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DENOISING DIGITAL IMAGE USING WAVELET TRANSFORM AND MEAN FILTERING

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***Abstract*— During the acquisition of a newly image, the clarity of the image is easily effected due to lighting of equipments that has been used to capture the image. The images contain lot of noise. The most common distortion in images is their poor contrast quality, blurred, out of focus, improperly bright. These problems obscured the detailed information of the image. So to get the proper information it is necessary to denoise the image. Edges are one of the important features of image. Sometimes while removal of noise face removes the edges that are important information for images in recognition task. To preserve that edge of the image the edge detection is necessary. So to solve all these problems it obtains the proper information from the image, we proposed a noble technique using SWT (Stationary Wavelet Transformation), Adaptive Mean Filtering, Edge Detection and Contrast Stretching approaches. We have conducted experiment on grey scale images of poor quality. The performances of the proposed method are compared with the other methods using the parameters Peak Signal Noise Ratio(PSNR), Signal Noise Ratio (SNR), Mean Square Error(MSE), Root Mean Square Error (RMSE). The results of experiment show that the proposed algorithm is very effective in denoising the image and contrast enhancement. The method required minimum processing time than other method.**

Keywords— **Image enhancement, SWT, AMF, Contrast Stretching, Brightness Preserving - Dynamic Histogram Equalization(BP-DHE) Local Histogram Equalization (GHE), PSNR, MSR, RSME.**

I. INTRODUCTION

Denoising an image and enhancement in image's contrast plays a crucial role in the image processing application that are digital photography, medical images analysis, remote sensing, LCD display processing and scientific visualization. The technique image processing is used to remove the noise, remove artifacts and preserve details. Its purpose is to amplify certain image feature for analysis, diagnosis and display.[10]

During the implementation of enhancement of the image, enhancement involves different operations like brightness, increment, sharpening, and blurring or noise removal during the implementation. While categorizing image enhancement operation can be divided into two categories that are:

1. Noise Removal
2. Contrast Enhancement

Noise Removal: Noise removal is that operation which is used to unwanted material from the image[3].

Contrast Enhancement: Contrast Enhancement is that process which is used to make image brighter, visual and detail worthful[4].

Fig1- Basic steps of Image Enhancement.

Local Histogram Equalization (LHE): the LHE improves the local contrast and enhance the definitions of edges I each region of the image[6].
Brightness Preserving - Dynamic Histogram (BP-DHE): This histogram normalizes the brightness of the image in order to preserve the brightness of the input image in the output [9-10].
Adaptive Mean Filtering: An adaptive filter is a system with a linear filter that has a transfer function controlled by variable parameters and a mean to adjust those parameters according to

an optimization algorithm. Adaptive filters are a kind of digital filter[15].

II. RELATED WORK

Mr. KirwaleGajanan et.al.(2014) [1]: They have proposed a noval approach for image quality enhancement via image super resolution. They said that super resolution (SR) of high resolution image reconstructed from noisy, blurred and aliasing the low resolution image using technique known as super-resolution reconstruction. The algorithms are used in super-resolution reconstructed process to combine the low resolution images to from high resolution images. The super-resolution process passes through three phases. i.e. registration, interpolation and restoration. They showed that the proposed technique gives the better results as compare to existing technique.

Miss SnehalK. Bnasod(2015) [2]: In this paper they have represent a new computational scheme based on multi-resolution decomposition for extracting the feature of interest from the Digital Aerial Image by suppressing noise. They said that wavelet transform performs a filter function on images. In their proposed work they have used Haar wavelet transformation. In this firstly the color image is converted into the grey image then Harr wavelet transformation technique is applied to calculate the low frequency component. Then second level of Haar transformation is applied to find the very low frequency component of image.

HilalNaimi et.al.(2015) [3] They proposed a new technique dual tree complex thresholding wavelet transform to denoise a medical image.

Manvi et.al.(2014) [4] They proposed a novel algorithm to improve the contrast of the image. They said that at present work, region based segmentation has been chosen, and these are many techniques used to enhance the contrast but the proposed technique enhances the contrast of the image to a great extent. They have compared the Power-law transformation, Unsharp masking metrices of the proposed technique with existing techniques. They said that proposed method offers a level of controllability and adaptability through which different levels of contrast enhancement.

Shresth Gupta et. al (2015) [5] They have make a survey an image enhancement technique. They said that image enhancement algorithm offers wide variety of approaches for modifying images to achieve visually acceptable images. The image is enhanced by using two techniques that are spatial domain and frequency domain.

Mandeep Kaur et.al.(2015) [6]: They proposed a Dualistic Sub-Image Histogram Equalization Based Enhancement and Segmentation Techniques with NN for Medical Image. In their paper they have presented a complete segmentation and enhancement of the medical image by using DSIHE technique. After the enhancement process they have done whole filling and branch removal is done respectively on the medical image. The performance of the proposed method is measured using absolute mean brightness error, peak signal to noise ratio and structure similarity index. The proposed technique gives a better result as compare to existing technique.

Lei Wang, Nian-de Jiang, Xing Ning (2012) [13] in this paper the research is done to make a medical image enhancement algorithm based on GSM model for wavelet coefficient. Firstly the Gaussian Scale Mixture (GSM) model denoises the image in auto-adapted wiener filter. This algorithm is used to denoise the medical CT image. Secondly the wavelet's approximate distribution and statistical characteristics are described through the qualitative analysis and classification of wavelet coefficients for the signal and noise.

Kanwaljot Singh Sidhu, Baljeet Singh Kaira, Ishpreet Singh Virk (2012) [14]in this paper they used a wavelet technique to denoise the medical image. This technique works on Haar and Daubechies transforms. In this paper they have used the concept of hard & soft threshold. A wavelet technique is used to denoise the medical image. In this paper four different medical images MRI, Ultrasound, are denoised using haar and db3 wavelets at both hard and soft threshold levels and the peak signal to noise ratio is calculated after denoising by both wavelet.

Tang Yong-Zheng (2014) [15] described that the result of a medical image is obtain in more accurate manner by fusion than other single medical image. He proposes a method of multi-focus medical image fusion based on improved redundant complex wavelet transform. The proposed multi-focus medical image fusion method integrates the pixel level fusion and some features level fusions. This method firstly decomposes multi-focus medical image fusion redundant wavelet transform (RWT). After that, to guide the organization coefficient it uses the extracted brink features.

III. PROPOSED APPROACH

In this paper we have conducted experiment on various gray level images of resolution 512*512. Firstly, in original image we added 5 db amount of Gaussian noise. after adding the noise PSNR, SNR, MSE, RMSE value of the noisy image is calculated. After adding the noise db1 wavelet transformation is applied on each image. After that 1-level decomposition of the image is done. The noise from the image is removed by using the Discrete Wavelet Transformation (DWT) algorithm and Stationary Wavelet Transformation (SWT) algorithm. After the implementation of DWT and SWT algorithm on noisy image, again we have calculated the PSNR, SNR, MSE, RMSE values of the image. The table 1 given below gives the comparison between the results obtained from implementation of DWT algorithm and SWT algorithm of image enhancement. The result in the table shows that the SWT algorithms for image enhancement gives better as compare to DWT algorithm.

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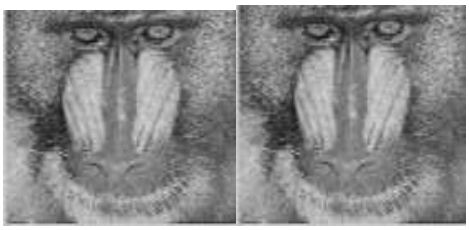
IV. EXPERIMENT AND RESULT

4.1 Results of PSNR, SNR, MSE, RMSE

1 Baboon Image

(a) **(b)**



(c) (d)

2. Barbara Image

(a) **(b)**

(c) (d)

3. Bridge Image

(a) **(b)**

(c) (d)

4. Elaine Image

(a) **(b)**

(c) (d)

5. Cameraman Image

(a) **(b)**

(c) (d)

Fig. a) Original Image b) Noisy Image c)Denoised Image Based on DWT Wavelet Transformation d) Denoised Image Based on SWT Wavelet Transformation

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Table -1 Experiment Result

IMAGE	PSNR	SNR	MSE	RMSE
1. Baboon Image				
Noisy Image	20.579	15.149	0.008	0.089
Denoised Image based on the DWT Wavelet	21.731	16.3005	0.006	0.0774
Denoised Image based on the SWT Wavelet	23.501	18.070	0.005	0.0707
2. Barbara Image				
Noisy Image	19.952	13.613	0.010	0.1
Denoised Image based on the DWT Wavelet	22.819	16.480	0.005	0.0707
Denoised Image based on the SWT Wavelet	24.713	18.375	0.707	0.054
3. Bridge Image				
Noisy Image	18.605	12.502	0.013	0.114
Denoised Image based on the DWT Wavelet	22.035	15.932	0.0062	0.078
Denoised Image based on the SWT Wavelet	24.027	17.924	0.003	0.094
4. Elaine Image				
Noisy Image	19.977	15.007	.1005	0.0317
Denoised Image based on the DWT Wavelet	26.922	21.912	0.002	0.044
Denoised Image based on the SWT Wavelet	29.623	24.723	0.0010	0.031
5.Camerama-n Image				
Noisy Image	17.726	12.144	0.016	0.126
Denoised Image based on the DWT Wavelet	21.574	15.992	0.06	0.077
Denoised Image based on the SWT Wavelet	23.551	17.969	0.04	0.0632

Results of Adaptive Mean Filtering After adding the noise in the original image, we have filter the image by using the mean filter Median filter and adaptive mean filter. From the following figure it is observed that the adaptive mean filter gives the better results as compare to mean filter and median filter.

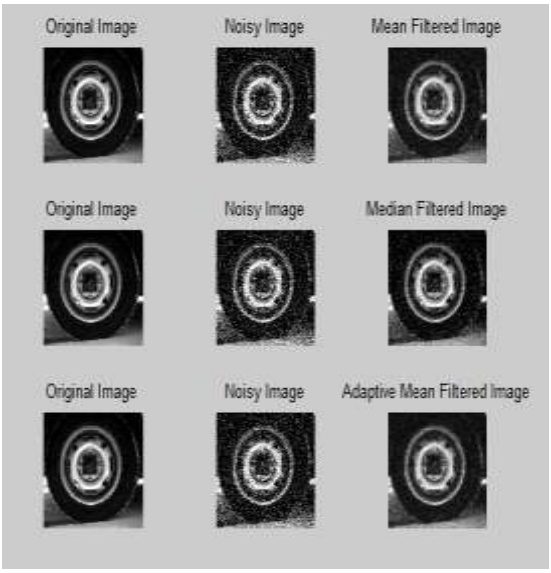

Fig4.2. Result of Adaptive Mean Filtering

4.3 Result of Brightness Preserving Dynamic Histogram Equalization (BP-DHE)

The Fig 4.3 shows that the contrast in the resulted image is enhanced after applying the Brightness Preserving Dynamic Histogram Equalization.

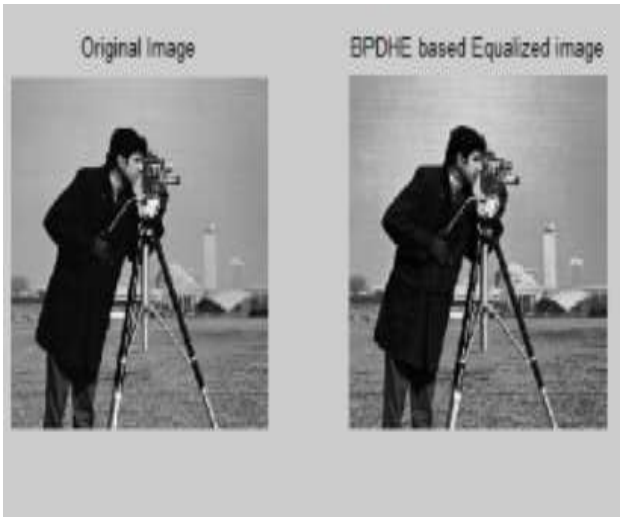

Fig 4.3 Result of BP-DHE

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4.4 Result of Local Histogram Equalization

Fig 4.4(a) shows the result of use of local histogram equalization. The results show that the contrast of the image becomes better than the original image after apply the local histogram equalization technique. The Fig 4.4(b) shows the histogram of original and equalized image.

Fig 4.4(a) Result of Local Histogram Equalization

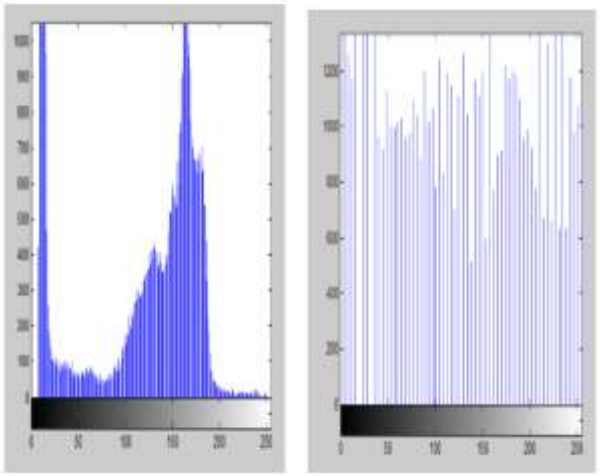

Fig 4.4(b) Histogram of Original and Equalized Image

V. CONCLUSION

In this paper image enhancement have been successfully used for improving the quality of image by using various techniques. We have used SWT and AMF technique to remove the noise from the image, edge detection technique to preserve the edges of the image and contrast is adjusted by contrast stretching approaches and finally we have obtained the desired the enhanced output image. The design and implementation has been done in MATLAB using image processing toolbox. The proposed method gives better results as compared to its other methods.

In future we will add edge detection in this technique to avoid the removal of edges of the images and General Histogram Equalization and Singular Value Equalization to enhance the contrast of the image.

VI. REFERENCE

[1] Mr. KirwaleGajanan, "A Novel Approach for Image Quality Enhancement via Image Super –Resolution," International Journal of Advanced Research in Computer Science and Software Engineering, Vol 4,issue 11, pp 608-612, November 2014.

[2] Miss SnehalK.Bnasod, "" Use of Wavelet Transform in Digital Aerial Image" Vol 3, issue 2, pp 839-841, Febuary 2015.

[3] HilalNaimi et.al., " Medical Image Denoising using Dual tree complex thresholding wavelet transform and Wiener filter," Journal of King Saud University Computer AND Informatio Sciences, vol 27, pp 40-45, January 2015.

[4] Manviet.al."A Novel Algorithm for Image Contrast Enhancement," International Journal of Electronic and Electrical Engineering, Vol 7, pp 165-170, 2014.

[5] Shresth Gupta et. al., "A Survey on Image Enhancement Techniques," International Journal of Electronic & Telecommunications, Vol 4, issue 1, January 2015.

[6] Mandeep Kaur et.al."A Dualistic Sub-Image Histogram Equalization Based Enhancement and Segmentation Techniques with NN for Medical Images," International Journal of Engineering and Science, Vol 5, Issue 1, January 2015.

[7] NaeemShareefet. al., "Segmentation of Medical Image Using LEGION", IEEE Transaction ON medical Imaging, Vol 18, No. 1. January 1999.

[8] S.DU, R.K.Ward, Adaptive region-based image enhancement method for robust face recognition under variable illumination conditions, IEEE Trans.Circuit Syst. Video Technol.20(9) Sep 2010,1165-1175.

[9] D.Sheet, H.Garud, A.Suveer, M. Mahdaoppa, J. Chatterjee, Brightness Preserving dynamics fuzzy histogram equalization, IEEE Trans. Consumer Electron .56(2010) 2475-2480.

[10] H.Ibrahin, n.s.p. Kong, Brightness Preserving Dynamic Histogram Equalization for image contrast enhancement, IEEE Trans. Consumer Electron 53 (2007) 1752-1758

[11] Lei Wang et al.," Research on Medical Image Enhancement Algorithm based on GSM Model for Wavelet Coefficient," *ELSEVIER* ,pp. 1298-1303, 2012.

[12] Diwakar Shrivastava, Dr. Vineet Richhariya,"Adaptive Contrast Image Enhancement based on Fuzzy Set Theory, " International Journal of Advance Computer

Science and Software Engineering, vol. 4, no. 2, pp. 453–462, February 2014.

[13] Kanwaljot Singh Sidhu, Baljeet Singh Kaira, Ishpreet Singh Virk , "Medical Image Denoising in the Wavelet Domain using HAAR and DB3 Filtering," EURASIP J. Adv. Signal Process. 2012.

[14] Kale Vaishanw G, "X-Ray Lung Image Enhancement by Spatial Filtering," *International Journal of Innovative Research and Science*, Vol. 3, No. 4, April 2014.

[15] Tang Yong – Zheng,"Research on Medical Images Fusion based on Redundant Complex Wavelet Transform," *Journal of Chemical and Pharmaceutical Research* , Vol 6, No. 5, 823-830, 2014.