelets/theory/")

The one-dimensional signal is map with two- dimensional time-scale joint representation by CWT which is highly redundant. discrete. Discrete wavelets are not having the property of continuously scalable and translatable but in discrete steps it can be scalable and translatable. This is achieved by modifying the wavelet representation in to create following equation. Although it is called a discrete wavelet,

it normally is a piecewise continuous function. *j, and k* are integers and $s_0 > 1$ is a fixed dilation step. Value of s_0 is usually equals to "2" so that the sampling of the frequency axis. This is a very natural choice for computers, as well as the human ear and music for instance. 0 which is known as the translation factor takes value "1" in order to achieve dyadic sampling of the time axis [28].

1.5.1 The Scaling Function

When the wavelet get stretched with time domain a factor of 2, its bandwidth changed into halved. every wavelet stretch half of the rest spectrum s covered, that means it need infinite number of wavelets for completing this job.

Because of the low-pass nature of the scaling function spectrum it is sometimes referred to as the *averaging filter*.

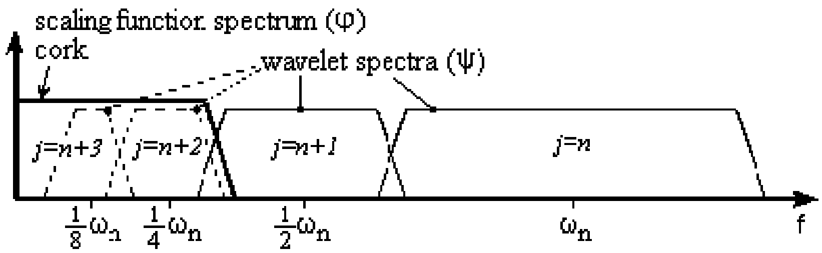


Figure (1.19) How an infinite set of wavelets is replaced by one scaling function

Source (“http://www.polyvalens.com/blog/wavelets/theory/”)

Because of the low-pass spectrum of the scaling function admissibility condition can be expressed similar to (3.5).

$$\int \phi(t)dt = 1 \qquad (2.15)$$

Which shows that the 0^{th} moment of the scaling function can not vanish.

1.5.2 Discrete Wavelet Transform

In the scaling function was expressed in wavelets from minus infinity up to a certain scale *j*. If wavelet spectrum is added to the scaling function spectrum, this will give a new scaling function, with a spectrum twice as wide as the first. The effect of this addition is that first scaling function can be easily expressed in terms of the second, because all the information needed to do this is contained in the second scaling function. It can be expressed formally in the so-called multiresolution formulation.

The two-scale relation states that the scaling function at a certain scale can be expressed in terms of translated scaling functions at the next smaller scale.

The first scaling function replaced a set of wavelets and therefore the wavelets can be expressed in this set in terms of translated scaling functions at the next scale. More specifically the wavelet can be written at level *j*:

The coefficients *h* (*k*) is called scaling filter and the coefficients *g* (*k*) is called as *wavelet filter*

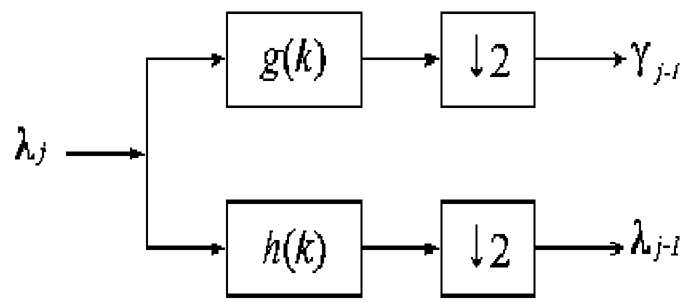


Figure (1.20) One stage of an iterated filter bank

Source("https://www.google.com/patents/EP1519564B1?cl=en")

1.5.3 Wavelet Decomposition & Reconstruction: Approximation and Details.

The DWT is computed by successive low-pass and high-pass filtering of the discrete time-domain signal as shown in Fig3.16. This is called the Mallet algorithm or Mallet-tree decomposition. The low pass filter is denoted by G_O

The filtering and decimation process is continued until the desired level is reached. The maximum number of levels depends on the length of the signal. This method is called decimated DWT in literature. There is also another method called undecimated DWT which has no decimate factor in scale calculation. In undecimated case, a signal is represented with the same number of wavelet coefficients at each scale. This means higher scales include coefficients of lower scales also. It is known that the use of non-decimated transforms minimizes the artifacts in the denoised data [30]. However decimated DWT gives more memory efficient performance with respect to undecimated one.

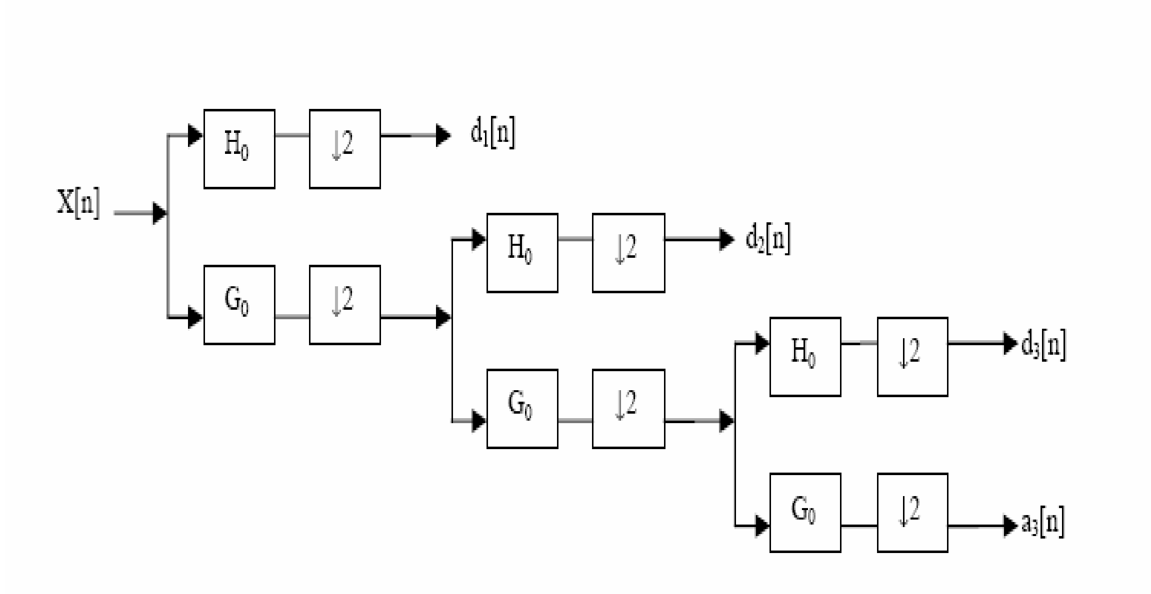


Figure (1.21) Mallet-tree decomposition

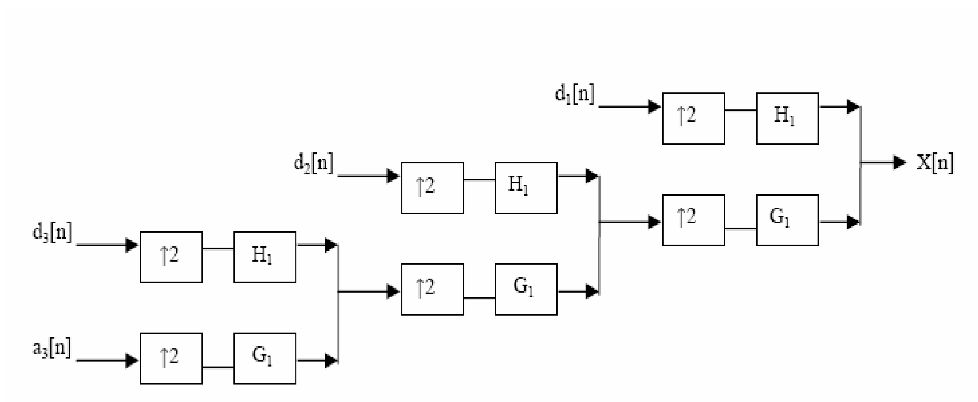
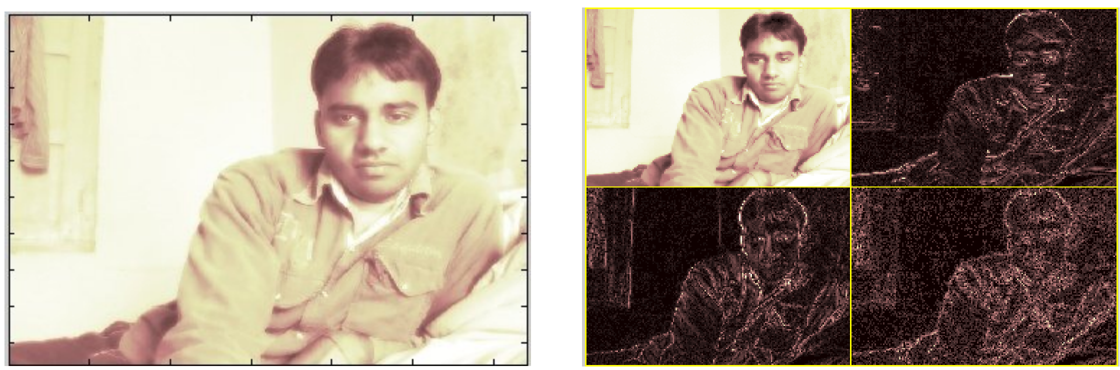


Figure.(1.22) Mallet-tree reconstruction

(i) 2-D Wavelet Transforms

2-d Wavelet Transform use two dimensional images for denoising here we can assume that original image is Y. it the matrix is represented as L x M matrix. L is no. of rows and M is no. of columns.



(a) (b)

Figure (1.23) (a) Original image and (b) One level DWT transform

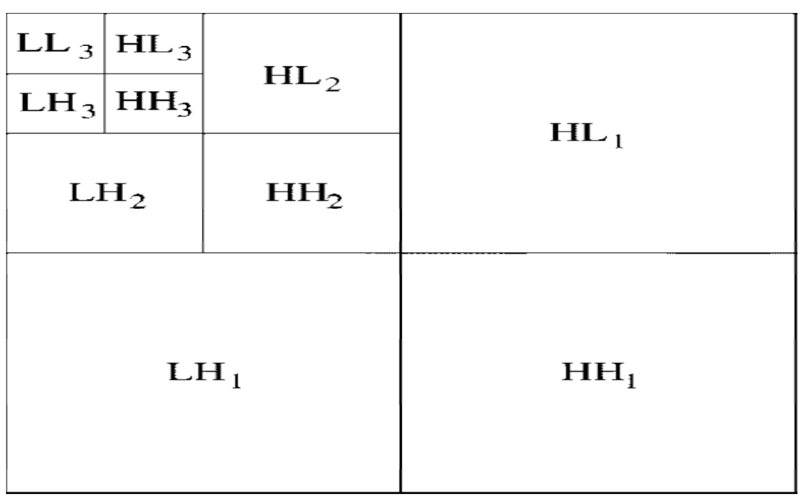


Fig. 1.23 arrange of approximation (LL3) and different or detail coefficients for the 2-D DWT.HL1, LH1 and HH1 are the highest resolution horizontal, vertical and diagonal details.

The low pass filtering comes from upper left hand corner in both directions. this low resolution frequency components split at higher level for the decomposition of image. the four components, make the original picture so called approximation. Other three components are called detail components.. The visible detail in this sub-image, such as, edge, have an over all vertical orientation since there alignment is perpendicular to the direction of the high pass filtering. Consequently they are called vertical details. After the decomposition of the image we applied median filter on the wavelets and next process is improved neigh shrink method and take the inverse discrete wavelet transformation of the signal. To get better quality of the image we applied the loop in this process. Loop continuous until the value of L (choose the window size L where L is positive odd number) becomes zero.

Figure (1.24) 'db2' Wavelet Decomposition

(ii) Two-level DWT Transform

In MATLAB 'wavedec2' is the command which perform the multi-level 2-D wavelet decomposition.

Figure. (1.25) 'db4' Wavelet Decomposition

1.6 WAVELET THRESHOLDING

The natural function which have absolute value larger than some specified threshold value. Such a threshold value is found to distinguish between EWC that belong in the reconstruction (corresponding, one would hope, to true coefficients which contribute significant signal) and those that do not belong (corresponding to negligibility small true coefficients).
Donoho and Johnstone propose an estimate of the noise level that is based only on the EWC at the highest level. The reason for considering only highest level of coefficients is that these tend to consist mostly of noise [32].

1.6.1 Hard Thresholding

Hard threshold is the best method for denoising artifacts, but when this algorithm use for sureshrink it does not provide successful result. Then Soft thresholding is introduced to remove the demerits of hard thresholding.

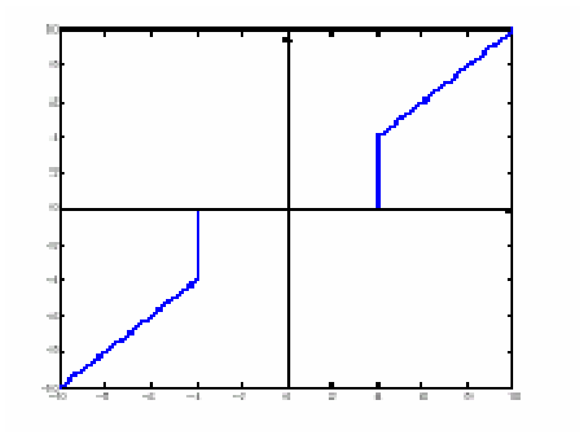


Figure (1.26) Transfer function of hard thresholding

Source("http://what-when-how.com/embedded-image-processing-on-the-tms320c6000-dsp/wavelet-demising-image-processing-part-1/")

1.6.2 Soft Thresholding

Soft thresholding sets any coefficient less than or equal to the threshold to zero then threshold is subtracted from any coefficient that is greater than the threshold. While at first sight hard thresholding may seem to be natural, the continuity of soft thresholding has some advantages. Sometimes, pure noise coefficients may pass the hard threshold and appear as annoying *blips* in the output. Soft thresholding shrinks these false structures.

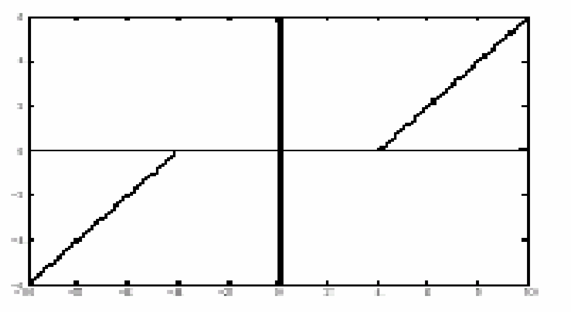


Figure (1.27) Transfer function of soft threholding

Source (http://file.scirp.org/Html/3-3400235_28277.htm)

1.7 ESTIMATING OF THE TRESHOLDING

In many applications estimating of the threshold value is done for each wavelet scale individually. WC in each scale under this estimated threshold values are accepted as noise characteristic of image. Threshold estimators or so called filtering operators in the wavelet domain can be subdivided into linear and nonlinear methods as shown in Fig.3.24.

In this section, performances of distinct threshold estimators will be analyzed starting with fixed threshold value for all wavelet scales called universal thresholding which is the most primitive one and go on with the most advanced data adaptive statistical methods. Between these methods also the results of Wiener filtering will be tested. Wiener filtering is a kind of linear denoising algorithm which is very successful if the noise distribution of original noisy image.

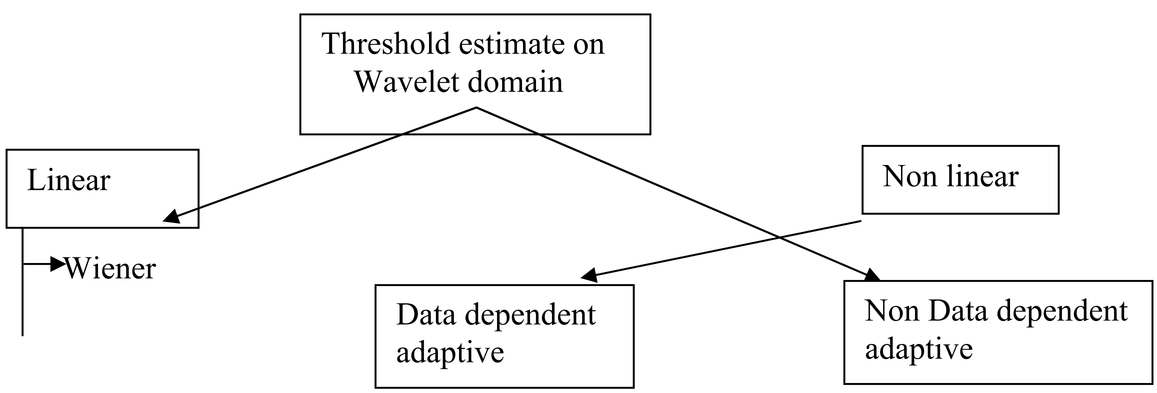


Figure (1.28) Threshold estimator

1.7.1 Linear Filters (Wiener Filter)

Linear filters such as Wiener filter in the wavelet domain can give good results if the signal corruption can be modeled as a Gaussian process. But designing a filter based on this assumption frequently results in a filtered image that is more visually displeasing than the original noisy signal. In a wavelet-domain spatially adaptive finite impulse response (FIR) Wiener filtering for image denoising is proposed [30]. It means that filtering is performed only within each wavelet scale, in other words threshold are calculated and applied for each scale separately.

1.7.2 Non-linear Filters

The WT denoising is the non-linear coefficient thresholding methods. The procedure maps white noise in the signal domain to white. while signal energy becomes more concentrated onto fewer coefficients in the transform domain, noise energy does not.

CHAPTER 2
REVIEW OF LITERATURE

R.Pushpavalli et al. (2013): Studied the novel adaptive network fuzzy system(ANFIS) based filter for the enhancement of images corrupted by the random valued impulse noise(RVIN) . The system based on two steps, in firest step impulse noise using asymmetric trimmed median filter(ATMF) and in second step image restoration is obtained by appropriately combing the ATMF and ANFIS at the removal of higher level of the random valued impulse noise on digital images. This technique offer excellent line edge and fine detailed preservation performance while at same time effectively enhancing the digital images. The extensive simulation results realized with ANFIS network with other filters and proposed filter is good in image denoising and edge preservation properties.

Pardeep Singh et al. (2013) : In his paper Analytical Analysis of image filtering techniques . The survey on different image filtering techniques shows the importance of image filtering in vision processing. Author found that the hybrid median filter and alpha trimmed has some potential benefits over existing filters when to reduced salt and pepper noise

Versa Rani et al.(2013): In paper show how digital image processing involve modification of digital data for improving image quality and this processing helps in increase the clarity , sharpness of image and other interested parameters. The digital image is given input to a programmed computer to change data with the help of certain set of equation and record the value of each pixel. Since image is consist of mixed noises like Gaussian noise, salt and pepper noise , so an hybrid filters are used to remove these mixed noises.

G.B sawarkar et al.(2013): In his paper "colour image enhancement with noise reduction give an idea about hybrid image in which impulsive noise and enhancement of image is done by concept of fusion image by boyh Globe and Local processes on luminescence and chrominance component of images. For better results, the noise cancellation behavior is viewed from human perception, an edge detection is performed and the approach is based on principle of the parameter controlled virtual histogram distribution method that enhance simultaneously the contrast and sharpness of images.

R Pushpavalli et al. (2013): In this paper shows the denoising of the image using Hybrid Fuzzy Filter Technique. The proposed hybrid filter is obtained by combining Non Linear filter(NF) and Adaptive Neuro Fuzzy Interference System(ANFIS). The parameters of neuro fuzzy network is optimized with certain known results. The filter is much more important because it results in excellent line edge and fine details preservation performance nad also remove the impuse noise. in paper Image Enhancement using Adaptive Neuro Fuzzy Interference System shows how hybrid filter are for denoising and enhanced digital image when the image is corrupted with salt and pepper noise. There are several filter but highly sensitive to noise is hybrid filter. The structure of hybrid filter proposed is based on combination of Non Linear switching median filter and Neuro Fuzzy network. The internal parameters of neuro fuzzy network are adaptively optimized by tranining.The most important feature of this proposed filter is excellent line edge and fine detailed preservation performance with at same time effectively remove noise from image.

Rekha Rani et al.(2012): In his paper Image denoising using hybrid filters discussed the the various problem in image transmission. There are many noise like salt and peppe noise , Gaussian noise , Rayleigh noise, impulse noise which are produced during image transmission and these types of noise are produced due to bit error arte , speed and dead pixels. The image blurred due to the object movement, camera movement and displacement of pixels. In this paper author try to remove combination of Gaussian and Rayleigh noise, impulse noise salt and pepper noise along with blurredness simultaneously from the image using hybrid filters. This paper shows a two-phase scheme for removing salt-and-pepper (impulse) noise. In the first phase, an adaptive median filter is used to identify pixels which are likely to be contaminated by noise. In the second phase, the image is restored using a specialized regularization method that applies only to those selected noise candidates. This scheme can remove salt-and-pepper-noise with a noise level as high as 90%. E.

A Balachandra Reddy et al.(2012): In his paper A Hybrid Color Image Enhancement Technique Based on Contrast Stretching. The peak based Histogram equalization proposed the use of contrast enhancement techniques for color images using RGB equalization components. The histogram ia an important method for image contrast enhancement but HE has two problems which are discussed in this paper. The first is input image convolved by Gaussian filter with certain parameters and second is the original histogram is divided into different aeras by valley values and finally contrast enhancement technique is applied for partial morphological improvements.

Rekha Rani at al. (2012): In medical field each dieases is identified by the medical image .if the doctor or the examiner of the patient is not able to clearly view disorder in the image, he will not be sure about his measurement of the seriousness of disease.the precise symptoms are to be identified in order to cure.the image must be free of all errors like noise .in medical imaging the images got effected by noises and artifact.in computer tomography for removing the artifact an effective technique that is ct image denoising technique is used. it improve the quality of image using three different phases.the three phases are preprosseing ,training and testing. in first phase awgn noise effect the ct image which is transformed by using multi- wavelet transformation.in the next phase the multi wqavelet coefficient which are obtained are further used as input to the adaptive neuro fuzzy inference system . in the last phase the image is regenerated by testing the ct image using the trained anfis.here the autore used used diferent corrupted ct image for testing and enhanceing the quality of images and this has given the goos psnr ratio from the result obtained. the enhanced ct image can be used for the proper diagonisis of the exact disease.

Paras Chawla et al.(2012): In his paper shows the important ofHybrid Filteration Technique for image denoising using artificial natural network in medical field. There are various techniques used to reduced noise and improve image quality. There are many filters designed assuming specific noise distribution. In medical field the qualitity of image has much importance like in CT imaging. The proposed techniques is additive white Gaussian noise from the CT image and improve it. The proposed work is comprises of three phases: Preprocessing, Training and Testing. In the processing the image which is affected by AWGN noise ios transformed using multi wavelets coefficients. In training phase these multiwavelets coefficient are given as input to Adaptive Neuro Fuzzy Interference system(ANFIS) and in Testing input CT image is Examined using this trained ANFIS and then enhance the quality of CT image.

Vinod Kumara, Dr. Priyankaa and Kaushal Kishoreb (2012): This paper based on combination of wiener and median filter. Which remove the impulse noise and blurrdness noise from the image. Impulse noise is generate during transmission due to bit error and or dead pixel in the image.for the imhascement and quality of image difeerent filetre are avalable .for reducing the salt and paper noise a non linear operation in median filter is used..when the impulse noise is 0.1% then the median filter gives the best result. But when the % is increases the result are not good provided by the median filter.the noise which filterout the noise generated by the the signal is removed by the wiener filter.spctical charactersticks are linear ramdom proces of signal and additive white gaussian noise.the degration of image quality is image noise.this produce a novel hybrid filter which is a combination of wiener and median filter. First the impulse noise is remove and the reslut is pass out to wiener filter which remove the blureddness from the image.

Gnanambal Ilango et. al. (2011): In medical iamge gauusian noise is commonly found which is reduce to make the better quality of image.this paper gives difeencnt hybrid technique for the removal of gaussion noise.the filter treated with finite set of certain estimation operations.

Gnanambal Ilango et al. (2011): In his paper study the hybrid filter for the removel of the Gaussian noise. The author proposed different hybrid filtering techniques for the removel of Gaussian noise by topological approach. The types of filters are classified as some finite sets of certain estimation and operations. These suggested operation are based on the analysis of non linear filters and quality of the enhanced image is measured in terms :Root Maen Square Error(RMSE) Peak signal to noise Signal Ratio.

M.Mohamed Sathik1 et al. (2011): jpeg compression normally use linear quantization and threshold values for maintaining the quality of the entire image. In proposed system adapt variable quantatization and threshold value correspond to foreground and background which preserve the vital area of image rather than the other area of image. This compression increases the compression ration and increases the quality of the compressed image. lossless and lossy compression are two technique for compression. it gives the better compression ration when we used hybrid technique.

Muthu Selvi et al. (2010): According to this paper hybrid filter remove all type of noise sucesscefully.the enhancement is performed with the help of winear filter and median filter. It remove mixed type of noises spatial domain method and frequency domain method technique are performed. Deconvolution is an example of Image restoration which increase resolution ,remove noise and increase contrast. meadian filter first remove impulse noise and then additive white Gaussian noise is removed.

Sreenivasulu Reddy Thatiparthi et al. (2009): Represent Atmospheric signal processing is of interest to many scientists, where there is scope for the development of new and efficient tools for cleaning the spectrum, detection, and estimation of parameters like zonal (*U*), meridional (*V*), wind speed (*W*), etc. This letter deals with a signal processing technique for the estimation of the aforementioned parameters, based on the wavelets, by analyzing the mesosphere–stratosphere–troposphere radar data that are backscattered from the atmosphere at high altitudes and severe weather conditions with low signal-to-noise ratio. The proposed algorithm is self-consistent in detecting wind speeds up to a height of 18 km, in contrast to the existing method which estimates the Doppler manually and fails at higher altitudes. The results have been validated using the Global Positioning System sonde data.

Susmitha Vekkot, and Pancham Shukla (2009): A hybrid filtration technique based maximum selection to filter mask and low frequency for wavelet decomposition. It enhanced the edged and image structure.

K. S. Sim, L. W. Thong (2009): Edge structure are boundryaries of object structure in image processing. this paper gives a edge dection for extraction and object recognisation the simulation result show that it provide the efficient and consistent edge feature in a noisy image .so hybrid egde detection give supierior result with less noise.

S.S Patil et al. (2009): In his paper Fingerprint Image Enhancement Techniques and Performance Evaluation For SPG and FFT . Fingerprint Engancement technique show how the finger print images are enhanced or the quality of finger print is improved by using SPG and FFT. For the quality of extracted finger print , an finger print is enhancement module in the AFIS system incorporated and this model improves the performance of finger print verification system and make the system noise rebust with respect to the quality of input finger prints.

B.R.S.Reddy et al. (2009): in his work try to explain an approach to improve the image quality. That is reduction of impulsive noise which may corrupt images during their acquisition and transmission is based on two stage processesfor the detection of noise and filtering of noise pixels. In the first approach, Salt and Pepper Noise (SPN) model is used where noise value may be either the minimum or maximum of the dynamic gray scale range of image and second approach is Random Valued Impulsive noise (RVIN) model where noise pixel value is bound by range of dynamic gray scale of image. In the first approach the enhancement of image is based on second order difference of pixels in order to identify the noise where as in second approach , the fuzzy model techniques is used to locate the contaminated pixels. The detection –filtration is done recursively so that filtered pixel take part in detection of noise in next pixel.

S.M. Mahbubur Rahman et al. (2008): Presents Deconvolution of images, which is very often tackled by using the diagonalization property of the circulant matrix in the discrete Fourier transform (DFT) domain. the discrete wavelet transform (DWT) has shown significant success for image denoising because of its space-frequency localization. In this paper, there is image restoration algorithm, wherein the DFT-based adaptive regularized constraint total least-squares deconvolution is performed followed by our previously proposed DWT-based maximum a posteriori estimator. The convergence of the proposed method is assured. Experimental results show that the method provides a restoration performance, which is better than that of existing methods.

Mitianoudis . N and Stathaki .T (2008) : It represents the strength and weakness of pixel level image. And generate the pixel level fused image.

T.Sahu et al. (2008): In his paper" Image Enhancement based on Abstraction and Natural Network" suggest a hybrid technique that ability to enhance the image by denoising it integrate two different processes into one. He proposed the a algorithm that uses image abstraction technique that used for detecting the image density into the different parts of image and after that operates the smooth filter and information of the edges are recombined with filtered images. The proposed technique also utilized the natural network for filtering noise generated edges. This approach not only enhances the images but also avoids the enhancement of noises.

Zhao Jiying , Laganiere Robert and Liu Zheng (2007): For evaluating the performance it gives the metrix with the help of pixel level image fusion. The experimental result compare the local cross correlation of input image.

D.K.Mishra et al. (2007): Shows that there are many filters are used for image enhancement in his paper "A Review Report if an finger print image enhancement of images where finger print enhancement is conducted on either binary image enhancement. Since binary image enhancement has some limitations so gray level finger print images are reviewed assuming that the local ridge frequency and orientation can be reliably estimated. The most commonly finger print enhancement technique that are used now days is contextual filter whose parameter depends upon local ridge frequency and orientation.

Yang Yi, Han Chongzhao, Xin Kang and Han Deqiang (2007): This represents the spectral and spatial information of remotely sensed images. There are four type of algorithm depending upon their feature statistical algorithm numerical algorithms, multi resolution decomposition algorithms , radiometric / spectral algorithms color space model algorithms .these algorithm provides qualitative and quantitative results. as the conclusion of this paper the wavelet transform is having the better performance than other fusion algorithms.

Qiguang Miao and Baoshul Wang (2006): This presents the image fusion algorithm based on curvalent transform and fusion framework. it preserve the edges and texture information than the wavelet transform method. on the based of wavelet entropy decomposition it provide the medical image fusion method. It discover the slight changes in signal and give evidence to doctor to find the pathological changes in early stage.

M.I.Quraishi et al. (2006) : In his work "A Comparative Study on Image Enhancement for Synthetic Aperture Radar (SAR) images " are analysis comparison of images edge enhancement technique . For SAR images, the method that is used is based on novel edge enhancement algorithm based 2D wavelets transform and also signify the motive of suppreses the speckle noise from image. The relying on feature of wavelet specify image and long compressed and transformed image is normalized. The other method is by taking Sobel edge detection of SAR images and final image is improved via fuzzy logic modified SAR images which finally enhanced by applying relaxed median filter.

Mal Heng , Jia Chuanying and liu Shuang (2005) : It gives the relation between image fusion rules and wavelet transform. For calculating spatial frequency the wavelet decomposition. Fusion experiment are performed on PAN and MS. which is a comparing activity method level of spatial frequency is introduced.

Wang Zhijun , Ziou Djemel ,Li Deren and Li Qingquan (2005): This provide the framework for general image fusion that compare the fusion methods. Most of the image fusion method having high- pass filtering and modulation. Brovey transform, principal component analysis is the wavelet transform multi resolution methods are find in GIF method. Here theoretical analysis of panchcromatic image is described that how this is modulated.

CHAPTER 3
PRESENT WORK

3.1 Problem Formulation In medical images, especially DX images for lower extremist and spine when raw image is processed there is chance of false edge making and also contrast is not suitable according to exam done Here are not only the maintain the contrast but also we have to preserve the edges. We are giving an enhancement using hybrid. For getting the better result from shrinkage approaches is blended with other operations. new parameters can be used for the evaluation of denoising techniques. Future, Gaussian-based model can be used to analyzed and compared the image characteristics.

In future we will work for device artifacts removal from the image like motion artifact, Ghost image artifact. Depending on environmental and device factor.

3.2 Objectives:

1. Basic motive to remove almost all types of noises.
2. Some other problems with image enhancement is that when noise is removed most of the information is also get lost like formation of false edges.
3. to maintain this we keep in mind for edge preservation(unsharp mask filter) and also different type of filter remove some information to keep it we use fusion.
4. To study different Type of enhancement Techniques
5. Implementing the hybrid Transform to enhance the image
6. To preserve edges (reduce the chance of making false edge). Better contrast and clarity in the image.
7. Find the better PSNR and standard deviation.

3.4 Research methodology

OS: Window /XP/Win 7/ or 8.

Tool and Language: Matlab (R2009a).

RAM: 1 GB or more.

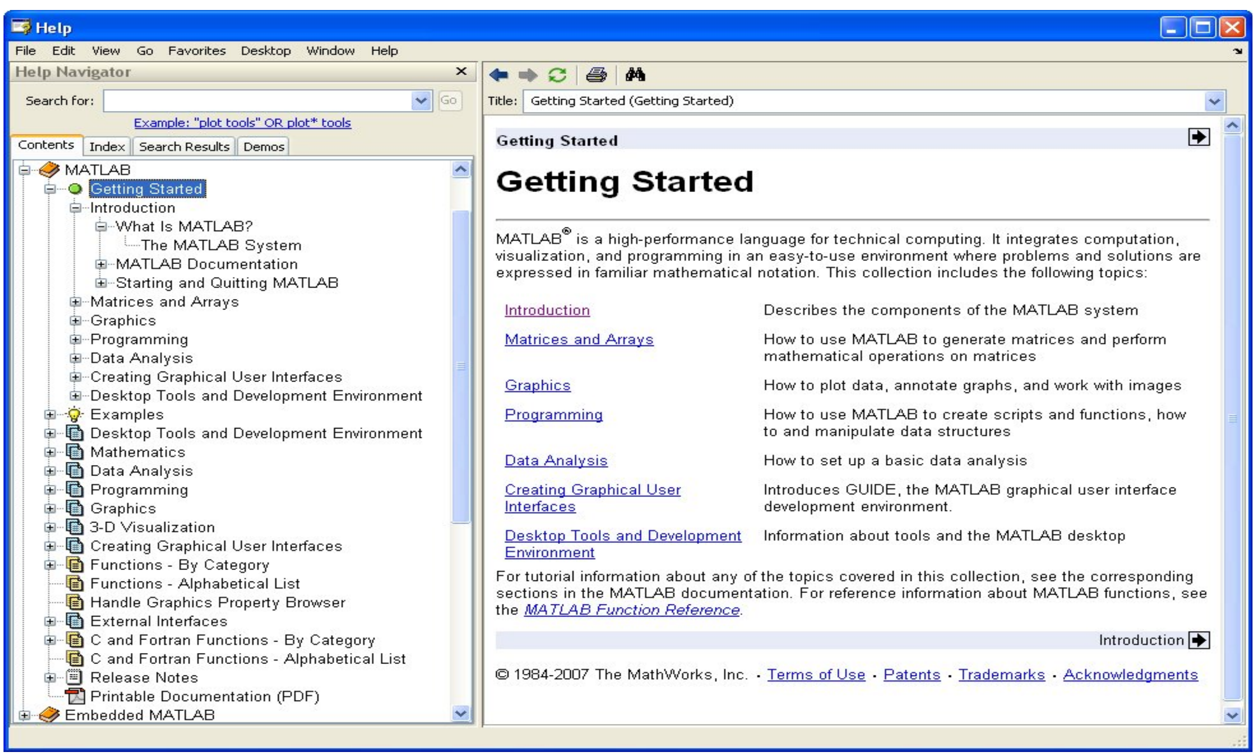
Hard Disk: 100 GB above.

Our Methodology :

Step by step procedure

1. Read the Image
2. Applying hybrid filtration by combining the various image enhacement filter
3. Applying unsharp mask filter to preserve the edges
4. Visualize the image.
5. Save the image.

Matlab work on the image in the form of matrix.during wornig we have to focus on the idea Image store in the form of two dimensional array in matlab and represented in the form of dot. For example when there is 100 x 50 matrix then 100 is the row values and 50 is columns values. And stored as 100 by 50 matrix in matlab but in some cases the coloured true image is stored in three dimensional array. A imag can be binary or indexed . in binary image the value store in 0 or 1 value and in indexed image the 3 array map with unit value.



Figure(3.1) Matlab Framwork

IMAGE ENHACEMENT TECHNIQUE

Denote a two-dimensional digital image of gray-level intensities by **I**. The image **I** is ordinarily represented in software accessible form as an $M \times N$ matrix containing indexed elements $I(i, j)$, where $0 \le i \le M - 1$, $0 \le j \le N - 1$. The elements $I(i, j)$ represent samples of the image intensities, usually called **pixels** (**pict**ure **el**ements). For simplicity, we assume that these come from a finite integer-valued range. This is not unreasonable, since a finite wordlength must be used to represent the intensities. Typically, the pixels represent optical intensity, but they may also represent other attributes of sensed radiation, such as radar, electron micrographs, x rays, or thermal imagery.The image enhancement processing can be done in two domains : 1) Spatial Domain and 2) Frequency Domain.

Spatial domain methods

Suppose we have a digital image which can be represented by a two dimensional random field $f(x, y)$.

An image processing operator in the spatial domain may be expressed as a mathematical function $T[\cdot]$ applied to the image $f(x, y)$ to produce a new image $g(x, y) = T[f(x, y)]$ as follows.

$$g(x, y) = T[f(x, y)]$$

The operator T applied on $f(x, y)$ may be defined over:

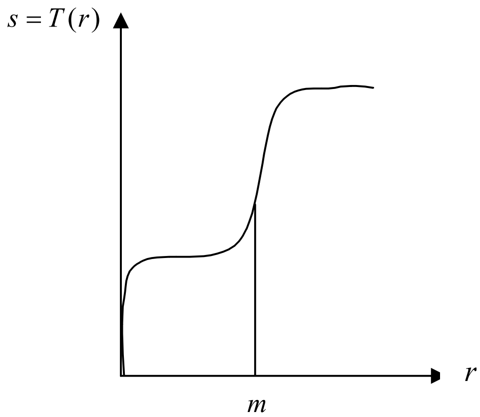
(i) A single pixel (x, y). In this case T is a grey level transformation (or mapping) function.

(ii) Some neighbourhood of (x, y).

(iii) T may operate to a set of input images instead of a single image.

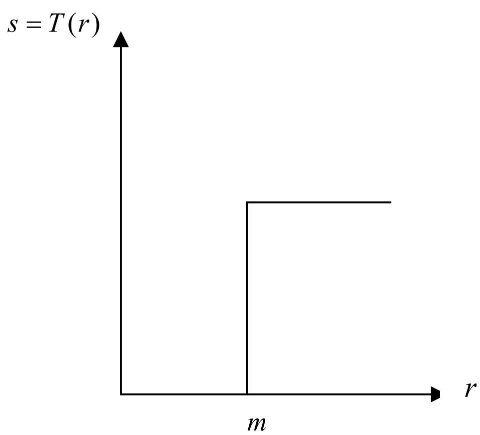
Example 1

The result of the transformation shown in the figure below is to produce an image of higher contrast than the original, by darkening the levels below m and brightening the levels above m in the original image. This technique is known as **contrast stretching**.



Example 2

The result of the transformation shown in the figure below is to produce a binary image.



Frequency domain methods

Let $g(x, y)$ be a desired image formed by the convolution of an image $f(x, y)$ and a linear, position invariant operator $h(x, y)$, that is:

$g(x, y) = h(x, y) * f(x, y)$

The following frequency relationship holds:

$G(u,v) = H(u,v)F(u,v)$

We can select $H(u,v)$ so that the desired image

$g(x,y) = \Im^{-1}\{H(u,v)F(u,v)\}$

exhibits some highlighted features of $f(x,y)$. For instance, edges in $f(x,y)$ can be accentuated by using a function $H(u,v)$ that emphasises the high frequency components of $F(u,v)$.

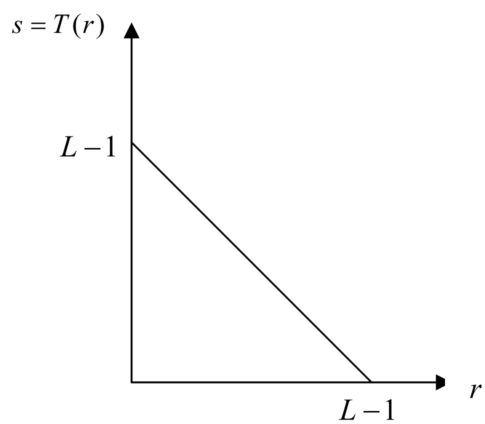
Spatial domain: Enhancement by point processing

We are dealing now with image processing methods that are based only on the intensity of single pixels.

Intensity transformations

Image Negatives

The negative of a digital image is obtained by the transformation function $s = T(r) = L-1-r$ shown in the following figure, where L is the number of grey levels. The idea is that the intensity of the output image decreases as the intensity of the input increases. This is useful in numerous applications such as displaying medical images.



Contrast Stretching

Low contrast images occur often due to poor or non uniform lighting conditions, or due to nonlinearity, or small dynamic range of the imaging sensor. In the figure of Example 1 above you have seen a typical contrast stretching transformation.

Histogram processing. Definition of the histogram of an image.

By processing (modifying) the histogram of an image we can create a new image with specific desired properties.

Suppose we have a digital image of size $N \times N$ with grey levels in the range $[0, L-1]$. The histogram of the image is defined as the following discrete function:

$$p(r_k) = \frac{n_k}{N^2}$$

where

r_k is the kth grey level, $k = 0,1,\ldots,L-1$

n_k is the number of pixels in the image with grey level r_k

N^2 is the total number of pixels in the image

The histogram represents the frequency of occurrence of the various grey levels in the image. A plot of this function for all values of k provides a global description of the appearance of the image.

CHAPTER 4

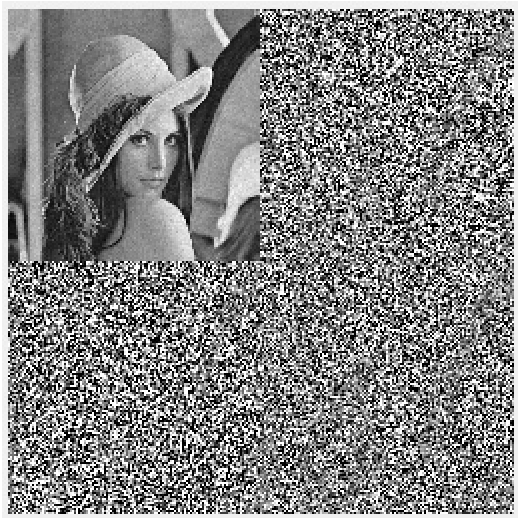
RESULTS AND DISCUSSIONS

Complete evaluation and accurate result of the algorithm is challenging. This dissertation provides the result of the image denoising technique like VisuShrink, SureShrink, BaseShrink, NeighShrink and proposed method hybrid filtration for denoising the image. Denoising technique is compared on the basis of different wavelets. The image denoising technique are compared on the basis of performance parameter like Peak Signal to Noise Ratio (PSNR), Normalized absolute error and mean square error (MSE), for gray scale image. Visual quality also determines the performance.

All the threholding technique is implemented using MATLAB (9.2) and its image processing toolbox. Denoising technique has been applied to image “Lena” [38] of size 256×256 with different noise level σ=5,10,15,20…..100. Noise model used is AWGN. The wavelet transform employs. The various filtration technique are used to denoising inage.

(a) (b)

Figure (4.1) Result of test image “Lena”



(c)

(d)

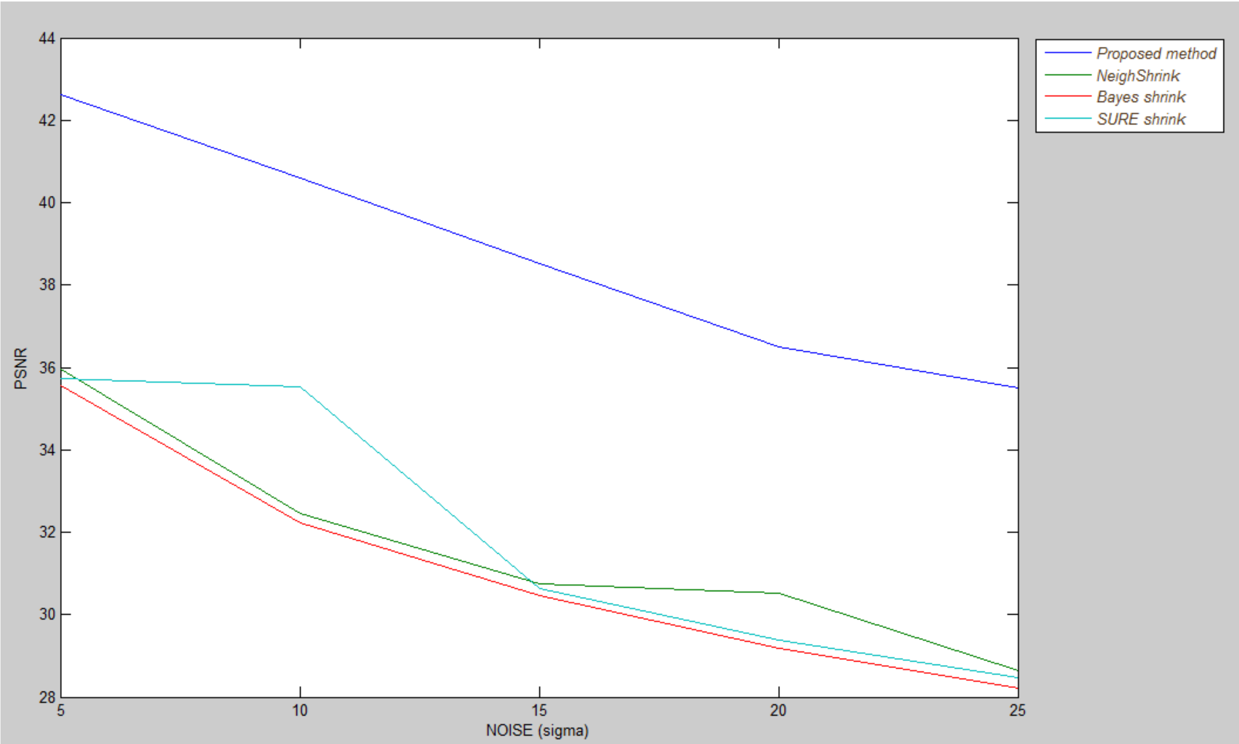
Figure (4.2) Denoising technique applied to the image of "Lena" (a) Original image (b) Noisy image (c) Decomposed structure (d) Denoised image

Fig.6.2 shows the visual quality of real image "Lena" of noise standard deviation 5 using wavelet decomposition. The performance of various denoising technique is evaluated in terms of PSNR & MSE

As the clear from the fig 4.2 that when denoising techniques are applied to the noisy image of "Lena" the visual quality of proposed method proves to be good as compare to the other techniques being implemented. Out of the techniques being implemented, the worst case is VisuShrink threholding method.

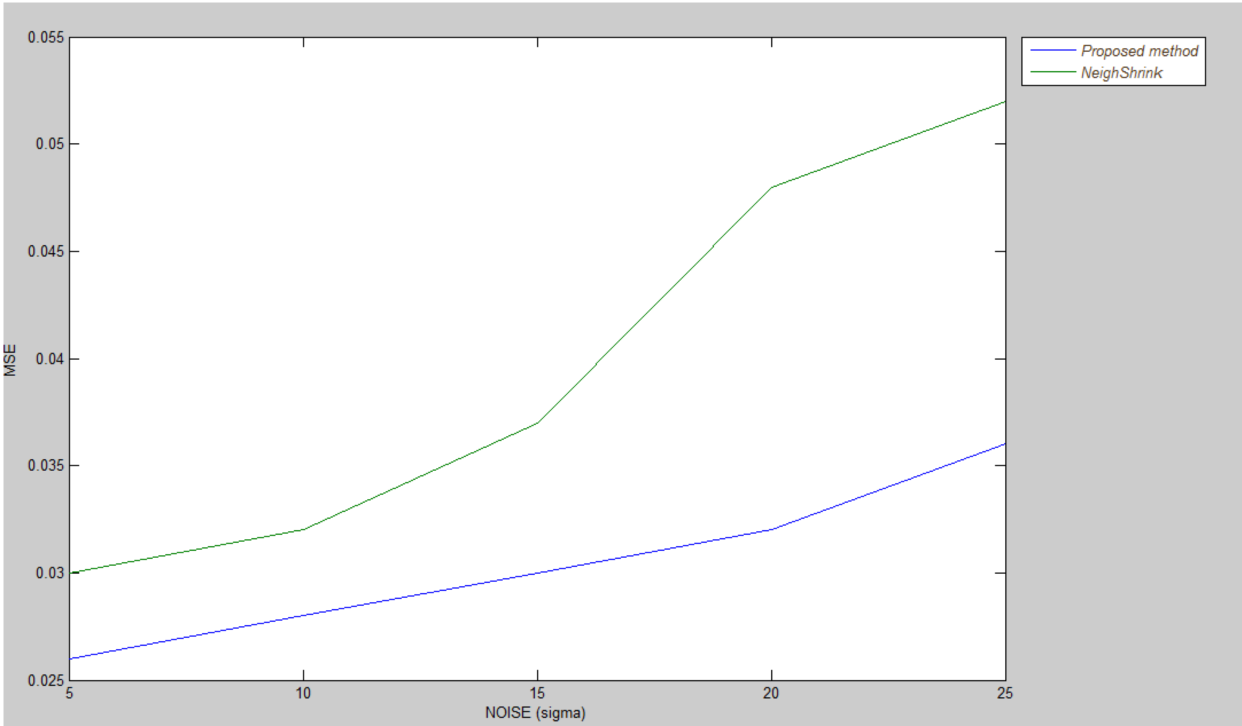
4.3 GRAPHS FOR VARIOUS PARAMETERS COMPARING DIFFERENT DENOISING TECHNIQUE FOR REAL IMAGE OF "Lena".

Following are the graph which performance of various denoising techniques. Fig 4.2 gives PSNR gain curves of denoising methods for test image "lena" with four level of decomposition gives MSE curves of denoising methods for test image "lena" with four level of decomposition.



Graph 4.1 comparison of PSNR curves for various Denoising Technique for the image 'lena'

It is clear that as noise level i.e. noise standard deviation, the PSNR of proposed method is higher as compare to the other denoising technique. Any denoising technique, having higher PSNR, is considered to be the best technique. So, proposed method proves to the best as compared to other techniques. It is also clear from the above figure that out of all the denoising, threholding technique being implemented, and the VisuShrink method is the worst case and so, its performance is also very poor. Hence, it is rarely used.



Graph 4.2 comparison of MSE curves for various Denoising Technique for the image 'Lena'

The fig depicts that as noise level i.e. noise standard deviation increase, MSE increase. It ise clear from fig that for any particular value of noise level, MSE of proposed is lower than the NeighShrink method. A lower value for MSE means lesser error, and as seen from the inverse relation between MSE and PSNR, this translates to a high value of PSNR. So, if any denoising scheme, having a lower MSE (and a high PSNR), is considered to be the best technique. So, proposed method proves to the best.

4.4 PARAMETER FOR GRAY-SCALE IMAGES

4.4.1 Mean Square Error (MSE)

The MSE represents the cumulative squared error between the denoised and the original image, whereas PSNR represents a measure of the peak error. The lower the value of MSE, the lower the error i.e. the pixel intensity of the input and output image are approximately same. MSE is defined as below:

$$MSE = \sum_{M,N} \frac{[I_1(m,n) - I_2(m,n)]^2}{M * N} \tag{4.1}$$

In the equation, *M* and *N* are the number of rows and columns in the input image, respectively.

4.4.2 Peak Signal to Noise Ratio (PSNR)

The PSNR block computes the peak signal-to-noise ratio, in decibels, between two images. This ratio is often used as a quality measurement between the original and a denoised image. The higher the PSN R, the better the quality of the reconstructed image.

$$PSNR = 10 \log_{10}\left(\frac{255^2}{MSE}\right) \tag{4.2}$$

4.4.3 Normalized Absolute error (NAE)

It is given as

$$NAE = \frac{\sum_{j=1}^{M}\sum_{k=1}^{N}\left|X(j,k) - \hat{X}(j,k)\right|}{\sum_{j=1}^{M}\sum_{k=1}^{N}\left|X(j,k)\right|} \tag{4.3}$$

NAE should minimum which means that the different between the input image and the output image is less.

4.4.4 Visual Quality

By looking at the denoised image, one can easy determine the different between the input image and the denoised image and hence performance of the denoising technique is evaluated.

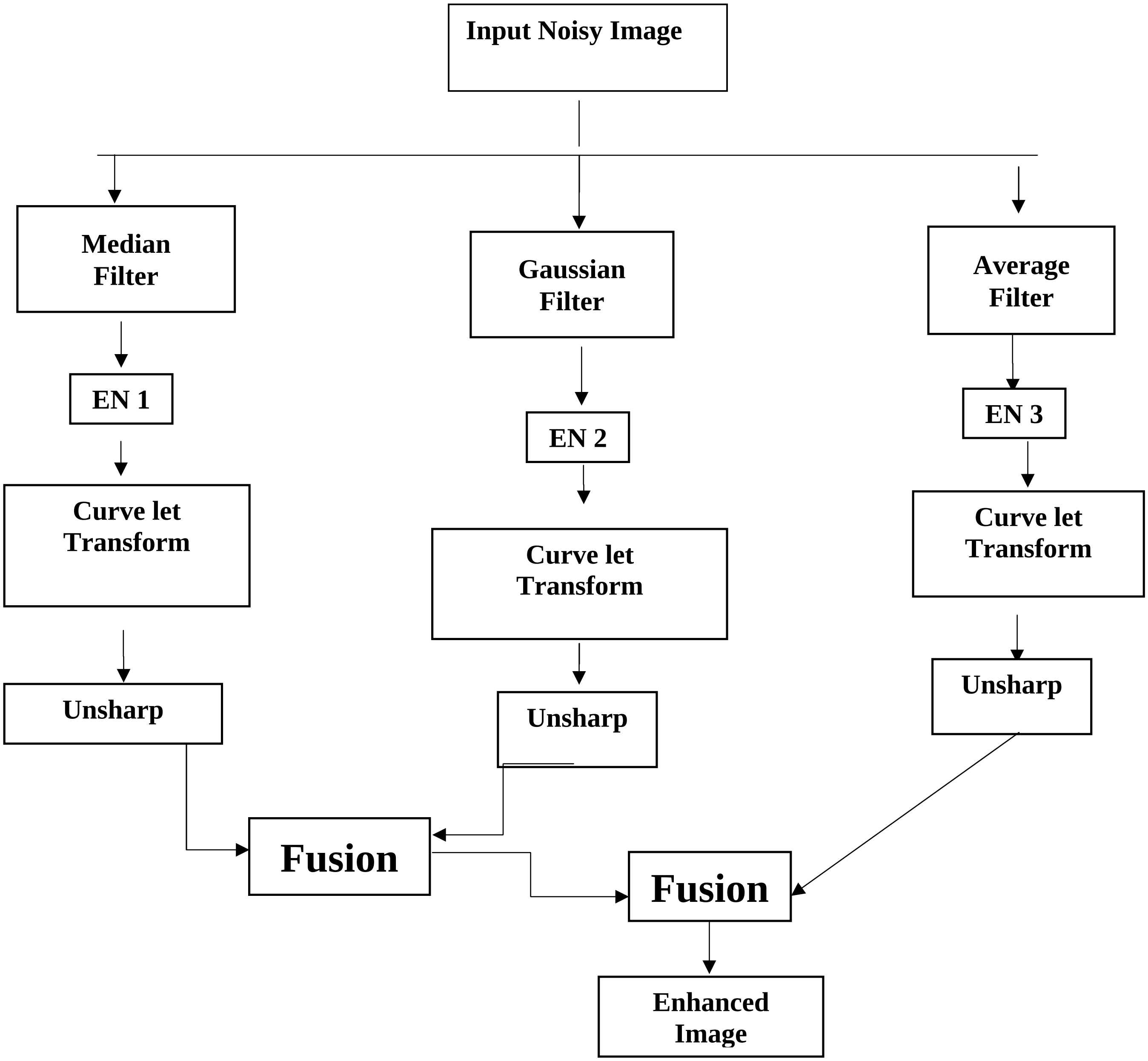
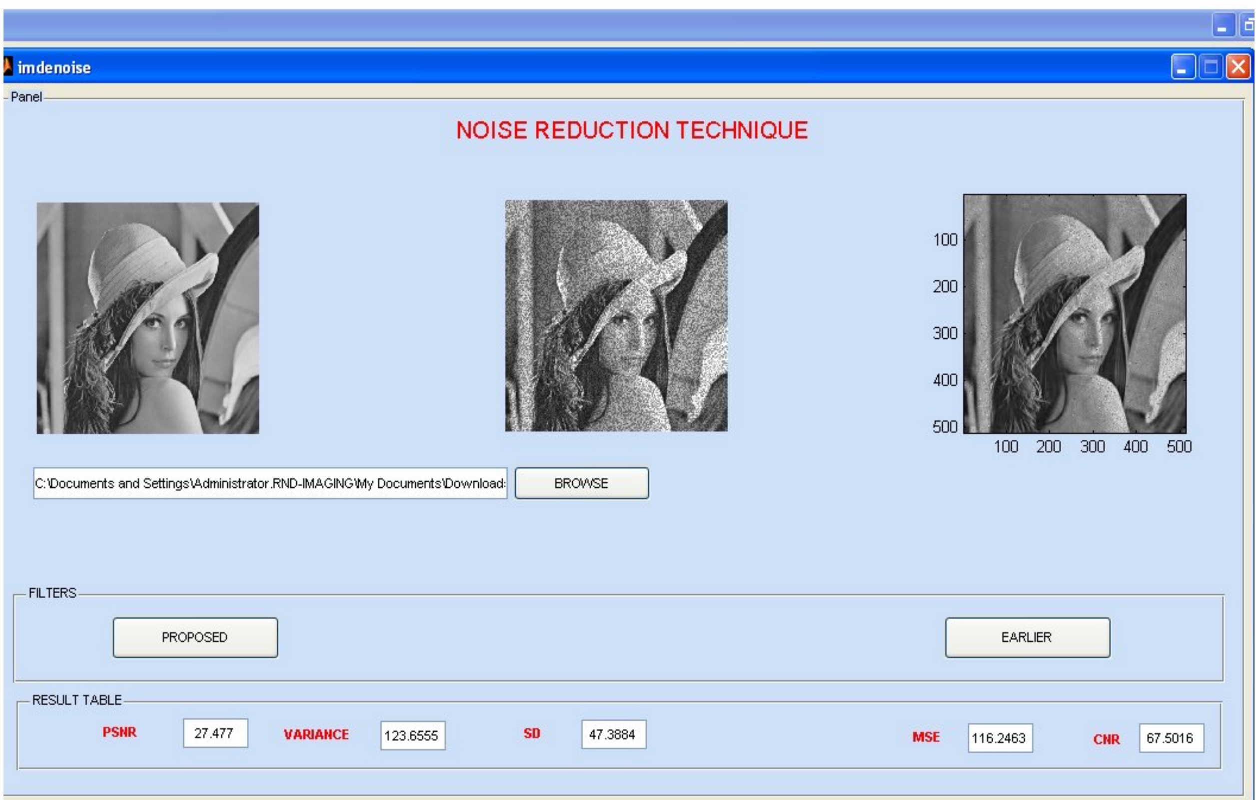


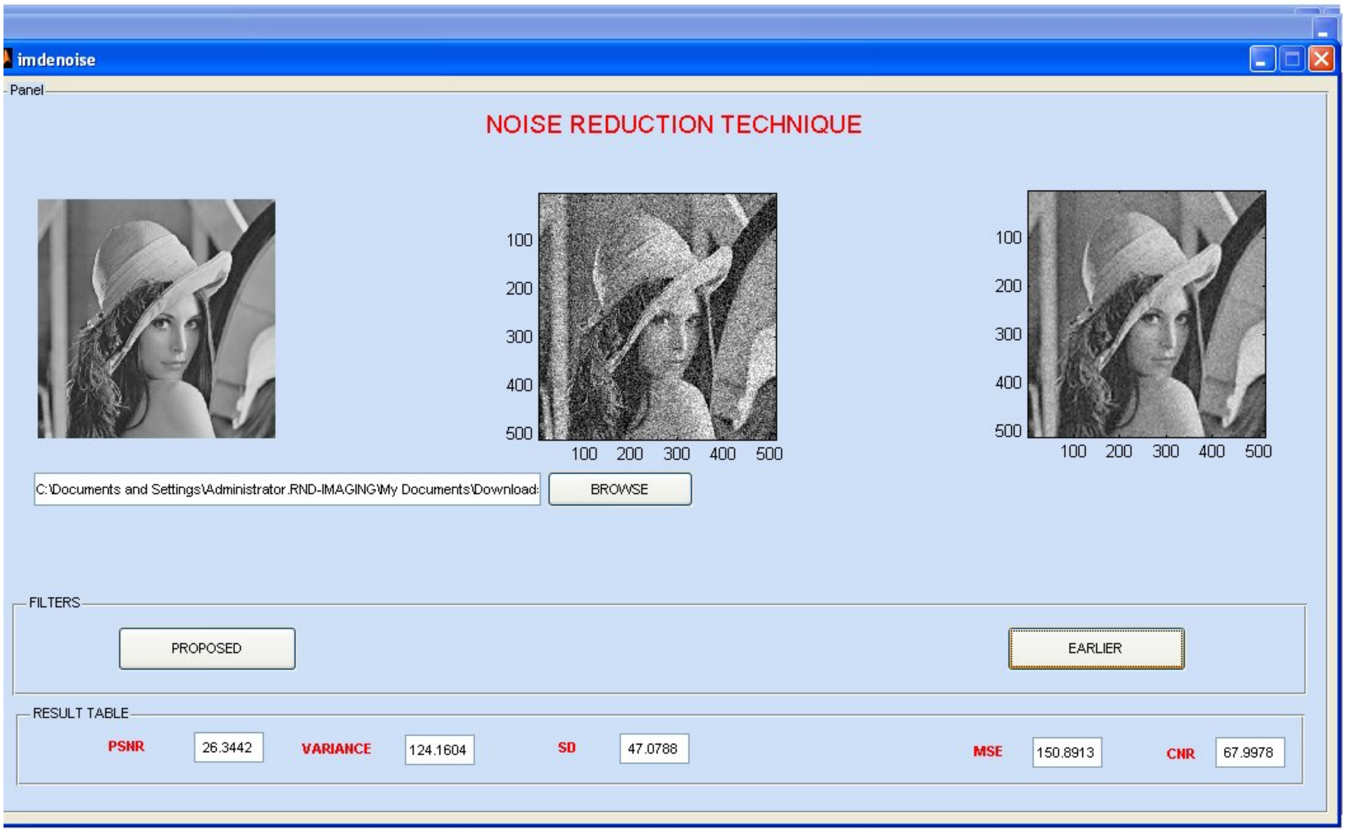
Figure (4.3) Enhancement of image

This Research work is explained as the figure 4.1 first take a sample of noisy image and pass through median filter and a encrypted image EN1 is the output. Similarly the image is pass through the Gaussian and average filter EN2 and EN3 is the output generated from these two filter. The encrypted images are passed through curve let transform and unsharp images is generated . these unsharp images is fused with each other and we get a enhanced image as a result.

Earlier Noise Reduction



Purposed Noise Reduction Technique:



	PSNR	VARIENCE	SD	MSE	CNR
PROPOSED	**26.3442**	**124.1604**	**47.0788**	**150.0913**	**67.9978**
EARLIER	**27.44**	**123.6555**	**47.3884**	**116.2463**	**67.5016**

Table(4.1) Comparison of Earlier and Purposed Method

IMAGE DENOISE

HYBRID based filters have preserve image detail more than mean filter but have pure denoising capability especially for images with various type of noise when executed in single mode However is seen that this filter is very usable for high intensive noises for example some resident noises after denoising. HYBRID filters are more likely to be an after filter. Main advantage of this filter lies on its input parameter which brings possibility to change intensity of threshold for specific conditions. For some image types especially for astronomical images stellar objects can be interpreted as a sort of impulsive noise in deep-sky images, especially when they are numerous: they are more or less randomly distributed, they are bright, and they are small. Taking advantage of this fact, the adaptive median filter can be used to remove or isolate stars on images while decreasing noise. From the result comparison it is clear that our hybrid filter technique has greater performance

CHAPTER5

CONCLUSION AND FUTURE SCOPE

Image denoising using hybrid filters discussed the the various problem in image transmission. There are noises which are produced during image transmission and these types of noise are produced due to bit error , speed and dead pixels. The image blurred due to the object movement, camera movement and displacement of pixels. In current work we have remove the noise with hybrid filter In future we will hybrid the Complex transformation such as curvelet and Contourlet In this dissertation, a framework for denoising based on prior knowledge of noise statistics has been presented. It has been seen that wavelet thresholding is an effective technique of denoising of noisy signal. Many thresholding schemes like VisuShrink, SureShrink, BaseShrink, and NeighShrink has been studied and compared. The quality of image depends upon the value of PSNR i.e. higher the value of PSNR better is the image quality. The value of PSNR can be increase by blending new shrinkage approaches with other schemes. It can also be increased changing the filter in new approaches.

In this work a noised image take as a working sample and the PSNR value is calculated before denoising and after denoising. The results are compared with both the stage. The perposed scheme gives the better result as compare to the earlier method.

CHAPTER 6
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CHAPTER 7

APPENDIX

AUTHOR'S PUBLICATION

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