IMAGE DENOSING USING VISHUSHRINK ALGORITHUM

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ABSTRACT: *Transmission of any visual information transmitted in the form of digital images is becoming a major method of communication now days, but the image obtained after transmission is often corrupted with noise. The received noisy image needs to enhance (denoising) processing before it can be used in applications. Image denoising is important task to produce a visually high quality image. Image denoising have been done so far decade by using histogram, linear, nonlinear methods and algorithms. In that they use transformation from one domain to another such as Fourier transform, Short Fourier transform, Wavelet and curvelet transform..In such domain various algorithms like Visushrink, Sureshrink Bayesshrink,*

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Keywords— Soft thresolding, Hard thresolding, Semisoft thresolding,Discrete Wavelet Transform (DWT).

I: INTRODUCTION

An image is often corrupted by noise during its acquisition and transmission. Image denoising is used to remove the additive Gaussian noise while retaining important maximum possible image features. Wavelet analysis has been demonstrated to be one of the powerful methods for performing image noise reduction. The procedure for noise reduction is applied on the wavelet coefficients obtained after applying the wavelet transform to the image at different scales. The motivation for using the wa- velet transform is that it is good for energy compaction since the small and large coefficients are more likely due to noise and important image features, respectively. The small coefficients can be thresholded without affecting the significant features of the image. In its most basic form, each coefficient is thresholded by comparing against a value, called threshold. If the coefficient is smaller than the threshold, it is set to zero; otherwise it is kept either as it is or modified. The inverse wavelet trans- form on the resultant image leads to reconstruction of the image with essential characteristics.

II: MOTIVATION FOR WAVELET THRESHOLDING

The plot of wavelet coefficients suggests thatsmall coefficients are dominated by noise, while coefficients with a large absolute value carry more signal information than noise. Replacing noisy coefficients (small coefficients below a certain threshold value) by zero and an inverse wavelet transform may lead to a reconstruction that has lesser noise. Stated more precisely, we are motivated to this thresholding idea based on the following assumptions:

1. The decorrelating property of a wavelet transform creates a sparse signal: most untouched coefficients are zero or close to zero.
2. Noise is spread out equally along all coefficients.
3. The noise level is not too high so that we can distinguish the signal wavelet coefficients from the noisy ones.

As it turns out, this method is indeed effective and thresholding is a simple and efficient method for noise reduction. Further, inserting zeros creates more sparsity in the wavelet domain and here we see a link between wavelet denoising and compression which has been described in sources such as [5].

III: HARD THRESOLDING

All coefficients whose magnitude is greater than the selected threshold value to remain as they are and the others with magnitudes smaller than t are set to zero. It creates a region around zero where the coefficients are considered negligible. And it can be defined as

$$T_H - \begin{cases} x & \text{for } |x| \geq t \\ 0 & \text{in all other regions} \end{cases}$$

IV: SOFT THRESOLDING

Soft thresholding is where the coefficients with greater than the threshold are Shrunk towards zero after comparing them to a threshold value. It is define as bellows

$$T_s = \begin{cases} sign(x)\,(|x| - t) & \text{for } |x| \geq t \\ 0 & \text{in all other regions} \end{cases}$$

V: SEMISOFT THRESOLDING

The soft thresholding function (also called the shrinkage function) takes the argument and shrinks it toward zero by the threshold. Soft thresholding rule is chosen over hard thresholding, for the soft thresholding method yields more visually pleasant images over hard thresholding. By choosing appropriate thresholds, the semi-soft shrinkage offers advantages over both hard thrinkage (uniformly small risk and less sensitivity to small perturbations in the data) and soft shrinkage (small bias and overall risk). Since the soft-thresholding functions are continuous with discontinuous derivative

$$T_{ss} = \begin{cases} 0 & |x| \le t_1 \\ sign(x)\left(\frac{t_2|x|-t_1}{t_2-t_1}\right) & t_2 < |x| \le t_2 \\ x & |x| > t_2 \end{cases}$$

VI: VISUSHRINK ALGORITHM

Visushrink is thresholding by applying the Universal threshold proposed by Donoho and Johnstone. This threshold is given by $\sigma\sqrt{2\log M}$ where σ is the noise variance and M is the number of pixels in the image. For the maximum of any M values nii(noise matrix elements) as $N(0,\sigma^2)$ will be smaller than the universal threshold with high probability, with the probability approaching 1 as M increases. Thus, with high probability, a pure noise signal is estimated as being identically zero[1].

However, for denoising images, Visushrink is found to yield an overly smoothed estimate. This is because the universal threshold(UT) is derived under the constraint that with high probability the estimate should be at least as smooth as the signal. So the UT tends to be high for large values of M, killing many signal coefficients along with the noise. Thus, the threshold does not adapt well to discontinuities in the signal[1].

The threshold in VisuShrink is also referred to as universal threshold and it is defined as:

$$T = \sigma\sqrt{2\log M}$$

where σ is the noise variance present in the signal and M represents the signal size or number of samples.

An estimate of the noise level σ is defined based on the median absolute deviation that is given by:

$$\sigma^2 = \left[\frac{(median\ |Y_{i,j}|)}{0.06745}\right]^2$$

where $Y_{i,j} \in HH_1$ subband.

Visushrink algorithm steps as follow:

1. Convert the image in frequency domain
2. Estimate the threshold value
3. Apply the soft or hard thresholding
4. Reconstruct image form frequency domain

VII: EXPERIMENTAL RESULT

First I find the universal threshold value from the wavelet coefficient of the high frequency band then I apply soft thresholding , hard thresholding and semi soft thresholding and their experiment results are shown below

FIG 1 . Noisy image

FIG 2 . Soft thresholding

FIG 3 . Hard thresholding

FIG 4 . Semi soft thresholding

IX:CONCLUSION

From the different experiment of shrinkage function, the resultant denosie images which depents upon original images edges, if more edages than image get more blurred. The threshold value play important role in the whole process if high threshold value than it loss image detail wavelet coefficient and if it low than noisy wavelet coefficient pass. Semisoft threshold has two threshold value and has both shrinkage function(hard and soft) advantages. For different images result as below(in terms of PSNR):

	soft	hard	semisoft
cameraman	25.13	26.77	26.98
Leena	26.98	27.44	27.50
moon	29.24	29.77	30.32

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