A Review Paper on Guided Image Filtering Technique

Ashish Kumar Rathore[1], Pradeep Kumar[2]

[1]Electronics & Telecommunication Engineering Department
RCET, Bhilai (C.G.) India
Ashishsrish89@gmail.com

[2]Electronics & Telecommunication Engineering Department
RCET, Bhilai (C.G.) India
Pradeep14335@gmail.com

Abstract: *In this paper we will present approach or technique for the "Guided Image filtering". A lot of methods are available for Guided Image filtering. Guided Image Filtering is a wide research area. It can be used in filters like Gaussian filter, Laplacian filter and Sobel filter. It can be applied in image blurring/sharpening, edge detection, and feature extraction. Filtering can be applied in many applications such as noise reduction, colorization, edge preservation, detail enhancement, texture editing, haze/rain removal, etc. The most popular of this is the edge-preserving smoothening. Edge preserving smoothening technique refers to the image processing technique that results in smoothing of textures, while retaining the sharp edges. The main problem arises in this fact that it has some issues related to sparsity, accuracy, scalability, cold star problem etc. The proper operation of the system can be reduced to 2 steps: first look for users who share the rating patterns with the active users and second use the ratings from those like mind users found in step 1 to calculate the prediction for the active users.*

Keywords: Edge preserving Filtering, Gradient Preserving Filtering, Extension to color filtering, Structured Transferring Filtering, Median Filtering, Bilateral Filtering.

1. Introduction

Image processing involves many operations such as image enhancement, segmentation, image restoration. To perform these operations, filtering is the most fundamental and important process. A filtering function applied to the values of the input image in a predefined neighborhood of the given location gives the filtered image in the same location. The linear translation invariant (LTI) filters like the Mean filter, Laplacian filter, Sobel filter are used mostly for blurring, sharpening, noise removal, image enhancement, etc. The guided filter has good edge-preserving smoothing properties like the bilateral filter. On the other hand, the guided filter can used smoothing properties with the help of the guidance image. It makes the filtering output more structured and less smoothed than the input. The guided filtering is both effective and efficient in a great variety of computer vision and computer graphics applications such as noise reduction, detail smoothing/enhancement, HDR compression, image matting/feathering, and joint up-sampling.

The organization of the paper is as follows literature survey is given in section; section 3 gives conclusion of literature review. Section 4 gives an idea about problem related to Speech Recognition. Section 5 different methods related to Speech Recognition. Section 6 gives the result of various Speech Recognition techniques which are reviewed and section 7 concludes the paper.

2. Literature Review

Many works have been done in the past in the field of Guided Image Filtering Technique and various methods were adopted for Guided Image Filtering Technique. Ms D G Gaul and Neelima Rajput et. al [1] proposed ".Guided Filter Technique: Various Aspects In Image Processing". In this paper we present guided image filter based on a local linear model. The guided filter delivers the filtering output by considering a reference image. The reference image is said as the guidance image which can be the input image or another different image. The guided filter has better edge preserving smoothing and gradient preserving property. The guided filter is effectual in a variety of computer vision and computer graphics applications.

Shyno.K.G. AND Sarika.S et. al [2] proposed "Feature Extraction of Hyper spectral Images Using Image Guided Filter." This paper proposes feature extraction is an effective way in both reducing computational complexity and increasing accuracy of hyperspectral image. In this paper a simple yet quite powerful feature extraction method based on image fusion and guided image filter is proposed. First, the hyperspectral image is partitioned into multiple subsets of adjacent hyperspectral bands.. 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. The guided filter can perform

edge-preserving smoothing operator like other filter but has better behavior near the edges.

Kaiming He and Xiaoou Tang et. al [3] proposed "A Technique for the Guided Image filtering." This paper, presents a novel explicit image filter called guided filter. The guided filter computes the filtering output considering the content of a guidance image which can be input image itself or another different image. The guided filter is used as edge-preserving smoothing operator like popular bilateral filter but it has better behavior near edges. It can transfer the structures of the guidance image to the filtering output enabling new filtering applications like dehazing and guided feathering.

Takahiro Hasegawa, Ryoji Tomizawa, Yuji Yamauchi, Takayoshi Yamashita et. al [4] proposed "Guided Filtering Using Reflected IR Image for Improving Quality of Depth Image." In this paper we propose the reflected IR image which can be used as guide image to improve the quality of depth image. The aim is to obtain a depth image of higher quality by using a guide image derived from a reflected IR image. It has less texture information and a high correlation with depth image. Using reflected IR image it is possible to perform filtering while retaining edge information between objects of different materials without being affected by textures on the surfaces of these objects.

. Wei Gan, Chao Ren, Xiaofei Wang, Xiaohai He et. al [5] proposed "An Improving Infrared Image Resolution Method via Guided Image Filtering." In this paper we propose a method to enhance infrared image by using the correlation of an infrared (IR) image and its corresponding visible image. Firstly, the phase congruency is used to generate the edge maps of the infrared and visible images. Then the correlated edge regions and the uncorrelated regions are calculated according to the edge maps. Finally different strategies are applied to those regions.

V.Venkateswara Reddy1, S.Ravi Kumar, G.Hari Krishna2 et. al [6] proposed "Guided Image Filtering for Image Enhancement." This paper proposes noise removing applications belongs to image restoration in digital image processing. A satisfying result cannot be found if processing method such as feature extraction, registration or image fusion is carried out on an image with noise. So removing the noise is absolutely necessary for image. In this paper we compare various filtering algorithm like spatial domain filters, Frequency domain filters, Edge-Preserving filters (Bilateral filters), and guided image filtering algorithms based on quality measurement parameters like PSNR.

Vrushali Patil, Dr. P. Malathi, Dr. Manish Sharma et. al [7] proposed "Edge Preservation using Guided Image Filter Technique". In this paper filtering is widely used in image and video processing for various applications. Edge-preserving image is valuable tool for a variety of applications such as denoising, tone mapping, non-photorealistic rendering in computer graphics and image processing. This can be achieved by a local filtering method such as bilateral filter. However, this method has to face the problems like edge-preservation abilities and smoothing abilities and tends to result in staircase effect..

Shivaprasad.B.M, Sujatha.S et. al [8] proposed "Enhancement of Debased Images Using Guided Bilateral Filter". Blurring of an image is a common problem that occurs when recording digital images due to long exposure time, or movement of objects, camera shakes. Clarity of picture assumes an imperative part in the picture handling without clear picture we can't encourage to use it for feature extraction or picture combination and so on. So principle focus of this paper is to upgrade the corrupted pictures.

Devi.S, Jini Cheriyan et. al [9] proposed " Integrating the Concept of Guided Image Filter and Coefficient Threshold for Image Denoising." In this paper, a novel approach which integrates the concept of guided image filter and coefficient threshold for removal of different types of noise. Guided image filter has spatial domain method and coefficient threshold has wavelet domain method. Guided image filter have no gradient distortion and have better performance near the edges. In order to enhance the output of the guided image filter, a wavelet based edge detection is performed.

Giovanni Chierchiay, Davide Cozzolino?, Giovanni Poggi et. al [10] proposed "Guided Filetering for PRNU-based localization of small-size image forgeries". In this paper we propose a PRNU-based technique which guarantees a good forgery detection performance irrespective of the specific type of forgery. This method has presence or absence of the camera PRNU pattern which is detected by a correlation test.

3. Conclusion of literature review

As we discussed for Guided Image filtering techniques different method can be applied. Edge-preserving filtering, Gradient-Preserving filtering, Extension to color filtering, structured-Transferring filtering, Median Filtering and Bilateral Filtering. Guided Filtering is mostly used filtering technique but then also it has some issues related to sparsity, accuracy, scalability. They all focuses on Scalability, Cold Start, Sparsity and Accuracy.

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, denoising, etc. With proper selection of parameter values depending upon the area of application desired results can be obtained. Guided filter performs very well in terms of both quality and efficiency in a great variety of application such as noise reduction, haze removal, image fusion, detail smoothing/enhancement, HDR compression and joint up-sampling. Obtained accuracy is 99.5%. This filter has great potential in computer vision and computer graphics in order to suppress and extracs information from images.

4. Problem Definition

The main problem arises in the guided filtering is the scalability, in which how quickly a recommender system can generate recommendations; second one is sparsity and also cold start Problem and better accuracy.
Scalability*:* In environment that these systems can make recommendation there are millions of users and products. Thus a large amount of computation power is necessary to calculate recommendation.
Data Sparsity: The number of items sold on major ecommerce sites is extremely large. The most active user will only have rated a small subset of the overall database.
Cold Start Problem: The cold start problem occur when a new users or items has just entered the system, it is difficult to find similar one because there is not enough information about the cold start problem is also called the new user problem or new item problem.

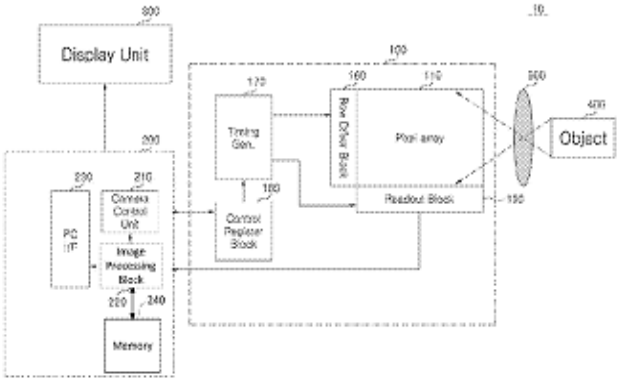
5. Methodologies

The various Guided Image Filtering Techniques can be described as follows:

5.1.1 Edge Preserving Filtering

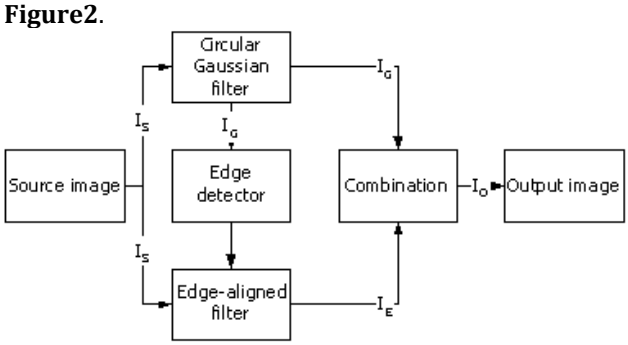
In image processing, images are often decomposed into a smooth base layer and one or more detail layers. The base layer describes intensity variations of image which is obtained by applying the filter on image. The difference between the original image and the base layer gives the detail layer. According to requirement of application, the layers may be processed with various approaches to get desired result. The base layer output is the blurred input image. Edge preserving decompositions can be used in various image processing such as detail enhancement, HDR compression, details fusion, etc. In image enhancement operation the base layer and the detail layer are processed in various ways and recombined. The quality of images for human viewing is improved by enhancement process. The guided filter has various set of parameters.

Figure1.



5.1.2 Gradient-Preserving Filtering

The guided filter has edge-preserving smoothing operator like the bilateral filter. It avoids the gradient reversal artifact that may appear in detail enhancement and HDR compression. A brief introduction to the detail enhancement of the algorithm is as follows. Given the input signal denoted by p,its edge-preserving smoothed output is used as a base layer q. The difference between the input signal and the base layer is described as the detail layer d= p _ q. The enhanced signal is the combination of the boosted detail layer and base layer
Figure2.



5.1.3 Extension to Color Filtering

The guided filter can easily be used to color images. In case when the filtering input p is multichannel, it can be applied to the filter of each channel independently. A color guidance image helps in preserving the edges that cannot be used in gray-scale bilateral filtering. A color guidance images are essential in the matting/feathering and dehazing applications, as we show later the local linear model is more likely valid in the RGB color space than in gray-scale.

5.1.4 Structure-Transferring Filtering

The guided filter is not simply a smoothing filter but it be used as the local linear model, the output q is used as scaling of the guidance I. This makes it possible to transfer structure from the guidance I to the output q, even if the filtering input p is smooth. The binary mask can be obtained from graph-cut or other segmentation methods and are used as the filter input p. The guidance I is the color image. The behaviors of three filters: guided filter, (joint) bilateral filter, and a recent domain transform filter. The bilateral filter may lose some thin structures (see zoom-in). This is because the bilateral filer are guided by pixel-wise color difference, whereas the guided filter has a patch-wise model.

5.1.5 Median Filtering

The median filter is another popular edge aware filter, which can be considered as a special case of local histogram filters. The median is the statistical concept which means the center value of the provided list. The pixel under consideration is replaced with the median magnitude. It also shows property of noise reduction, while preserving edges more effectively as compared to a linear smoothing filter. Rank order and morphological processing are proposed variations for the basic median concept.

5.1.6 Bilateral Filtering

The bilateral filter is another non iterative strong approach to preserve edges in images. It produces filter output at the considered pixel as an average of neighboring pixels. But the bilateral filter has disadvantage of gradient reversal artifact. For a pixel on an edge which has few similar pixels in the neighborhood, the weighted average becomes unstable. The result is that the smoothed output is not consistent with the input at the edges. So detail enhancement like operations which requires the consistency of input signal and output signal has to be performed with better gradient preserving filter.

6. Conclusion

In this paper a novel filter is widely applicable in computer vision and graphics. Different from the recent trends we design a new filter that exhibit the nice property of edge-preserving smoothing. It can be computed efficiently and non approximately. This filter is more generic than “smoothing” and is applicable for structure-transferring, enabling novel applications of filtering-based feathering/matting and dehazing applications.

The novel explicit image filter 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, denoising, etc. With proper selection of parameter values depending upon the area of application desired results can be obtained.

References

[1] Neelima Rajput and Ms D.S Gaul, “Guided Filter Technique: Various Aspects In Image Processing”, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 28, no. 11, pp. 1768- 1783, 2013.

[2] Shyno.K.G. and Sarika.S, “Feature Extraction of Hyperspectral Images Using Image Guided Filter” International Conference on Explorations and Innovations in Engineering & Technology (ICEIET – 2016).

[3] Kaiming He, Member, IEEE, Jian Sun, Member, IEEE, and Xiaoou Tang, Fellow, IEEE, “ A technique for Guided Image Filtering” IEEE Transactions on Pattern Analysis and Machine Intelligence, VOL. 35, NO. 2013

[4] Takahiro Hasegawa, Ryoji Tomizawa, Yuji Yamauchi, “Guided Filtering Using Reflected IR Image for Improving Quality of Depth Image” IEEE Transactions on Pattern Analysis and Machine Intelligence, 35(6):1397–1409,2014

[5] Wei Gan, Chao Ren, Xiaofei Wang, Xiaohai He, “An Improving Infrared Image Resolution Method via Guided Image Filtering” IEEE transactions on Image filtering , VOL. 9, NO. 10, OCTOBER 2014.

[6] V.Venkateswara Reddy, S.Ravi Kumar, G.Hari Krishna “Guided Image Filtering for Image Enhancement” International Journal of Research Studies in Science, Engineering and Technology Volume 1, Issue 9, December 2014, PP 134-138.

[7] Vrushali Patil, Dr. P. Malathi, Dr. Manish Sharma “Edge Preservation using Guided Image Filter Technique” International Journal of Engineering Research and General Science Volume 3, Issue 4, July-August, 2015

[8] Shivaprasad.B.M , Sujatha.S “Enhancement of Debased Images Using Guided Bilateral Filter” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 5, Issue 5, May 2016

[9] Devi.S, Jini Cheriyan “ Integrating the Concept of Guided Image Filter and Coefficient Thresholding for Image Denoising” International Journal of Engineering Research and Development Volume 9, Issue 4 (December 2013), PP. 43-50

[10] Giovanni Chierchiay, Davide Cozzolino ,” Guided Filetering for PRNU-based localization of small-size image forgeries IEEE Transactions on Signal Processing, vol. 53, no. 10, pp. 3948–3959, Oct. 2013

Ashish Kumar Rathore is M.Tech Scholar in Digital Electronics in RCET, Bhilai, Chhattisgarh. He received the B.Tech degrees in Electronics and Communication Engineering from SRM Delhi, in 2012.