GRADIENT HISTOGRAM ESTIMATION AND PRESERVATION FOR IMAGE DENOISING USING DWT

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Abstract - *contrast image. In histogram equalization the intensity values are distributed an effective manner. It helps areas on the image with low contrast to have a better or higher contrast before filtering steps.Histogram equalization generally takes the intensity levels of an image and calculates the total number of pixel in the image at each pixel intensity level. The intensity levels of the image are then spread over to fill the entire space of available intensities, and thereby it increasing the contrast of the image. This is achieved by allocating the pixels at each intensity level with the percentage of the range that matches there percentage of the total number of pixels in the image. PSNR is most commonly used to measure the quality of reconstruction of lossy compression(e.g., image compression). The signal in this case is the denoised data and original data.*

Key Words: *PSNR, denoised, histogram.*

1. MATHEMATICAL MODEL

PSNR=10[log]_10 ([[MAX]_I]^2/MSE) (1)

=20[log]_10 ([MAX]_I/√MSE) (2)

=20[log]_10 ([MAX]_I)-10[log]_10(MSE) (3)

The above equation (1), (2), (3) shows the PSNR value. PSNR is most easily defined via the Mean Squared error (MSE) is shown in equation (4). A noise-free m×n monochrome image I and its noisy approximation K..

MSE is defined as:

MSE=1/mn∑_(i=0)^(m-1)∑_(j=0)^(n-1)[[I(i,j)K(i,j)]]^(4)

I=represents the matrix data of our original image K=represents the matrix data of our degraded image in question.

m=the numbers of rows of pixels of the images and i represents the index of that row.

n= the number of columns of pixels of the image and j represents the index of that column.

MAXI is the maximum signal value that exists in our original known to be good image.

1.2 IMAGE DENOISING USING GRADIENT HISTORGRAM

The pixels will still remain in the same order relative to all lighter and darker pixels in the original image, they will just be shifted and or stretched in terms of where and how much of the intensity range they occupy. Image histogram equalization actually deals with averaging and reduction of noise by adding certain other noisy images also. Image denoising can be done in the many ways includes one of the strong techniques called image filter..

Filters are commonly used to adjust the rendering of an image, a background, or a border. Once using histogram, image contrast is increased it can be passed for the filtering process. First average masking is used here for removing the blur of the image as filter. Median filter is used here for removing the noise as it includes salt-and pepper noise. After median filter input image is passed to the high pass filter for denoising and sharpening.

Exploiting some image and noise prior models, Histogram of Oriented Gradients (HOG) are feature descriptors used in computer vision and image processing for the purpose of object detection and The details counts of gradient orientation in localized part of an image. This method is same to the edge orientation histograms, scale-invariant feature, and shape contexts, but not the same in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy

The second step of calculation involves creating the cell histograms. Every pixel within the cell casts a weighted vote for an orientation-based histogram channel based on the values found in the gradient computation. The cells can either be rectangular or radial in shape, and the histogram channels are evenly fill over 0 to 180 degrees or 0 to 360 degrees, depending on whether the gradient is "unsigned" or "signed". Dalal and Triggs found that unsigned gradients used in conjunction with 9 histogram channels performed best in their human detection experiments.

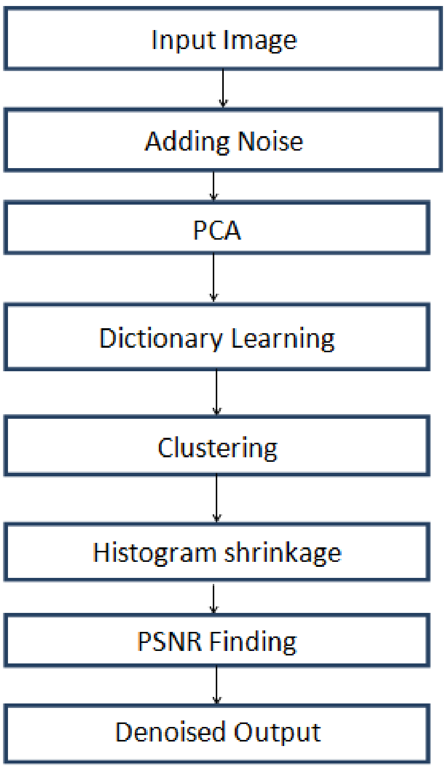

Fig 1 Flow Chart Of Gradient Histogram Based Image Denoising

Fig 1 shows the flow chart of Gradient Histogram Preservation for computation of Gradient values and calculate the colour values.

As for the vote weight, pixel contribution can either be the gradient magnitude itself, or some function of the magnitude. It achieves the worst decomposition level that as low as low level. The low level PSNR values only achieved. A method is aimed at minimizing image noise while it optimizing contrast of image subtle features level getting as low level.

2 PROPOSED IMAGE DENOSING ALGORITHM

Numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. The other wavelet transforms, It is an advantage over Fourier transforms is temporal resolution: it captures both frequency and location information (location in time).

The first DWT was invented by Hungarian mathematician AlfrédHaar. Input represented by a list of 2^n numbers, the Haar wavelet transform can be considered to pair up input values,storing not the same data and passing the sum. This process is doing again recursively, pairing up the sums to provide the next scale, which leads to 2^n-1 differences and a final sum.The lifting scheme is a technique for both designing wavelets and performing the discrete wavelet transform. it is worthwhile to move these steps and design the wavelet filters while performing the wavelet transform. It is called the second generation wavelet transform. In this technique was introduced by WimSweldens.

The Generalized Lifting Scheme is a derivative of the Lifting Scheme, in which the add and subtract operations are absorbed into the update and prediction steps, respectively. These steps can be any mapping, leading to many general lifting scheme.

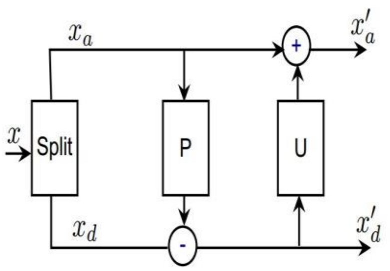

Fig 2 Simple Lifting Scheme

In the figure 2 the input signal x is first split into its even and odd polyphase components, respectively called that is nearly signal xa and the detail signal xd. The odd samples of x are then predicted from the neighboring even ones. The predictor operator P is a linear combination of them and it is in general chosen such that it gives a good estimate of xd. The new obtained signal $x'd = xd - P(xa)$ is then smaller than xd. Finally, the even samples of x are transformed into a low-pass filtered and subsampled version $x'a$ of the original signal x. This is done by using an updating operator U which is a linear combination of the elements of $x'd$.The approximation signal $x'a = xa + U(x'd)$ is then obtained. The principal disadvantage of the LS described above, that the linear filtering design is fixed and thus, does not match well the sharp transitions in the signal. The lifting schemes with adaptive prediction (APLS) [10], [11], [12] or adaptive update (AULS) [7], [8], [9] have been designed to overcome this limitation by the use of a filter that is able to adapt itself to the input signal it is analyzing Fig2 shows that the input image for gradient histogram preservation

The Lifting scheme (LS) is a method to simplify performing the wavelet transform in an efficient way. The (LS) can be performed by three steps:-split stage, predict stage, and update stage.

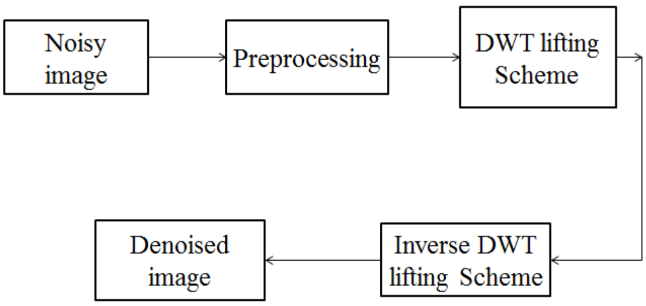

Fig 3: Block diagram of DWT using lifting scheme

The above figure 3 shows the updated sigma value. The preprocessing block will check the image format size and colour space. A typical lifting stage is composed of three steps : Split, Predict and Update is shown in the Figure. In the lifting scheme the split stage is used to decomposed the picture into small images. Update stage is check the image coefficient values with decomposed images.The predict stage update the coefficient values. In IDWT blockimage pixels is converted into original matrix and finally denoised image is obtained..

2.1 SIMULATION AND RESULTS

Fig 4 Gradient histogram input image

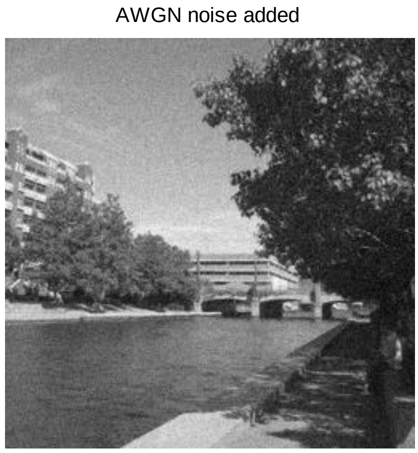

Fig 5 AWGN noise added image of Gradient Histogram Based Image Denoising

Fig 6 Output Image of gradient based image denoising

Fig 7 DWT Based Image decomposition image

Fig 8 Output image DWT Based Image Denoising

The figure 4 shows the input image of gradient histogram and DWT. Figure 5 AWGN noise added image of Gradient Histogram Based Image Denoising. Fig 6 shows Output Image of gradient based image denoising. Fig 7 shows DWT Based Image decomposition image. Finally the output image is obtained is shown in figure 8.

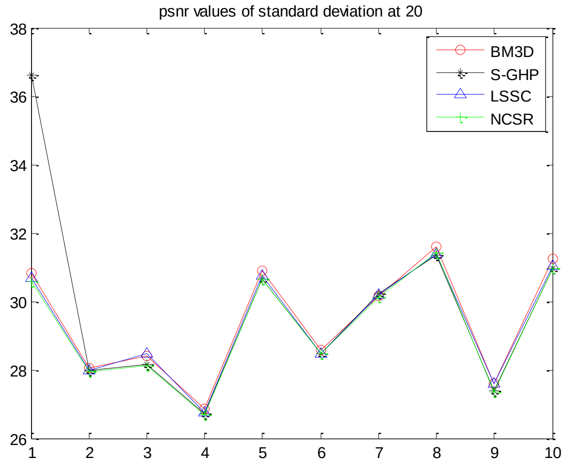

Fig 9 image Vs PSNR values

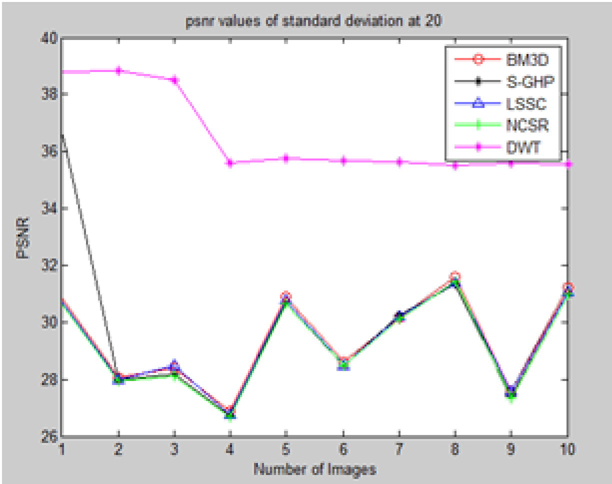

Fig 10 image Vs PSNR values

Fig 9 shows gradient histogram imageVs PSNR values output Figure 10 shows DWT image Vs PSNR values.

Table 1-Comparision of Input images VsPSNR Values of S-GHP,DWT

Input Images	S-GHP	DWT
1	30.6	35.78
2	27.97	35.85
3	28.17	35.49
4	26.72	35.59
5	30.65	35.71
6	28.46	35.69
7	30.22	35.66
8	31.34	35.53
9	27.4	35.60
10	30.98	35.54

3.CONCLUSION

A approach for image denoising via discrete wavelet transform, by using a lifting scheme is proposed in the paper. This approach, based on the estimation of the energy in the transform sub bands, gives better performances than the classical gradient histogram estimation. Dwt using lifting scheme introduce to reduce the time consumption and to increase PSNR values so quality images is obtained and to make the images to look more natural.Future work will be dedicated to other thresholding methods, such as SureShrink, which is a hybrid of the universal and the sures threshold.

4. REFERENCE

[1] J. Portilla, V. Strela, M. J. Wainwright, and E. P. Simoncelli, "Image denoising using a scale mixture of Gaussians in the wavelet domain,"*IEEE Trans. Image Process.*, vol. 12, no. 11, pp. 1338–1351, Nov. 2003

[2] M. Elad and M. Aharon, "Image denoising via sparse and redundant representations over learned dictionaries," *IEEE Trans. Image Process.*, vol. 15, no. 12, pp. 3736–3745, Dec. 2006.

[3] W. Dong, L. Zhang, G. Shi, and X. Wu, "Image deblurring and superresolution by adaptive sparse domain selection and adaptive regularization," *IEEE Trans. Image Process.*, vol. 20, no. 7, pp. 1838–1857, Jul. 2011.

[4] A. Buades, B. Coll, and J.Morel, "A review of image denoising methods, with a new one," *MultiscaleModel.Simul.*, vol. 4, no. 2, pp. 490–530, 2005.

[5] K. Dabov, A. Foi, V. Katkovnik, and K. Egiazarian, "Image denoising by sparse 3D transform-domain collaborative filtering," *IEEE Trans. ImageProcess.*, vol. 16, no. 8, pp. 2080–2095, Aug. 2007.

[6] B. Toufik and N. Mokhtar; (2012). "The Wavelet Transform for Image Processing Applications", Advances in Wavelet Theory and Their Applications in Engineering, Physics and Technology, Dr. DumitruBaleanu (Ed.), ISBN: 978-953-51-0494-0, InTech.

[7]. J. Joshi, and N. Nabar; "Reconfigurable Implementation of Wavelet based Image Denoising", IEEE international Midwest symposium on Vol.1, pp. 475-478, 2006.

[8]. w. sweldens; "the lifting scheme: a construction of second generation wavelets", tech. rep. 1995. industrial mathematics initiative, department of mathematics, university of south carolina.

[9]. d. l. donoho and i. m. johnstone; "ideal spatial adaptation by wavelet shrinkage", biometrika, vol. 81, no. 3 (aug., 1994), pp. 425-455.

[10]. K. Andra, C. Chakrabarti, and T. Acharya, "A VLSI Architecture for Lifting-Based Forward and Inverse Wavelet Transform", IEEE Transactions On Signal Processing, Vol. 50, No. 4, April 2002.

BIOGRAPHIES

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