Enhancement of Biomedical Image Based on Transform Function and Neural Network

Rajendrasingh Ramanand Rajput
M.Tech,
Computer Science and Engineering,
RKDF College (RGPV University), Bhopal, India

Abstract: Image enhancement is an important task in image processing, use of spectral subtraction improves the quality of an image and reduces noise level. Noise reduction is an important step for any complicated algorithms, in computer vision and image processing. In this dissertation proposed a hybrid method for medical image enhancement for improvement of Echocardiographic Images. The process of Echocardiographic Images gets the high component value of noise in environment. For the reduction of these noise used wavelet transform domain method. The wavelet transform method is well recognized method for noise reduction. In wavelet transform method the local noise component value is not considered. Then after the enhancement process noise are still remain in Echocardiographic Images. For these low components value collection used multiple sequences. And finally used self-organized map network.

***Index Terms* - Digital Image, Image Enhancement, SOM, DWT, PSNR.**

I. INTRODUCTION

Digital images are often corrupted by noise during their acquisition and transmission. A fundamental challenge in image enhancement is to reduce noise while maintaining the desired image features such as edges, textures, and fine details. An enhancement process is normally applied to digital images to obtain more information or details contained in the images. This process is very useful for consumer electronic products which the process is normally applied in preprocessing and post processing stages. However, most recorded images are poor in contrast and having non-uniform illumination. These conditions occur due to the insufficient lighting sources and improper focusing during the image acquisition process. Insufficient illumination makes the brightness in the image unevenly distributed. Thus, image enhancement has been employed to improve the interpretability or perception of information in images. In addition, it provides better input images for further processing tasks. In particular, there are two common types of noise namely Gaussian noise and Impulse noise, which are introduced during the acquisition and transmission processes. Noisy images can be found in many applications. Noise is also introduced in digital images, when a damaged image is scanned.

Digital cameras may introduce noise because of CCD sensor malfunction, electronic interference or flaws in data transmission. In the last two decades, many methods have been introduced in the literature to remove either Gaussian or Impulse noise. For most users and in most applications the main purpose of image enhancement is to bring conspicuity to features and details that are otherwise obscured in the original image. The image enhancement techniques can be roughly divided into two types: filter-based techniques and histogram-based techniques. Filter-based techniques increase image contrast by boosting high frequency components; for examples, using high-pass filters to sharpen edges and textures, or using homomorphic filtering and bilateral filtering to suppress the low-pass luminance signal and emphasize the high-pass reflectance signal. Another well-known filter-based technique that uses Gaussian filters to simulate the collaboration of retina and cortex of human visual system.

II. SOM NEURAL NETWORK

The SOM is unlike most classification or clustering techniques in that it provides a topological ordering of the classes. Similarity in input patterns is preserved in the output of the process. The topological preservation of the SOM process makes it especially useful in the classification of data which includes a large number of classes. In the local image sample classification, for example, there may be a very large number of classes in which the transition from one class to the next is practically continuous.

Step 1: Learning rate is set; weights are initialized, set topological neighborhood parameters.

Step 2: While stopping condition is false, repeat Step 3 – 9

Step 3: For every input vector x, repeat Step 4 – 6

Step 4: For every j, squared Euclidean distance is computed.

$D(j)= \sum (w_{ij}-x_i)^2 \quad I = 1 \text{ to } n \text{ and } j = 1 \text{ to } m$

Step 5: When D(j) is minimum find index J,

Step 6: For all units J, with the specified neighborhood of J, and for all i, update the weights.

$w_{ij}(new)=w_{ij}(old)+ \alpha[x_i-w_{ij}(old)]$

Step 7: Update the learning rate.

Step 8: Decrease the radius of topological neighborhood at specified times.

Step 9: Test the stopping condition.

The map formation occurs in two phases:

Initial formation of perfect (correct) order.

Final convergence

III. PROPOSED METHODOLOGY

This section, we discuss image enhanced methodology based on SOM neural network model. The image features are extracted from the image using wavelet transform function. SOM acts as a clustering mechanism that projects N-dimensional features from the WT function into an M-dimensional feature space. The resulting vectors are fed into an SOM that categorizes them onto one of the relearned noise classes. The proposed scheme is work along with MS. The MS process the collection task of local intensity of medical image data. The collected noise value combined with high intensity image value and generates vector value for the process. They mapped features from each frame of the word onto the SOM output to form a trajectory of winner nodes for a given word. The SOM learns this trajectory for each enhanced constraint value is comprised of a hierarchical organization of SOM and SOM. SOM receives inputs from the WT function bank and maps onto an M-dimensional space where M is the dimensionality of the SOM output node distribution. The transformed feature vectors are fed into the SOM, which classifies them. We call the feature space generated from the WT function output as primary feature space and M-dimensional feature space from SOM output as secondary feature space. The vectors from the secondary feature space are called secondary feature vectors.

Processing of proposed Algorithm

Step1. Initially input image passes through WT function and decomposed into two layers' different value.

Step2.the layers value different higher and lower part.

Step3. The collection of lower intensity value used MS (multiple sequences)

step4. MS collects the local noise value after that combined with high intensity value.

Step5. After collecting total noise value convert into feature vector image data passes through self-organized map network

Step6. In phase of feature mapping in feature space of SOM network create a fixed cluster according to threshold of details of image part.

Step7. Here show steps of processing of SOM network.

1) Initialize each node's weights.
2) Choose a random vector from training data and present it to the SOM.
3) Every node is examined to find the Best Matching Unit (BMU).
4) The radius of the neighborhood around the BMU is calculated. The size of the neighborhood decreases with each iteration.
5) Each node in the BMU's neighborhood has its weights adjusted to become more like the BMU. Nodes closest to the BMU are altered more than the nodes furthest away in the neighborhood.
6) Repeat from step 2 for enough iteration for convergence.
7) Calculating the BMU is done according to the Euclidean distance among the node's weights (W1, W2, … , Wn) and the input vector's values (V1, V2, … , Vn).
1) This gives a good measurement of how similar the two sets of data are to each other.

8) The new weight for a node is the old weight, plus a fraction (L) of the difference between the old weight and the input vector… adjusted (theta) based on distance from the BMU.

9) The learning rate, L, is also an exponential decay function.

1) This ensures that the SOM will converge.

10) The lambda represents a time constant, and t is the time step

Steps 8. After processing of SOM network out data of image

Step 9. Finally gets denoise image and calculate the value of PSNR and SIM value.

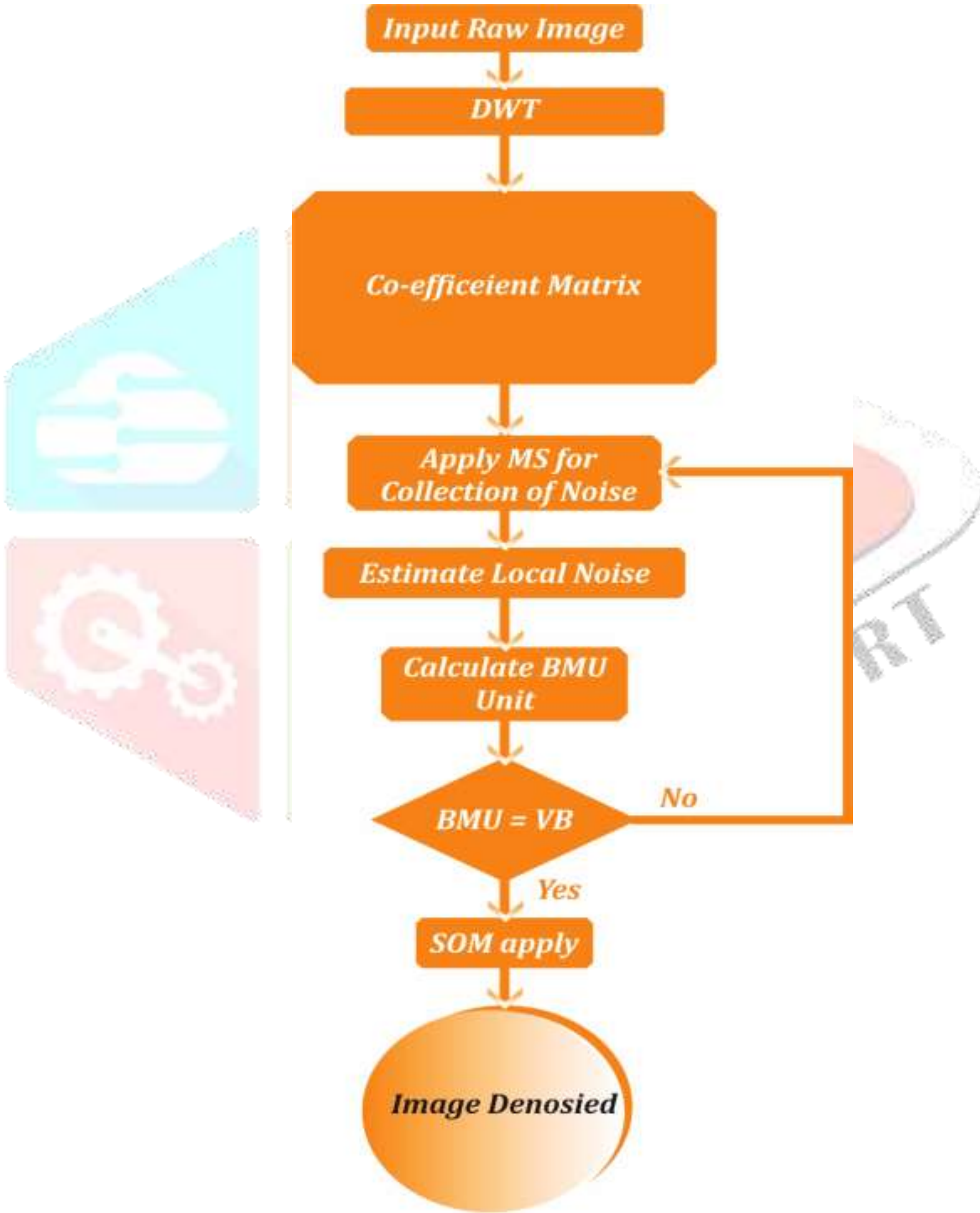

Figure 1: shows that propsoed model of medical image enhanced

IV. RESULTS AND DISCUSSION (EXPERIMENTAL RESULT ANALYSIS)

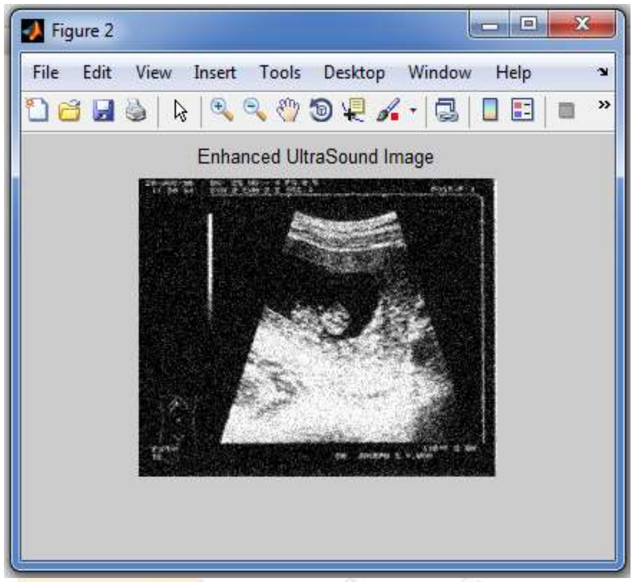

Figure 2: Shows that the enhanced ultra sound output image window of Image 6 week using LEG Methods

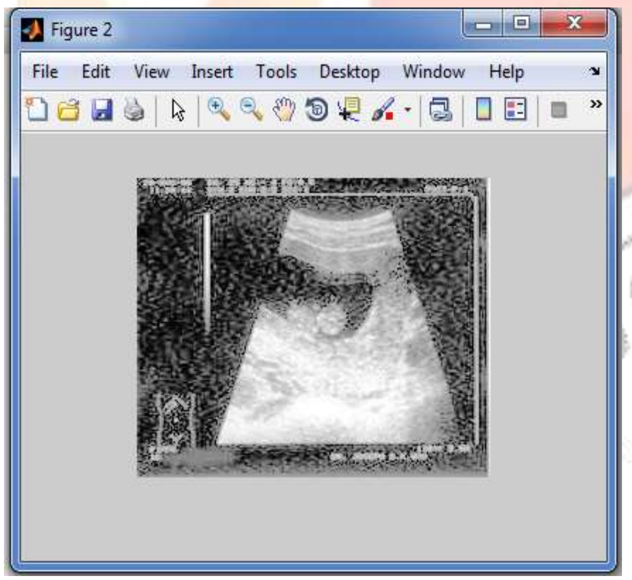

Figure 3: Shows that the enhanced ultra sound output image window of Image 7 week using Proposed Methods.

IMAGE	Name of Method	PSNR	SSIM
6 Week	LEG	19.83	0.198
	PROPOSED	33.590	0.335

Table 1: Show that the Comparative values of 6 Week image using LEG and Proposed Method. Find the resultant values of PSNR and SSIM.

IMAGE	Name of Method	PSNR	SSIM
7 Week	LEG	15.48	0.154
	PROPOSED	18.48	0.184

Table 2: Show that the Comparative values of 7 Week image using LEG and Proposed Method. Find the resultant values of PSNR and SSIM.

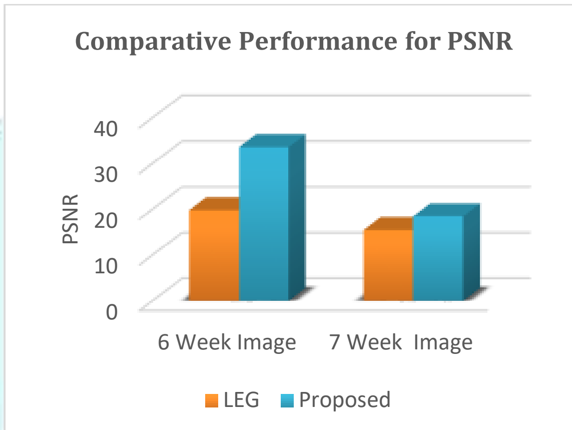

Figure 4: Shows that the comparative performance of PSNR for 6 week and 7 week image using LEG and Proposed Methods

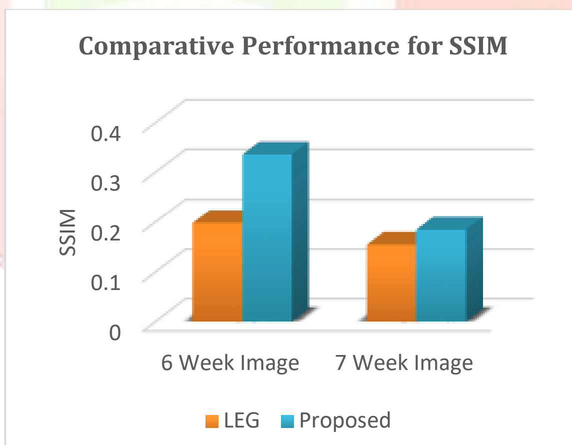

Figure 5: Shows that the comparative performance of SSIM for 6 week and 7 week image using LEG and Proposed Methods.

V. CONCLUSION AND FUTURE WORK

In this paper, Experimental results showed capability of proposed method to remove noise in terms of PSNR and visual quality. Different architectures and different activation functions is considered. The experimental results show the mean with the traditional enhancement methods, the proposed threshold-based enhancement digital image enhancement algorithm for mixed digital image enhancement is relatively clear, especially in the more noise, more complex cases, can show its good performance. In the enhancement process in order to achieve better enhancement effect, the system takes more time to pay; the other for color digital image processing has not been a good result. Therefore, focus on late goals and improve the efficiency of color image enhancement. Our experimental result shows that better result in compression of old and traditional method of image enhancement. But the computational time of process is increase. In future we used optimizations method for the reduction of time and improvement of quality of image

VI. ACKNOWLEDGMENT

I would like to thanks Prof. Ravindra Gupta for his valuable guidance and also thankful for the below references.

REFERENCES

[1] Yi Niu, Xiaolin Wu, Guangming Shi "Image Enhancement by Entropy Maximization and Quantization Resolution Up conversion" IEEE Transactions on Image Processing, VOL. 25, 2016.Pp 4815-1828.

[2] ParisaGifani, Hamid Behnam, FarzanHaddadi, Zahra AlizadehSani, and Maryam Shojaeifard "Temporal Super Resolution Enhancement of Echocardiographic Images Based on Sparse representation" IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, VOL. 63, 2016. Pp 6-20.

[3] Laurent Navarro, Guang Deng and Guy Courbebaisse "The Symmetric Logarithmic Image Processing Model" Preprint submitted to Digital Signal Processing, 2015. Pp 1-25.

[4] V. Murugan, R. Balasubramanian "An Efficient Gaussian Noise Removal Image Enhancement Technique for Gray Scale Images" International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:9, 2015. Pp 790-794.

[5] Khairunnisa Hasikin, Nor Ashidi Mat Isa "Fuzzy Image Enhancement for Low Contrast and Non-Uniform Illumination Images" International Conference on Signal and Image Processing Applications, IEEE 2013.Pp 275-280.

[6] Tao Huang, Yan Liu, Tongwei Ren, Lei Huang, JiaBei, Qin Liu "High Dynamic Range Image Tone Mapping with Edge Preserved Dithering" ACM, 2014.Pp -14.

[7] K. Sujatha, D. Shalini Punithavathani, Lallawmzuala Khawlhring "Analysis and Epigrammatic Study of Various Tone Mapping Operators for High Dynamic Range Images" Indian Journal of Science and Technology, Vol 8, 2015. Pp 1-9.

[8] Shibudas Kattakkalil Subhashdas, Bong-Seok Choi, Ji-HoonYoo, Yeong-Ho-Ha "Color Image Enhancement Based on Particle Swarm Optimization with Gaussian Mixture" Proc. of SPIE-IS&T, 2015. Pp -1-11.

[9] Wan Nural Jawahir Hj Wan Yussof, Muhammad Suzuri Hitam, Ezmahamrul Afreen Awalludin, Zainuddin Bachok "Performing Contrast Limited Adaptive Histogram Equalization Technique on Combined Color Models for Underwater Image Enhancement" International Journal of Interactive Digital Media, Vol-1, 2013. Pp 1-6.

[10] S. Brindha "Satellite Image Enhancement Using DWT – SVD and Segmentation Using MRR –MRF Model" Journal of Network Communications and Emerging Technologies (JNCET) Volume 1, 2015.Pp 6-10.

[11] Gouri B. Deshpande, Dr. K. Ramesha "MRI Brain Image Enhancement Using XILINX System Generator and DWT" Bonfring International Journal of Advances in Image Processing, Vol. 5, 2015. Pp 16-22.

[12] B. Sridhar, Dr.K.V.V.S. Reddy "Performance Evaluation of 2D Adaptive Bilateral Filter For Removal of Noise from Robust Images" International Journal of Image Processing, Vol-7, 2013. Pp 17-30

[13] Navneet Kaur and Sonika Jindal "A Review of MRI Images Based on Segmentation Techniques" ISSN 2347 – 8616 Volume 4, September 2015, Pp 20-25.

[14] YogitaNamdeo Pore and Yoginath R. Kalshetty "Review on Blood Cell Image Segmentation and Counting" ISSN 2319 – 4847 Volume 3, Issue 11, NOVEMBER 2014, Pp 369-372.

[15] P. Daniel Ratna Raju and G. Neelima "Image Segmentation by using Histogram Thresholding" IJCSET Vol 2, Issue 1, January 2012, Pp 776-779.