COLOR IMAGE IMPLEMENTATION OF GUIDED FILTER DERIVED BY LOCAL LINEAR MODEL

Aparna Lahane[1], Dr.V.B.Malode[2]

[1,2]*Electronics, MGM's Jawaharlal Nehru Engineering College, 9India)*

ABSTRACT

Filtering is widely used in image processing for various applications now. The guided filter has been proposed and became one of the popular filtering methods. Derived from a local linear model, the guided filter generates the filtering output by considering the content of a guidance image, which can be the input image itself or another different image .Image Enhancement is one of the most important and difficult techniques in digital image Processing. Image Enhancement is used for improve the quality. Guided filter uses the color images for implementation because color guidance image can better preserves the edges that are not distinguishable in gray-scale. Guided filter simulation done using MATLAB. We demonstrate that the guided filter is both effective and efficient in a great variety of computer vision and computer graphics applications including noise reduction, detail smoothing/enhancement. And then calculating its PSNR value using VHDL.

Keywords – Color image, Image Enhancement, Image Smoothing, MATLAB, VHDL.

I.INTRODUCTION

Image processing is processing of image using mathematical operation. Input for image processing image, series of image and video. Digital image processing is the use of computer algorithm to perform image processing on digital image. In digital processing pre-processing, enhancement, information extraction is done. In processing time many images are affected by random variation in intensity or sometimes environmental parameter affect the images. During transmission images introduces the noise so filtering is used for noise reduction. More specifically, filtering can be applied in many applications such as noise reduction, texture editing, smoothing, enhancement, haze removal, and joint up sampling. Filtering is the most important image processing techniques used for image feature extraction or enhancement. Filtering is mostly used for enhancing and smoothing the input image. Image enhancement is used in many applications like forensics, atmospheric sciences, medical images, microbiology. Image enhancement improves the quality of image. Image enhancement involves four parameters likes brightness, contrast, saturation, sharpness. Brightness is can be modified by increasing by gamma. Gamma is a non-linear form of increase in brightness. Contrast is the separation between the dark and bright areas of an image. Saturation is increasing the separation between the shadows. Sharpness is related to edges, the contrast along the edges of a photo. The enhancement methods are divided into spatial domain and frequency domain method. Spatial domain technique is directly deal with the image pixels. In spatial domain for getting desired output the pixel vales are manipulated. In frequency domain techniques, the image is first transferred s into frequency domain. It means that, the Fourier Transform from the image is computed first. Every one of the enhancement operations are performed for the Fourier transform of the specific image and then

reverse Fourier transform is performed to get the concomitant image. The most common benefit of image smoothing is to remove the noise from the image. Different edge preserving image smoothing methods are used for preserving the important features or structures or salient edges in the image, so as to lead the improvement in the visual quality of the image. This is a method for edge preserving smoothing, which is related to the previous methods like bilateral filter and fast bilateral filter for the display of high dynamic range images signal processing approach, edge preserving decompositions, multi-scale image decomposition based on local extreme, histogram based image smoothing, L0 gradient minimization. Mean filtering is easy to implement. It is used as a method of smoothing images, reducing the amount of intensity variation between one pixel and the next resulting in reducing noise in images. For simulation of guided filter Matlab is used. Matlab is set of numerical analysis and high-performance computing software. Matlab language provides for matrix arithmetic operators, relational operators, logical operators, conditional operators and assignment operator. Matlab is high level language. It gives simple programming. Matlab is easy to use and flexible. System generator is used for model generation in Matlab.

II.EXISTING METHODS

1.Bilateral Filter The bilateral filter was perhaps the simplest which computed the filtering output at each pixel as the average of near-by pixels, weighted by the Gaussian of both range and spatial distance. The bilateral filter smooth's the image while preserving edges. Constraint of the bilateral filter was it endure from "gradient reversal" artifacts. The reason was that when a pixel (often on an edge) has few similar pixels around it, the Gaussian weighted average is unstable. Efficiency was another problem regarding the bilateral filter.

2. Non-average Filter Edge-preserving filtering could also be achieved by non-average filters. The median filter was a familiar edge-aware operator, and was a special case of local histogram filters. Histogram filters had O(N) time implementations in a way as the bilateral grid. The non-average filters were often computationally expensive.
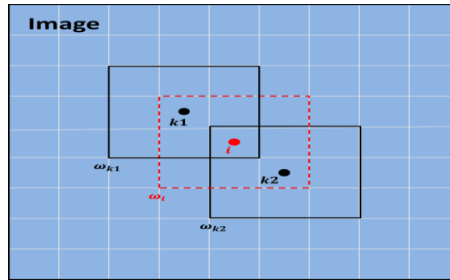
III. ALGORITHM

Here we are working on parameters image enhancement and image smoothing, PSNR. Guided filter produces filtered output 'q' by using guidance image 'I' and input image 'p'. Based on the application, guidance image can be input image itself or different image. And calculating the PSNR value.

q_i is a local linear transform of guidance image I in a window ωk centered at pixel k as shown in Fig .below which can be given as

$$q_i = a_k I_i + b_k, \forall i \in \omega k \quad ....(1)$$

Where a_k and b_k are linear coefficients in a window ωk which is having radius r. Pixel i and windows ωi and ωk as shown below

Guided filter algorithm

1. Read the image say *I* (color image) which acts as the guidance image.

2. Take *p=I*, where *p* is filtering image (color image).

3. Take the values for *r* and *ε* where *r* is radius of window and *ε* is regularization parameter.

4. Compute following mean values by applying averaging filter '*fmean*':

$meanI = fmean(I)$

$meanp = fmean(p)$

$meanIp = fmean(I .* p)$

$meanII = fmean(I .* I)$

5. Compute covariance of (*I*,*p*) using formula:

$covIp = meanIp - meanI .* meanp$

6. Compute variance using formula:

$varI = meanII - meanI .* meanI$

7. Compute linear coefficients *a* and *b* as:

$a = covIp / (varI + ε)$

$b = meanp - a .* meanI$

8. Compute mean of *a* and *b* as:

$meana = fmean(a)$

$meanb = fmean(b)$

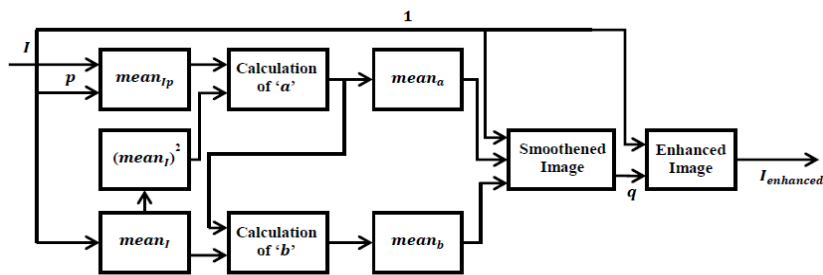9. Compute filtered output as:

$q = meana .* I + meanb$

Fig.1.Internal block diagram of guided filter

IV. RESULTS AND DISCUSSION

In this paper, we have presented a novel explicit image filter which can be used in various image processing applications. Guided filter is generic concept for edge preserving smoothing and structure transferring filtering. It is more effective as compared to other existing approaches in aspects such as detail enhancement, image smoothening etc. also can calculate the PSNR value using Verilog hardware programing.
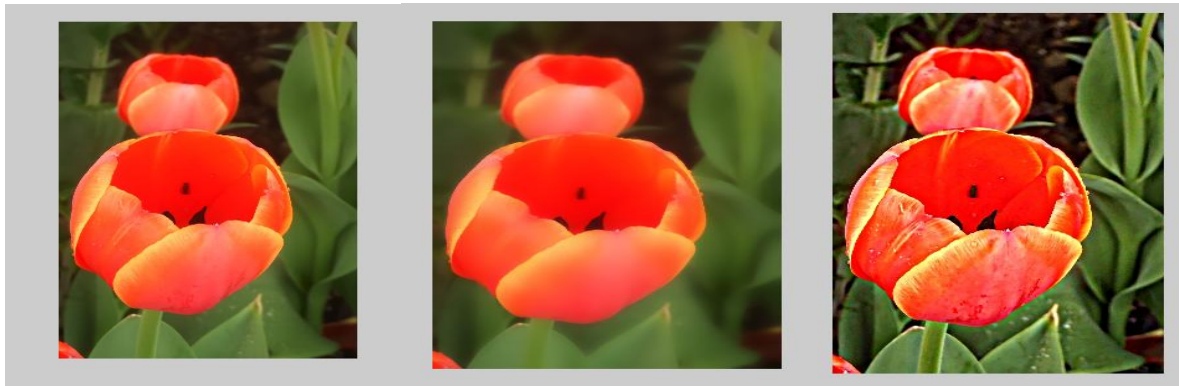

| Fig:2:input image | Fig:3:Smoothen image | Fig:4:Enhanced image |

| Fig:5:input image | Fig:6:Smoothen image | Fig:7:Enhanced image |

Input image	Bilateral filter	Guided filter
Enhancement	16.720dB	16.770Db
Smoothening	15.010 dB	15.113Db

Table - 1. The PSNR comparison

V. CONCLUSION

In this paper, we have presented a novel explicit image filter which can be used in various image processing applications. Guided filter is generic concept for edge preserving smoothing and structure transferring filtering. It is more effective as compared to other existing approaches in aspects such as detail enhancement; image smoothening etc. also can calculate the PSNR value using Verilog hardware programing.

VI. ACKNOWLEDGEMENTS

VII. REFERENCES

[1] Chieh-chi kao, Jui-hsinlai, "VLSI architecture design of guided filter for 30 frames/s FULL-HD   video", IEEE   transactions oncircuits   and systems for video technology, vol. 24, no. 3,March 2014, pp.513-524 .

[2] Kaiming He, Jian Sun, "Guided Image Filtering", IEEE Transactions On Pattern Analysis and Machine Intelligence, vol. 35, no. 6, ,June 2013, pp.1397-1409.

[3] Tomasi, C., Manduchi, R.: Bilateral filtering for gray and color images. ICCV (1998)C. Liu, W. Freeman, R. Szeliski, and S. B. Kang, "Noise estimation from a single image," in *Proc. IEEE CVPR*, vol. 1, 2006, pp. 901–908.

[4] F. Durand and J. Dorsey, "Fast bilateral filtering for the display of highdynamic- range images," *ACM Trans. Graph.*, vol. 21, no. 3, Jul. 2002, pp. 257–266.

[5] Z. Farbman, R. Fattal, D. Lischinski, and R. Szeliski, "Edge-preserving decompositions for multiscale tone and detail manipulation," *ACM Trans. Graph.*, vol. 27, no. 3,:10, Aug. 2008, pp. 67:1–67.