COMPARATIVE STUDY OF DIFFERENT DENOISING ALGORITHMS IN VIEW OF INCREASING PSNR

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Abstract

The research towards effective image denoising methods & its improving results are essential for desired output & effective impression. The different algorithms are used to denoising the image in different manner. When the PSNR (peak to signal noise ratio) is as high as possible and MSE (mean square error) is suitably low. So that, the noise from image is eliminated & clear image can be introduced. In this paper we compare different shrinking methods towards denoising image & review on better one. The study is only the review related for denoising image using wavelet transform. Through which we can find out the better method for image denoising and get good denoised image at the receiver after transmission of noisy image.

Keywords – *PSNR(peak to signal noise ratio), MSE(mean square error)*

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1. INTRODUCTION

There are various methods have been introduced for removing noise. The methods called denoising methods with their algorithms. The techniques have been used in these methods are based on different platforms, like edge detection, filtering process &other shrinking methods i.e. neigh shrink, SURE shrink, Normal shrink, VISU shrink, Bivariate shrink, bayes shrink etc. the main aim of all these methods is to remove noise from image by concentrate towards the increased in PSNR.

The purposed of all these techniques is to eliminate noise from image without losing the information & construct image at the receiver side without damaging its purity. In different shrinking methods, the mathematical function is used called as wavelet transform. Due to lossless visualization is occur in wavelet transform at the reconstruction side we used wavelet transform method. Wavelet also having the three main functions in digital image processing are

1. Image Compression,
2. Image Detection
3. Image Denoising

In this method discrete wavelet transform method is used.

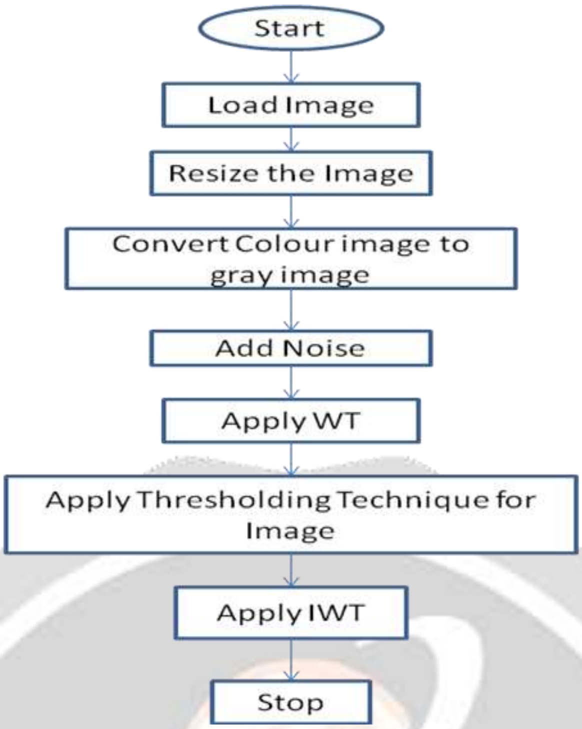

Fig.1 Generalized Algorithm for Wavelet Transform.

2.COMPARATIVE STUDY OF DIFFERENT SHRINKING METHODS:

2.1. SURE SHRINK:

The SURE shrink is level decomposed thresholding method used to specifies threshold value tj with each resolution of level j in wavelet transform.

The MSE is defined as

$$MSE=\frac{1}{n^2}\sum^{n}_{x,y=1}(z(a,b)-s(a,b))^2$$

z(a,b):Signal estimate.

s(a,b):Original signal.

n:Size of signal

t^* :Represents sure shrink .

$$t^*=\min(t\sigma(\sqrt{2logn})$$

t:Value for minimizes the SURE

σ:Noise variance and it defined on the basis of median absolute deviation

Therefore,

$$\sigma=\frac{(\{|\theta j-1,k|:k=0,1,\ldots 2j-1-1\})}{0.6754}$$

σ=median

n:Size of image

In previous working of neigh shrink is with the help of neighboring window to find out maximum PSNR by keeping low MSE. Using this technique the PSNR value is 29.28dB.and the SURE shrink used to reconstruct the corrupted image.

2.2. BAYES SHRINK:

Bayesian risk: Mixing of image signal and noise signal. In this shrink, separation of original image signal noise signal is takes place.

tB: Bayes threshold

tB= $\frac{\sigma 2}{\sigma s}$;

σ^2:noise variance

$\sigma_{s:}$ signal variance without noise

with respect to adaptive noise definition

w(x,y)=s(x,y)+n(x,y)

so , both signals are separated and represented by,

$\sigma w^2=\sigma s^2+\sigma^2$

$\sigma w^{2=}\sum_{x,y-1}^{n} w2(x,y)$

The signal variance,

$\sigma s^2=\sqrt{\max(\ \sigma w2+\sigma 2,0)}$

σ^2 and σs^2:are the calculated Bayes threshold with the help of this formula each band are threshold with wavelet coefficient.

2.3. BIVARIATE SHRINK:

Bivariate shrinkage is the only method in which image or signal coefficient both are having advance performance. And drawback in bayes shrink i.e. "Bayesion risk" is overcome and mixing of image signal and noise signal is avoided.

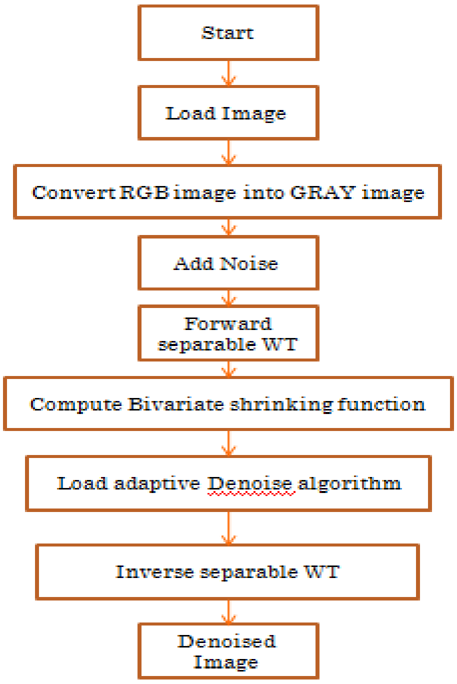

Fig.2.Bivariate Shrinking algorithm

Consider, w2 is a Parent of w1

w2is a coefficient of same place as w1

y1=w1+n1

y2=w2+n2

w1 and w2 observes that y1 and y2 are signals having noise and n1 and n2 are their samples

Therefore, we assume that,

Y=w+n

y=(y1,y2)

w=(w1,w2)

n=(n1,n2)

Therefore, standard estimate for w by corrupted y is

$w^{\wedge}(y)=arg^{max}\ w^{pw/y}(w/y)$

Therefore, $w^{\wedge}(y)=arg^{max}w[Pw/y(w/y),pw(w)]$

$w^{\wedge}(y)=arg^{max}w[(PN(Y-W)),Pw(w)]$

Probability density, in signal found by estimation of coefficient.

Therefore, for Gaussian Noise,

$Pn(n)=\frac{1}{2\Pi Gn2}*exp(-n1^2+n2^2+2\sigma n^2)$

combinely, with wavelet coefficients

$Pw(w)=\frac{2}{2\Pi Gn2}*\exp(-\sqrt{3}\sqrt{w1}^{2}+w2^{2})/\sigma$

from pervious equation of noisy observation,

$w^{\wedge}(y)=\arg\max_{w}[\log(Pn(y-w))+\log(Pn(w))]$

So we defined, $f(w)=\log(Pw(w))$

from above wavelet coefficient equation,

$w^{\wedge}(y)=\operatorname{argmax}_{w}[-\frac{(y1-w2)2}{2\sigma n2}-\frac{(y2-w2)2}{2\sigma n2}+f(w)]$

This is equivalent with following solved equation,

$y1-\frac{w\wedge 1}{\sigma n2}+f1(w^{\wedge})=0$

$y2-\frac{w\wedge 2}{\sigma n2}+f2(w^{\wedge})=0$

f1 and f2 are the representative of derivatives of f(w),with respect to w1 and w2.

And $f(w)=\log(P_{w}(w))$

$\log(\frac{2}{2\pi\sigma 2}*\exp(\sqrt{3}\sqrt{w1}^{2}+w2^{2}/\sigma)$

$\log(\frac{2}{2\pi\sigma 2}-(\sqrt{3}\sqrt{w1}^{2}+w2^{2}/\sigma)$

$f1(w)=-\sqrt{3}\frac{w1}{\sqrt[\sigma]{w1}^{2}}+w2^{2}$

$f2(w)=-\sqrt{3}\frac{w1}{\sqrt[\sigma]{w1}^{2}}+w2^{2}$

From above equation, we get

$Zw^{\wedge}1=\frac{\sqrt{y12+y22-\sqrt{3\frac{\alpha n2}{\sigma}}}}{\sqrt{y12+y22}}+y1$

2.4. NEIGH SHRINK

The neigh shrink is work on DWT of image signals. The DWT is based on decomposition of signal with independent, spatially recognized frequency channels. By applying the signals through two complimentary filters, both signals are generate accuration and details. These two components move back into original signals without losing information.

Here 2Dimage is generated in which N level of decomposition is perform 3N+1 using various frequency bands LL,LH,HL,HH.

The LL,LH,HL and HH are the frequency bands having the information of vertical details, horizontal details and average image. The wavelet transformed are work on thresholding with respect to proper thresholding with respect to proper thresholding value.

LL2	LH2	LH1
HL2	HH2	
HL1		LL1

In Neigh Shrink method dj, k are the wavelet coefficient with neighborhood mash of size 3*3 and S is a summation which is calculated by follow,

$S=\sum ilBj,k\ d^2,l$

dj,k: Wavelet coefficient in selected window

if $S<\lambda^2$ then it's corresponding dj,k is set to zero or shrinking calculated using

dj,k=dj,kβj,k

$\beta j,k=[1-\lambda^2/S^2\ j,k]$

$\lambda=\sigma\sqrt{2logn}^2$

Threshold value

σ^2 -Variance

n -Signal Length

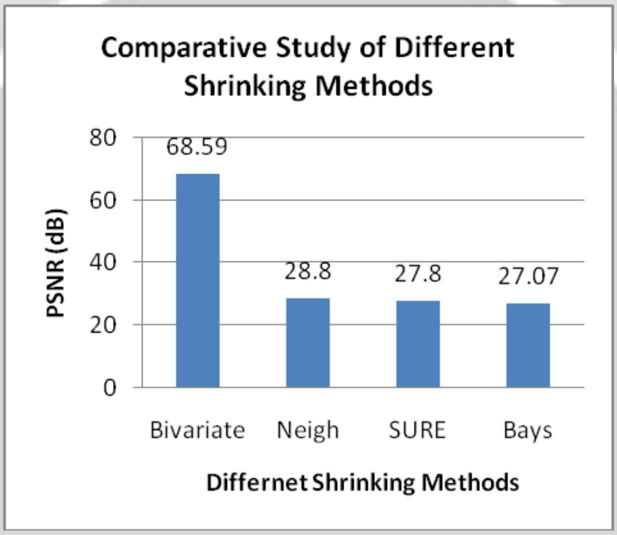

CHART-1.COMPARITIVE STUDY OF RESULTS

3. CONCLUSION

The effective techniques for image denoising is wavelet transform technique using energy of signals in some high signal values. When we corrupted image with Gaussian noise adding σ value by using wavelet thresholding we Denoised the image and capture original natural image. In this paper we discussed different denoising methods and find the best method among them on the basis of increased PSNR value and low MSE value. The final conclusion is that the Bivariate shrinkage provides better results among them in different noise conditions for different images.

4. ACKNOWLEDGMENTS

In all image denoising algorithm which one is better among them, is find out with the help of different research papers. The Bivariate Shrinkage having improve results towards increasing PSNR and reduces the MSE. And in this work my guide Dr. Akant and Dr. Khanapurkar are helping me a lot.

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