Enhancing The Filtering Approach For The Colored Image And Wavelet Transformation

Kamlesh Lakhwani, R. R. Sinha, P. D. Murarka

Abstract: In this research work three spatial domain filters Average filter, Median filter and Winner filter are studied and a new filter of transform domain named as KVL filter is designed after the name initials of its founder "Kamlesh Vasudev Lakhwani". KVL filter works on the basis of DWT transform compression property and pass filtering concepts. This research works gives a comparative study between all these filters.

Index Terms: Filter, Image, MSE, PSNR, SNR, UIQI, Wavelet.

1 Introduction

When images are processed in computer they are regarded as digital images, they could be color, gray scale images. Each image is made up of pixel which is equal to the product of height and width. Every pixel has an integer value of which demonstrates the intensity or visibility of that pixel; this value varies between 0-255[1].

Digital Image Processing

Images are stored in the computer and processed nearby for a lot of reasons; together computer and image are in digital form so the processing done on images using the computer are known as digital image processing. Processing could be sharpening the image, removing noise, transforming image formats, compress image, and transfer over network, increasing visibility or intensity of image, rotating image, cropping image, etc[3]-[6].

Different stages of Image processing functions:

Low Level:	Noise Reduction, Contrast Enhancement
Medium Level:	Attribute Removal (limits, shapes, states)
High Level:	Examination and Explanation of the contents of a picture

De-Noise (Filtering)

As we all know that noise is an unnecessary signal or scalar value which is not extensive; so exclusion of noise is essential. Many techniques are previously developed in past decades. They are primarily separated into two domains [7]

1. Spatial Domain De-noising
2. Transform Domain De-noising

- *Kamlesh Lakhwani is currently pursuing Ph.D. degree program in Computer Science and Engineering in Suresh Gyan Vihar University, Jaipur, Rajasthan, India, E-mail: kamlesh.lakhwani@gmail.com*
- *Dr. R. R. Sinha is a Professor in Computer Science in Suresh Gyan Vihar University, Jaipur, Rajasthan, India. E-mail: ripuranjan.sinha@mygyanvihar.com*

Spatial Domain De-noising:

In this method, de-noising the image is filter by the different sub-types of de-noising are following filters:

(a) Linear Filter- This Filter is based on Linear Sequential and performs the equations.
- Mean Filter
- Weiner Filter

(b) Non-Linear Filter-This Filter is also called ordered Filter which is based on the hierarchy of the mathematical representation.
- Median Filter
- Weighted Filter

2 Problem Statements

Image De-Noising (Filtering) came into existence due to the overloaded use of the images to express emotions and feeling and messages over internet. Communication media is dependable on images rather than text. Visualization gives and easiness to understand things more preciously [2]. During the communicational transfer of data (images) over internet sometimes images get blurred or become unreadable and unrecognizable. This happens due to some extra element involvement in the original image pixels; known as noise. This noise may be positive or negative depends on the behavior of it on original image and required to be removed. Although there are many techniques developed for the sake of de-noising. In this thesis light is putted on Average Filter, Median Filter and Weiner Filter. These are of spatial domain filters. DWT is chosen in this paper which a transform domain element to filter out images in original image and noise [8].

3 Proposed KVL Filter

Although Discrete Fourier Transform was successful and implemented appropriately for image de-noising but the errors specified in it like aliasing, leakage makes somewhat problem which must be reduced. Design a filter which uses the property of compression and boundedness with Discrete Wavelet Transform. The filter we proposed is termed as KVL filter under the name initials of its designer "Kamlesh Vasudev Lakhwani". In this filter we used the filter banks of DWT and applied the basic functionality of it which is passing the image under the filters and getting the image coefficients during the process of filtration.

3.1 Working of KVL Filter

Represent the Flow of the de-noising method for the noised image with the respective threshold value according to the flow graph of the filter.

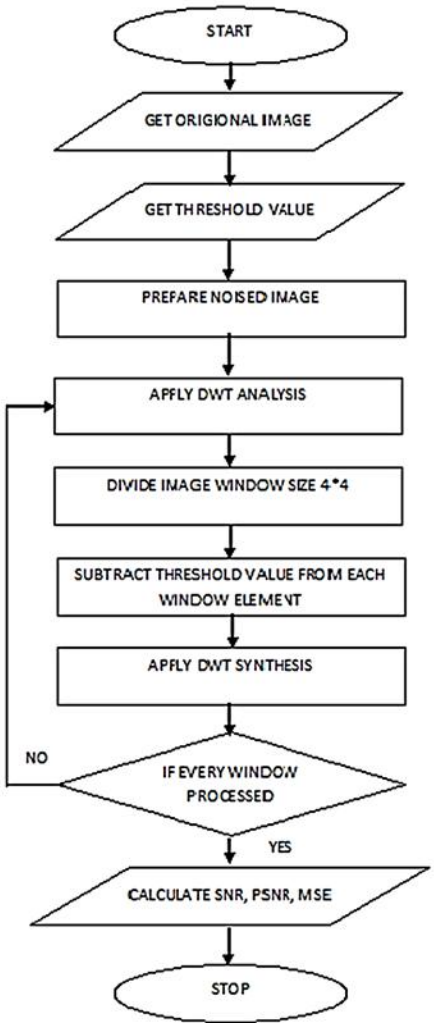

Fig.1. *Flow Chart of Proposed KVL Filter*

KVL Filter uses thresholding technique to filter digital images. To make it more effective it has applied according to a window based scheme in this scheme the max value of pixels intensity is calculated among a bunch of sixteen elements and threshold is chosen among it or the passed value by the user and the decided is applied to window so that the luminance affects the image hardly only the chrominance values are affected which are unnoticeable and thus image get smother and de-noising took place.

4 OBSERVATION

Some of images are taken from the sample images for observe the work of different filters and the proposed KVL filter. To apply filters on noised images first of all noised is added into the original images for generation of noised image than various filters are applied on noised image to de-noise the image one by one than SNR (Signal Noise Ratio), PSNR (Peak Signal to Noise Ratio), MSE (Mean Square error) and UIQI (Universal Image Quality Index) parameters are calculated for various filters including KVL filter like average filter, median filter, winner filter and KVL filter. After the calculating SNR, PSNR, UIQI and MSE values for average, median, winner and KVL filter these values are compared in the tabulated form and graph is prepared for analysis of result.

Some of the images selected from sample images are shown below; also their original, noised and filtered or de-noised images by different filters are shown below. After filtration PSNR and MSE values calculated for respective filter and for comparison, calculated result is shown in tabulated as well as in the form of bar charts.

Fig.2 (a) *Original Image* ***Fig.2 (b)*** *Noised Image*

Fig.2(c) *Mean filtered Image* ***Fig.2 (d)*** *Median filtered Image*

Fig.2 (e) *Wiener filtered image* ***Fig.2 (f)*** *KVL filtered image*

Fig.2(a-f). *Barnfall.jpeg with different filters.*

TABLE 1

SNR, PSNR, MSI and UIQI values of barnfall.jpeg image with different filters.

barnfall.jpeg				
	MSE	**SNR**	**PSNR**	**UIQI**
Orig/Nois	675.13373	5.6426758	19.836906	0.4151881
Median	360.18419	6.5656156	22.565557	0.4013317
Mean	254.44018	7.3203103	23.902943	0.4475785
Wiener	228.44237	7.5543555	23.9072	0.3535483
KVL	210.74699	7.9986897	24.89319	0.4787987

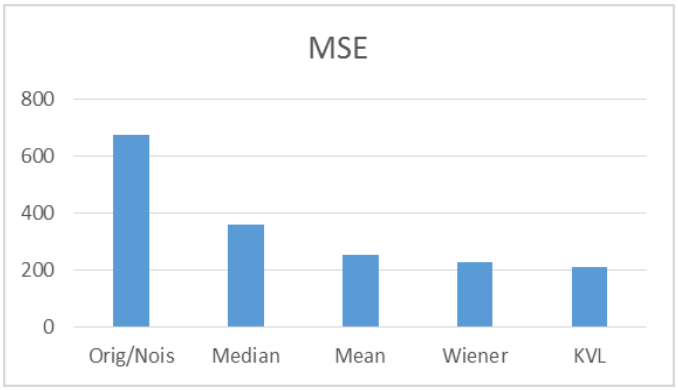

Fig.2. *Graph of Mean Square Error for barnfall.jpeg image with different filters.*

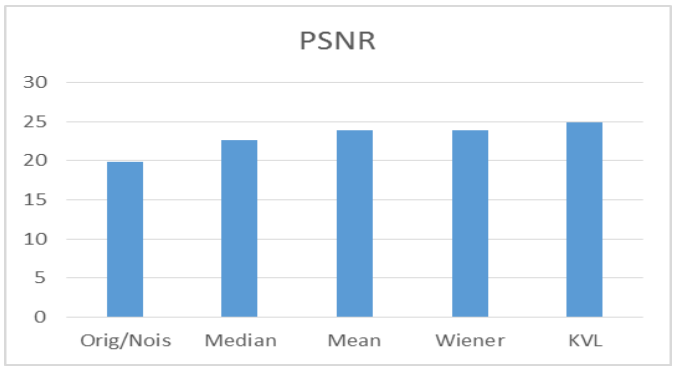

Fig.3. *Graph of Peak Signal Noise Ratio for barnfall.jpeg image with different filters.*

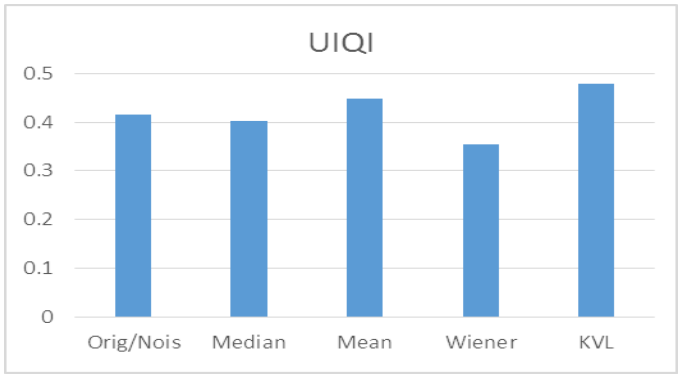

Fig.4. *Graph of Universal Image Quality Index for barnfall.jpeg image with different filters.*

Fig. 5 (a) *Original Image* ***Fig. 5 (b)*** *Noised Image*

Fig.5(c) *Mean filtered Image* ***Fig.5 (d)*** *Median filtered Image*

Fig .5 (e) *Wiener filtered Image* ***Fig. 5 (f)*** *KVL filtered Image*

Fig.5 (a-f). *beeflowr.png with different filters.*

TABLE 2
SNR, PSNR, MSI and UIQI values of beeflowr.png image with different filters.

beeflowr.png				
	MSE	**SNR**	**PSNR**	**UIQI**
Orig/Nois	653.5255	6.714656	19.97818	0.164299
Median	305.2323	8.1305	23.2845	0.170324
Mean	221.4857	8.826924	24.67735	0.201004
Wiener	158.6707	9.551168	26.09171	0.221231
KVL	141.2242	9.948375	26.63171	0.26622

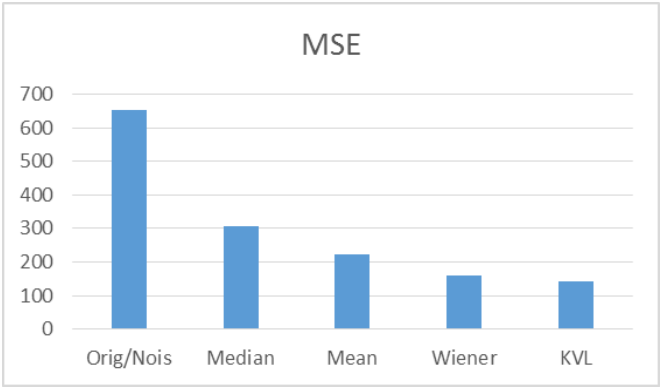

Fig.6. *Graph of Mean Square Error for beeflowr.png image with different filters.*

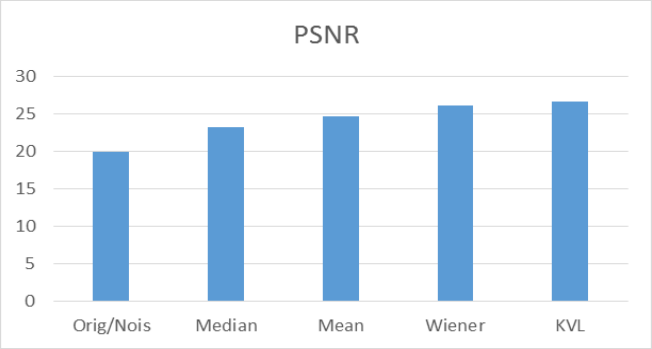

Fig.7. *Graph of Peak Signal Noise Ratio for beeflowr.png image with different filters.*

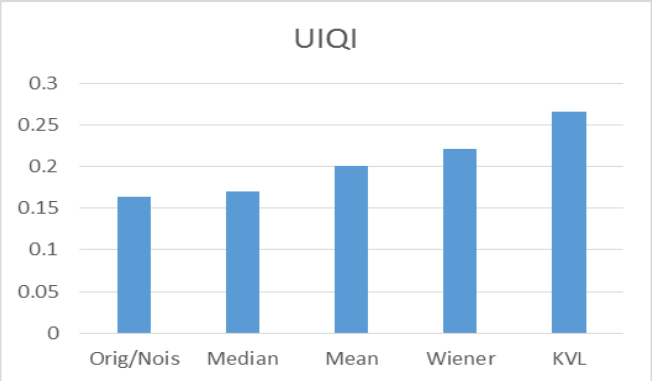

Fig.8. *Graph of Universal Image Quality Index for beeflowr.png image with different filters.*

5 Conclusion

The observation and comparative study make the statement clearly that KVL Filter have best result in all comparison as PSNR value, MSE value and UIQI value comparison or image viewing. KVL filter is applicable on each type of digital image format whether it is gray-scale or color image. More than fifty images are taken as sample images and used with RGB color mode and applied DWT based KVL Filter to remove noise from it which was done successfully and results were better after comparison from other filters used in past and hope it will definitely work in future.

6 References

[1] Kamlesh Lakhwani et.al. “An Improved Approach of Imag Enhancement Using Fusion Technique”, International Journal of Engineering Research & Technology (IJERT) Vol. 3 Issue 7, July – 2014.

[2] Kamlesh lakhwani, Karnika dixit,” A Novel Method of Color Image Enhancement by Color Space Transformation Followed by Gamma/Logarithmic Transformation”, International Journal Of Computers & Technology, Vol 8, No.1, June 15, 2013.

[3] OGE MARQUES “Practical Image and Video Processing Using Matlab®”.

[4] H. Hua and G. de Haana,b “Classification-based Hybrid Filters for Image Processing-paper”.

[5] Soumya Dutta, Bidyut B. Chaudhuri “A Color Edge Detection Algorithm in RGB Color Space” International Conference on Advances in Recent Technologies in Communication and Computing © 2009 IEEE.

[6] Gurmeet Kaur, Rupinder Kaur, “Image De-Noising Using Wavelet Transform and Various Filters”, International Journal of Research in Computer Science ISSN 2249-8265 Volume 2 Issue 2 (2012).

[7] Motwani, Mukesh C., et al. "Survey of image denoising techniques. Proceedings of GSPX. 2004.

[8] Martin Vetterli “Wavelet and filter bank-paper” IEEE Transactions on Signal Processing, Vol. 40, No.9, September 1992.