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A NOVEL METHODOLOGY FOR IMAGE PROCESSING USING WEIGHTED GUIDED FILTER AND HYBRID MEDIAN FILTER

Abstract
Digital image processing has revolutionized the content perception from physical photo appearance to digital image appearance by implementing the digitalization. Digital image processing helps to achieve good process in various research fields but still enhancing the degraded content to normal content is concerned area. Image enhancement attains attention due to its high application applicability. A novel framework is proposed in this paper by combine the edge based weighting scheme with guided image filtering to get proposed weighted guide image filtering (WGIF). WGIF scheme yields low complexity as GIF and preserve the sharp gradient information. WGIF has ability to provide the local and global smoothing filters advantages and successful to avoid the halo artifacts. In practical WGIF is for single image feature enhancement. Further, this is enhanced to remove that type of noise in maximum amount by preserving the main image features. Image processing consists of many filters in order to remove the impulse noises. One of the filter is Hybrid median filter which is somewhat improved version of median filter, which removes the noise better than median filter. Experimental results provide low complexity and high performance over traditional state of art methods.

Keywords
Guided image filter, Halo artifacts, Low complexity, Image enhancement, Hybrid median filter

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1. Introduction

Digital image is defined as “An image is not an image without any object in it”. Human visual system has ability to perceive the objects in digital image using edges in efficient manner. Halo artifacts introduces blur in digital image which makes perception of content difficult. Various filtering techniques have designed in literature to preserve the global and local statistics but none can meet the desired requirements and various algorithms yields high complexity which fails them to achieve practical reliability. Digital image processing domain has differentresearch fields and all these research fields haveapplications ranging from low level to high level. Edge preservation in all these research fields attains attention and implementation of smoothing filters has ability to filter noise content by preserving the edge information. Smoothing algorithms can be classified into two types namely global filters such as bilateral filter , tri-lateral filters , and finally guided image filter . Global filters attain images with good quality but these filters are highly expensive. Local filters are considered as alternative to global filters which are simple and cost effective but fail to conserve the sharp edges information like global filters. When local filters are forcefully adopts to smooth edges it results halo artifacts. Halo artifacts produced by bi-lateral filter and guided image filter are fixed in equipped way using similarity parameter in terms of range and spatial. Bilateral filtering mechanism is considered as adaptive filter and this adaptive mechanism helps to handle the halo artifacts and on negative side it destroys the 3D convolutional form . An interesting algorithm named weighted guided image filtering scheme is proposed in this paper by combining the edge-based weighting scheme along with guided image filtering. Calculation of edge based weighting scheme is calculated by using 3×3 local variance in a guidance image. This local variance scheme of one indi-

vidual pixel is normalized by all pixels local variance in guidance image. The acquired normalized weights of all pixels are then adaptively adapted to WGIF. WGIF helps to avoid halo artifactsin accurate manner for excellent visual quality. The intricacy of WGIF is same as GIF. The proposed weighted guide image filtering (WGIF) is applied for multiple purposes as single image mist removal, single image detail enhancement and different exposed images fusion. Image filters produce a new image from an original by operatingon the pixel values. Filters are used to suppress noise, enhance contrast, find edges, and locate features. If we want to enhance the quality of images, we can use various filtering techniques which are available in image processing. There are various filters which can remove the noise from images and preserve image details and enhance the quality of image. The common noise which containsthe image is impulse noise. The impulse noise is salt and pepper noise (image having the random black and white dots). Mean filter not perfect for remove impulse noise. Impulse noise can be removed by order statistics filter. Themedian filter is the filter removes most of the noise in image. But there is advanced filter called hybrid median filter whichpreserves corner with removal of impulse noise.

2. METHODOLOGY

Digital image composed of three contents namely color, shape and texture. Assessing the image information based on edges (gradient) has ability to perform the enhancement tasks and fusion in reliable way in the field of digital image processing. Acquiring the digital content of images with good visual quality in computational photography and other applications with complexity is still concerned area because many global filters yields high complexity which show adverse impact on enhancement process.. In this paper, a strategy is implemented to enhance the image contents based on edge information by incorporating the guided image filter (GIF) with novel edge based weighting scheme to form weighted guided image filter with minimal complexity and better visual quality. The edge information plays an important role in implementing weighted guide image filtering algorithm for various applications. The key element of proposed algorithm is to ensure a confined linear model between a guidance image (G) and filtering output . The confined linear model ensures filtering output has an edge only if the respective guidance image (G) has an edge. Consider G as guidance image and the respective variance is denoted by. The edge based weighting schemes is well defined by local variance of 3×3 local variance windows of all pixels as follows

$$\gamma G(P') = \left(\frac{1}{N}\right)\sum_{p=1}^{N}\frac{[\![\sigma]\!]^2 G(P')+\varepsilon}{\sigma^2 G(P)+\varepsilon} \quad (1)$$

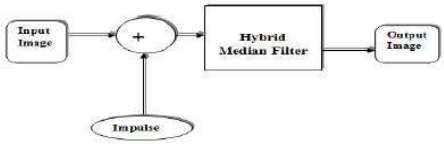


Figure 1. The Block Diagram of Image Restoration Using HMF

denotes a small constant selected for input image dynamic range "L" and its value is All guidance image pixels are used in the computation of The pixel importance is measured by weighting mechanism with respect to whole guidance image. The value of weighting mechanism is larger than 1 if is at an edge and value is small if is in a flat area. The feasible blocking artifacts appearance can be efficiently prevented in the final image and the smoothing operation is carried out at weighting mechanism. The proposed weighted filtering scheme is incorporated with cost function and finally the minimization of differences between image to be filtered and filtered output as follows.

$$E = \sum_{P\varepsilon\Omega\varsigma}\left[\left[(ap'G(p) + bp' - [\![X(p))^2 + \frac{\lambda}{\gamma G(p')}ap'^2\right]\right]$$

The computation of ap' and bp' are as follows

$$ap' = \frac{\mu G\odot X,\varsigma 1(P') - \mu G.\varsigma 1(P')\mu X,\varsigma 1(P')}{\sigma^2 G,\varsigma 1(P') + \left(\frac{\lambda}{\gamma G(P')}\right)} \quad (2)$$

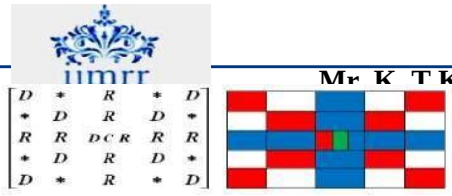
3. PROPOSED METHODOLOGY

The impulse removal can be very much good in hybrid median filter. So by that hybrid median filter the almost impulse noise is removed from image. The filter which removes unwanted things. In order to that image noises we can use the filter such as

• **Linear Image Smoothing Filters:** One method to remove noise is by convolving the original image with a mask that represents a low-pass filter or smoothing operation. For example, the Gaussian mask comprises elements determined by a Gaussian function. This convolution brings the value of each pixel into closer harmony with the values of its neighbours. In general, a smoothing filter sets each pixel to the average value, or a weighted average, of itself and its nearby neighbours; the Gaussian filter is just one possible set of weights.

• **Nonlinear Image Filters:** A median filter is an example of a non-linear filter and, if properly designed, is very good at preserving image detail. To run a median filter: 1. consider each pixel in the image, 2. sort the neighbouring pixels into order based upon their intensities, 3. replace the original value of the pixel with the median value from the list.

MEDIAN FILTERING



Median filtering is a non-linear filtering technique that is well known for the ability to remove impulsive-type noise, while preserving sharp edges. The median filter is a order statistics filter. Also Mean filter is used to remove the impulse noise. Mean filter replaces the mean of the pixels values but it does not preserve image details. Some details are removes with the mean filter. But in the median filter, we do not replace the pixel value with the mean of neighbouring pixel values, we replaces with the median of those values. The median is calculated by first sorting allthe pixel values from the surrounding neighbourhood into numerical order and then replacing the pixel being consideredwith the middle pixel value.

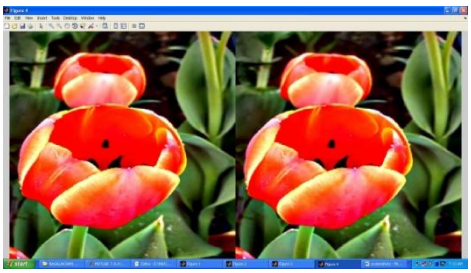
HYBRID MEDIAN FILTER

Hybrid median filter is windowed filter of nonlinear class that easily removes impulse noise while preserving edges. In comparison with basic version of the median filter hybrid one has better corner preserving characteristics. The basic idea behind filter is for any elements of the signal (image) apply median technique several times varying window shape and then take the median of the got median values. The hybrid median filter takes two medians: in an "X" and in a "+" centered on the pixel. The output is the median of these two medians and the original pixel value. Motivation: preserves corners B = hmf (A, n) performs hybrid median filtering of the matrix A using an n x n box. Hybrid median filter preserves edges better than a square kernel (neighbour pixels) median filter because it is a three-step ranking operation: data from different spatial directions are ranked separately. Three median values are calculated: MR is the median of horizontal and vertical R pixels, and MD is the median of diagonal D pixels. The filtered value is the median of the two median values and the central pixel C: median ([MR, MD, C]). As an example, for n = 5: Y = median MR, MD, C

Hybrid median filter algorithm:

1. Place a cross-window over element;
2. Pick up elements;
3. Order elements;
4. Take the middle element;
5. Place a +-window over element;
6. Pick up elements;
7. Order elements;
8. Take the middle element;
9. Pick up result in point 4, 8 and element itself;
10. Order elements;
11. Take the middle element.

For all window filters there is some problem. That is edge treating. If you place window over an element at the edge, some part of the window will be empty. To fill the gap, signal should be extended. For hybrid median filterthere is good idea to extend image symmetrically. In other words we are adding lines at the top and at the bottom of theimage and add columns to the left and to the right of it. A hybrid median filter has the advantage of preservingcorners and other features that are eliminated by the 3 x 3 and 5 x 5 median filters. With repeated application, the hybridmedian filter does not excessively smooth image details (as do the conventional median filters), and typically providessuperior visual quality in the filtered image. One advantage of the hybrid median filter is due to its adaptive nature,which allows the filter to perform better than the standard median filter on fast-moving picture information of smallspatial extent.

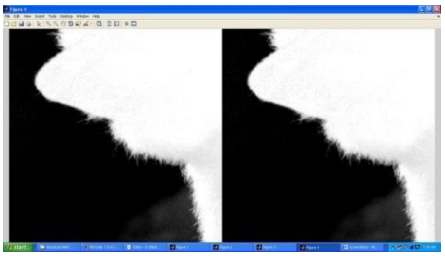


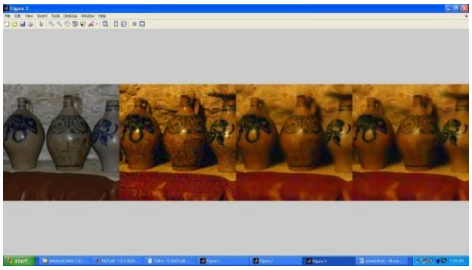
4. RESULT

The below depicted figures represents the resultant for different operations like Enhancement, smoothing, feathering and deblurring.

5. CONCLUSION

An optimized framework is proposed in this work by incorporating the hybrid median filtering to get the efficient results. The impulse noise can be removed efficiently and smooth the all noise other than impulse noise. The hybrid median filters have some of the advantages in image pro-





cessing. For repeated application the hybrid median filter does notexcessively smooth image details, Edge treating is possible, Hybrid median filter preserves edges better than a median filter, Preserves brightness difference.

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