International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869, Volume-3, Issue-5, May 2015

Enhancement of Salt and Pepper Noise Image using Sharpness Indexed Filtering

Santosh Kumar Singh, Vinesh Jain, Rakesh Rathi, Jyoti Gajrani

***Abstract*— In this paper, we presented a simple and dynamic wavelet-based algorithm for Enhancement of salt and pepper noise image. Five step of methods are followed here (Adding salt &pepper noise, Denoising, Decomposition, Sharpness Estimation, and Filtering) First Adding noise and then Denoising is done using medfilter on the input images. After that it is decomposing to the input image thru a 3-level separable Discrete Wavelet Transform. And log-energies of the DWT sub-band are also computed. This proposed method is the fastest, accurate and simplest, and best-performing techniques for the sharpness estimation rather than other.**

***General Terms*– Discrete Wavelet Transform, image noise, sharpness estimation.**

***Index Terms*— Salt & Pepper noise, Denoising, Decomposition, DWT, Image Sharpness, Wavelet Decomposition.**

I. INTRODUCTION

A useful goal in image processing is to determine whether one image (region) appears sharper than another does. Many applications find sharpness measure a crucial factor for tasks such as main-subject detection, image quality assessment, and image restoration. We present a sharpness estimator; sharpness can be estimated by examining the energy in high-frequency bands. Here, we use a three-level separable discrete wavelet transform (DWT) and measure the log-energy of each DWT sub-band. Sharpness is estimated based on a weighted geometric mean of these log-energies. we will demonstrate, despite its simplicity, with the currently best performing techniques.

II. DISCRETE WAVELET TRANSFORM

Image Denoising is one of the most visible application of wavelets. Discrete wavelet transform is one of wavelet transform for which wavelets are discretely sampled. DWT (Discrete wavelet transform is used for signal coding. DWT procedure decompose an image into several Sub-bands like HH, HL, LH, and LL. All sub-bands gives different information. HH gives diagonal information, HL gives horizontal representation, LH gives vertical information and LL consisting of low frequency components means important information. In next step, LL is further divided at the higher levels of decomposition. The three level of decomposition are used in our paper. Graphically it can be represented as shown in following figure.

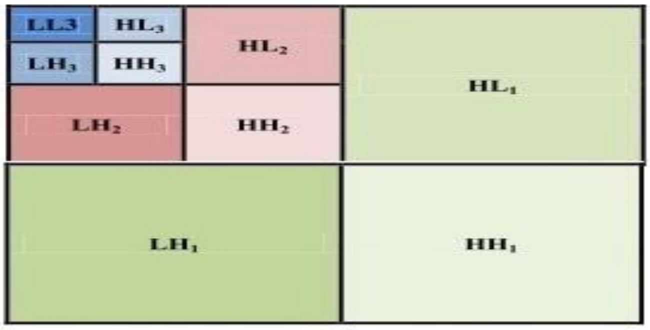

Fig.1 DWT Two dimensional data

Santosh Kumar Singh, is pursuing his M.Tech (IT) fourth semester from the Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Vinesh Jain, Assistant Professor, Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Rakesh Rathi, Assistant Professor, Hod (CS/IT)Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Jyoti Gajrani, Assistant Professor, Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

III. IMAGE SHARPNESS ESTIMATION

The algorithm uses the assumption that for the sharpness regions in the image, most of its energy will be distributed in the high-frequency subbands of the wavelet decomposition. The lower the level of wavelet subband or the higher the frequency, the more energy is distributed in that level. Thus, the sharpness measure is estimated from the log-energy in the high-frequency sub bands via wavelet coefficients.

3.1 STEP 1: COMPUTE THE LOG-ENERGY OF EACH DWT SUB-BAND.

Sharp image usually contain high-frequency then images which appear smooth .we first measure the log-energy of each sub band at each decomposition level as follows:

$$LE_{LH_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} LH_n(i,j)\right) \ldots\ldots\ldots\ldots\ldots 1$$

$$LE_{HL_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} HL_n(i,j)\right) \ldots\ldots\ldots\ldots\ldots 2$$

$$LE_{HH_n} = \log_{10}\left(\frac{1}{Cn}\sum_{i,j} HH_n(i,j)\right) \ldots\ldots\ldots\ldots\ldots 3$$

Where, Cn: no. of DWT Coefficients.

The lowest resolution level LL is consisted as the approximation part of the original image. Neglecting LL Sub band at this level. The individual sub band log-energy is calculated through equation (1), (2) and (3).

3.2 Step 2: Compute the Total Log-Energy at Each Decomposition Level.

The total log energy present at each level of decomposition is given by following equation.

$$TLE_n = W(LE_{HH_n}) + 0.375(1-W)(LE_{HL_n} + LE_{LH_n}) + 0.25(1-W)(LE_{LL_n}) \ldots\ldots 4$$

Where, TLE: The total log energy at each level of decomposition.

W: The Weightage.

XY ∈ {LH, HL, and HH} is the wavelet sub band.

3.3 Step 3: Compute the Scalar Sharpness Index.

To determine a scalar sharpness index we combining each TLE_n. This is representing the overall sharpness of the image.

$$SSI = \sum_{n=1}^{3} 2^{L-n} TLE_n \dots\dots\dots\dots 5$$

Where, SSI: Scalar Sharpness Index

L: Factor

N: No.of Decomposition Levels

And from equation 5 The Scalar Sharpness Index is calculated by combining each TLE_n which represents the image's overall sharpness.

3.4 Step 4: Compute the Block-Based Scalar Sharpness Index.

To determine a Block-Based Scalar Sharpness index we use to the SSI. For enhanced image output.

$$S = \sum_{i=1}^{SB} SSI_i^2 \quad \text{Where,} \quad BSSI = \left(\frac{S}{SB}\right)^{0.5} \dots\dots\dots\dots 6$$

Like SSI and BSSI can be used for filtering the image to give an enhanced image output.

A Scalar of the input image sharpness is computed through the weighted average of the computed log-energies. Overall sharpness Index SSI is used as a filtering component and the image is filtered out to give the Sharpened Image. a Block based algorithm is presented to determine the local perceived sharpness. The BSSI is calculated by taking the RMS of 0.01 of largest value of SSI which takes the no. of Block Size. It is the most competitive and simple with the currently best performing techniques for the sharpness estimation.

IV. ENHANCEMENT PROCEDURE

Steps for the enhancement of salt and pepper noise reduction are carried out as below:

1. Take the original image.
2. Checking Whether the INPUT Image is RGB or not If RGB then Convert into Gray Scale.
3. Distort it with salt and pepper noise.
4. Use the median filtering method to denoise the image.
5. Convert Image to type double.
6. Decomposition of Image The db1 filter is used.
7. Compute a 3-level decomposition of the image using the db filters.
8. Calculation of Total Log-Energy.

V. FLOW CHART OF METHODOLOGY

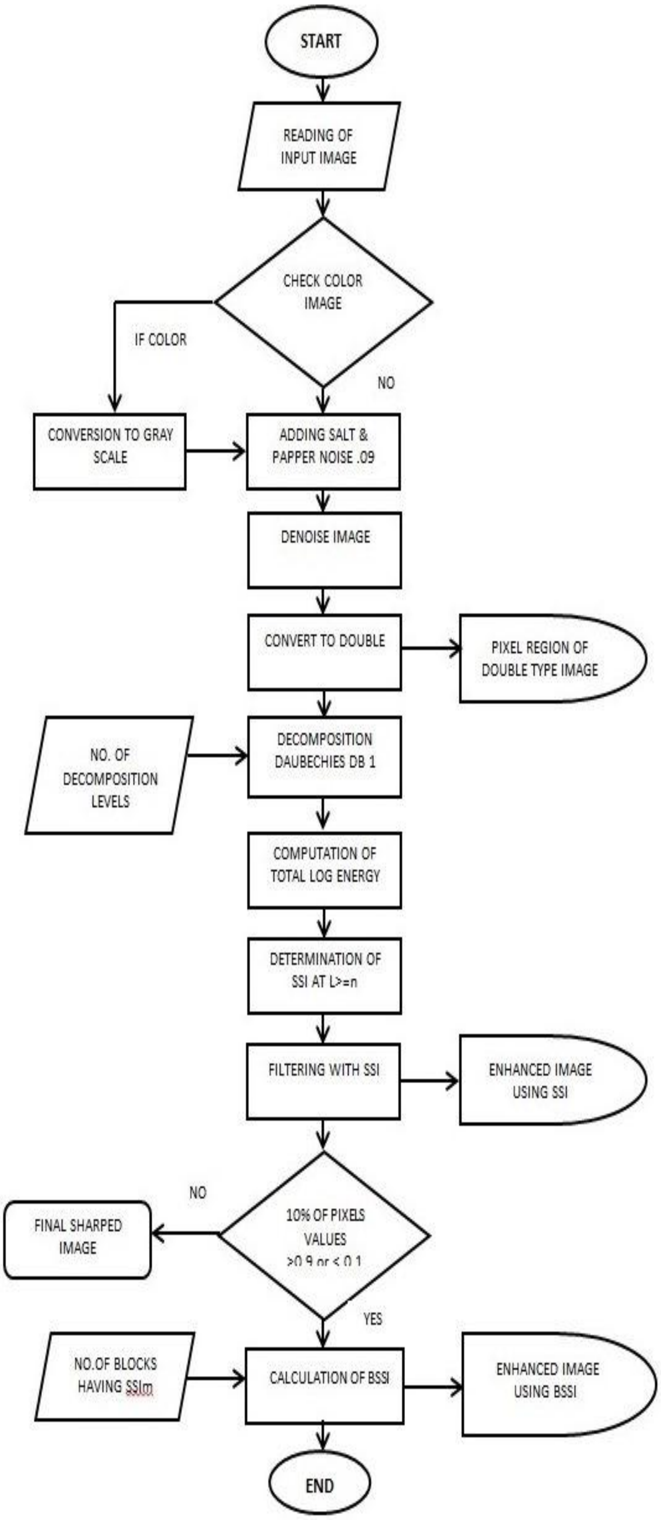

Fig.2 Flow chart

VI. EXPERIMENTAL RESULTS

In this Paper first we used three level of decomposition then we select the small area of image and we show to pixel image. And For filtering parameter, block based Scalar Sharpness Index (BSSI) of the original image is used. and the original image is filtered out to give the enhanced image.

Fig 3. Input Image

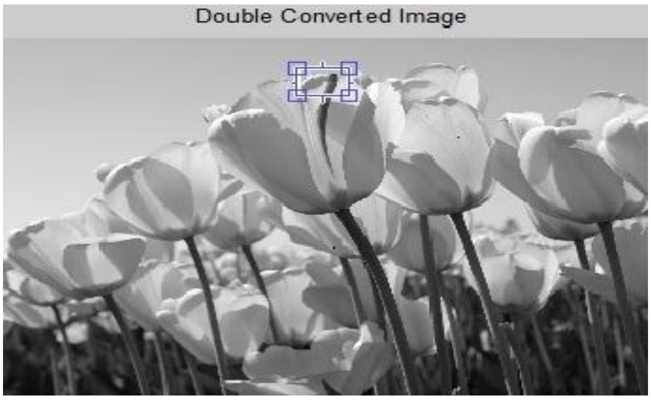

Fig 7. Double Converted Image

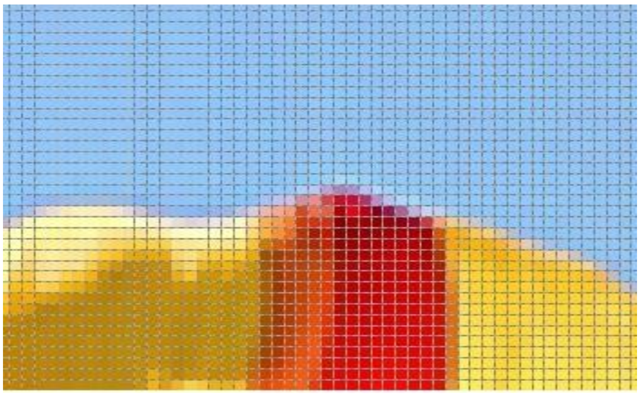
Fig 4. Pixel Region of selected input Image


Fig 8. Pixel Region of Double Converted Image


Fig 5. Salt & Pepper Noise Image

Fig 9. Image after Block Based SSI


Fig 6. Gray Scale Image


Fig 10. Pixel Region of Image after Block Based SSI

VII. CONCLUSION

Enhancement of an Salt & Pepper Noisy Image is necessary task in image processing. Filters are used best for removing noise from the images. For the enhancement of salt & pepper noise images a Simple, Fast and Dynamic algorithm is presented. A Scalar Index corresponding to the input Images sharpness is computed through the log-energies after decomposition. salt & pepper noise images are taken into consideration and the Scalar Sharpness Index (SSI) representing the Images overall sharpness is calculated. This is used as a filtering component and the image is filtered out to give the Sharpened Image. Here a Block based algorithm is presented (BSSI) determine the block based sharpness and after filtering the image we get final result.

REFERENCES

[1] Wang, Changhong, Taoyi Chen, and Zhenshen Qu. "A novel improved median filter for salt-and-pepper noise from highly corrupted images." In Systems and Control in Aeronautics and Astronautics (ISSCAA), 2010 3rd International Symposium on, pp. 718-722. IEEE, 2010.

[2] H. W. Park and H. S. Kim, “Motion estimation using low-band-shift method for wavelet-based moving-picture coding”, IEEE Trans. Image Process., vol. 9, no. 4, Apr. 2000.

[3] N. Zhang, A. E. Vladar, M. T. Postek, and B. Larrabee, “A kurtosisbased statistical measure for two -dimensional processes and its application to image sharpness”, Sect. Phys. Eng. Sci. Amer. Statist. Soc., 2003.

[4] Jayaraj, V., D. Ebenezer, and K. Aiswarya. "High density salt and pepper noise removal in images using improved adaptive statistics estimation filter." International Journal of Computer Science and Network Security 9.11 (2009): 170-176.

[5] C. T. Vu, T. D. Phan, and D. M. Chandler, "A spectral and spatial measure of local perceived sharpness in natural images”, IEEE Trans. On Image Process., vol. 21, no. 3, Mar. 2012.

[6] Jean-Luc Starck, Jalal Fadili, and Fionn Murtagh, "The Undecimated Wavelet Decomposition and its Reconstruction", IEEE Transactions on Image Processing, Vol. 16, no. 2, Feb. 2007.

[7] R. Ferzli, L. J. Karam, and J. Caviedes, “A robust image sharpness metric based on kurtosis measurement of wavelet coefficients”, Int. Workshop on Video Processing and Quality Metrics for Consumer Electronics, Jan. 2005.

[8] M. J. Chen and A. C. Bovik, “No-reference image blur assessment using multiscale gradient”, Int. Workshop on Quality of Multimedia Experience, QoMEx, Jul. 2009.

H. Tong, M. Li, H. Zhang, and C. Zhang, “Blur detection for digital images using wavelet transform”, IEEE Int. Conf. Multimedia and Expo, ICME 2004,Vol. 1, Jun. 2004

Santosh Kumar Singh, is pursuing his M.Tech (IT) fourth semester from the Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Vinesh Jain, Assistant Professor, Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Rakesh Rathi, Assistant Professor, Hod (CS/IT)Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.

Jyoti Gajrani, Assistant Professor, Department of Computer Engineering and Information Technology, Govt. Engineering College, Ajmer.