

De-noising Of Image and Its Performance Evaluation

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Abstract : The most important task in image processing is denoising the image. Lots of research is conducted in this era but the compelling challenge in this field is to get the efficient denoised image. In this paper three noises are added to the image one by one and then denoised with the bayes shrink and vishu shrink . Different authors had proposed the simple formulas for these methods. Comparison of both filters with effect of noise is done using the various image matrices such as BER, MSE, PSNR . The filters are implemted on the matlab (R2013a)

Keywords: Ber , Mse , Psnr , Salt And Pepper , Speckle , Gaussian

I. Introduction

1.1 NOISE :- it is the unwanted signal or sound. It is the random variation of brightness or colour in image there are many types of noise such as speckle noise , salt and pepper noise , Gaussian noise , awgn , blur , spot noise , jpeg peg2000 , contrast etc out of which we work on these following three noises

1.1.1 SPECKLE NOISE :- Speckle noise attacks the image and degrade its quality significantly and it become difficult for observer to discriminate small details of image in diagnostic process.[1] Speckle noise is multiplicative in nature visual interpretation become difficult [2] laser holography and ultra sounding are easily effected by speckle degradation. In bright areas it shows the greater degradation than in dark areas

1.1.2 GAUSSIAN NOISE :- This noise is evenly distributed over the signal. As the name indicate this noise , this type of noise has Gaussian distribution. This means that each pixel in noisy image is the sum of the true pixel value and a random Gaussian distribution noise value[1]

$$F(g) = 1/\sqrt{2\pi}\sigma^2 \cdot e^{-(g-m)^2/2\sigma^2} \quad (1.1)$$

where g represents the gray level, m is the mean or average of the function, and σ is the standard deviation of the noise. When introduced into an image, Gaussian noise with zero mean and variance as 0.05 would look as in Image [3]

1.1.3 SALT AND PEPPER NOISE :- Salt and pepper noise is an impulse type of noise, which is also referred to as intensity spikes. This is caused generally due to errors in data transmission. It has only two possible values, a and b . The probability of each is typically less than 0.1. The corrupted pixels are set alternatively to the minimum or to the maximum value, giving the image a “salt and pepper” like appearance. Unaffected pixels remain unchanged. For an 8-bit image, the typical value for pepper noise is 0 and for salt noise 255. The salt and pepper noise is generally caused by malfunctioning of pixel elements in the camera sensors, faulty memory locations, or timing errors in the digitization process.[3]

1.2 DENOISEING :- It is a technique to remove the noise from the noise image and get the noise free image it can be done with the help of various wavelet transforms out which we take the we take the following

1.2.1 VISU SHRINK:- Visu Shrink was introduced by Donoho [4]. It uses a threshold value t that is proportional to the standard deviation of the noise. It follows the hard thresholding rule. It is also referred to as universal threshold and is defined as

$$t = \sigma \sqrt{2 \log n} \quad (1.2)$$

σ^2 is the noise variance present in the signal and n represents the signal size or number of samples. An estimate of the noise level σ was defined based on the median absolute deviation [6] given by

$$\sigma = \text{median}(\{ |g_{j-1,k}| : k=0,1,\dots,2^{j-1}-1 \}) / 0.6745 \quad (1.3)$$

where $g_{j-1,k}$ corresponds to the detail coefficients in the wavelet transform. VisuShrink does not deal with minimizing the mean squared error [27] It can be viewed as general-purpose threshold selectors that exhibit near optimal minimax error properties and ensures with high probability that the estimates are as smooth as the true underlying functions [4]. However, VisuShrink is known to yield recovered images that are overly smoothed. This is because VisuShrink removes too many coefficients. Another disadvantage is that it cannot remove speckle noise. It can only deal with an additive noise. VisuShrink follows the global thresholding [5] scheme where there is a single value of threshold applied globally to all the wavelet coefficients.

1.2.2 BAYES SHRINK :- BayesShrink was proposed by Chang, Yu and Vetterli [6] The goal of this method is to minimize the Bayesian risk, and hence its name, BayesShrink. It uses soft thresholding and is subband-

dependent, which means that thresholding is done at each band of resolution in the wavelet decomposition. Like the SureShrink procedure, it is smoothness adaptive. The Bayes threshold, t_B , is defined as

$$t_B = \sigma \sqrt{2} / \sigma_s \tag{1.4}$$

where σ^2 is the noise variance and σ_s^2 is the signal variance without noise. The noise variance σ^2 is estimated from the subband HH1 by the median estimator shown in Equation (1.4). From the definition of additive noise we have

$$w(x, y) = s(x, y) + n(x, y) \tag{1.5}$$

Since the noise and the signal are independent of each other, it can be stated that

$$\sigma_w^2 = \sigma_s^2 + \sigma^2 \tag{1.6}$$

σ_w^2 can be computed as shown below:

$$\sigma_w^2 = 1/n^2 \sum W^2(x, y) \tag{1.7}$$

$$\sigma_s = \sqrt{\max(\sigma_w^2 - \sigma^2, 0)} \tag{1.8}$$

With σ^2 and σ_s^2 , the Bayes threshold is computed from Equation (1.8). Using this threshold, the wavelet coefficients are thresholded at each band.

II. Simulation And Parameter

In this work image quality assessment is done with the following :-

Tools	Parameters
Image	any random image (noddy)
Noises	speckle , salt and pepper Gaussian
wavelet transforms	vishu shrink and bayes shrink
Software	Matlab
Version	13
Parameters	BER, MSE , PSNR

Table 1 showing the simulation parameters

III. Results

In this section we compare the results of image with two different wavelet transforms bayes shrink and vishu shrink that we studied in this paper on three different noises speckle , salt and pepper and Gaussian noise results with this parameters are got by compareing the original and noise image and original and recovered image

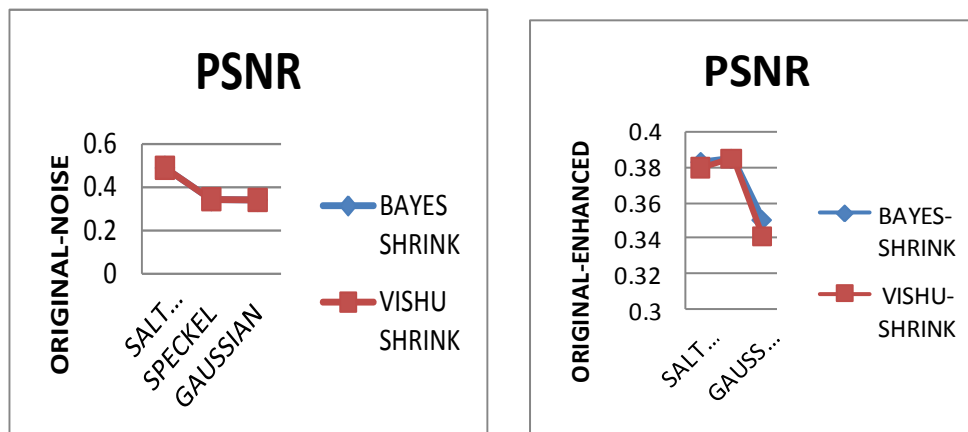


Figure 1 value of PSNR with two wavelet transforms from and compare the original and noise image and original enhanced image

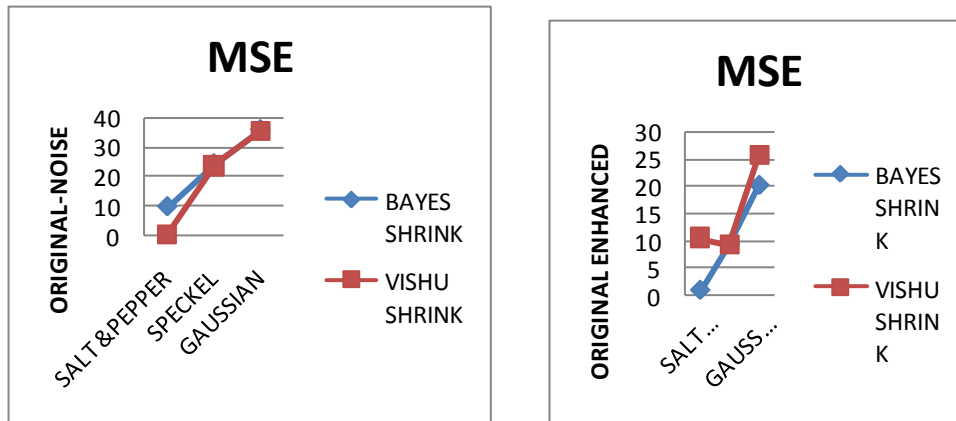


Figure 2 value of MSE with two wavelet transforms from and compare the original and noise image and original enhanced image

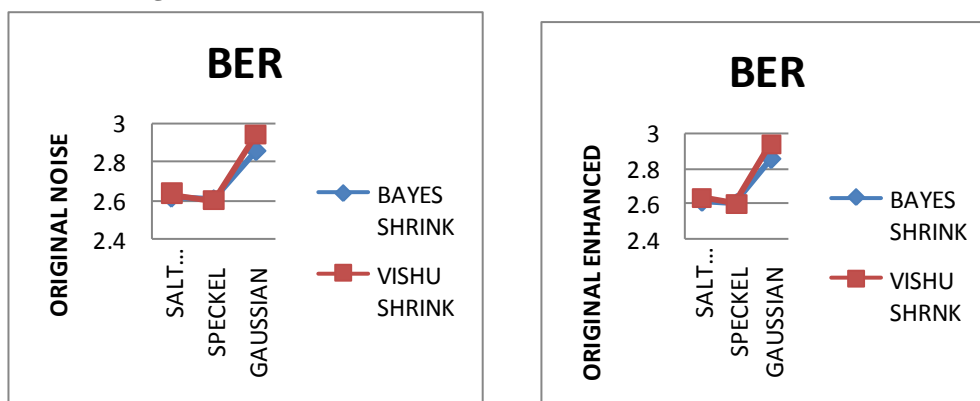


Figure 3 value of BER with two wavelet transforms from and compare the original and noise image and original enhanced image

IV. Conclusion

From the above results and observations it is concluded that out of the vishu shrink and bayes shrink wavelet transforms bayes shrink wavelet shows the best result with all three parameters BER , PSNR , MSE . This wavelet is suited for denoising the image with speckle noise , salt and pepper noise , and Gaussian noise while compared with original and enhanced image

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