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Improved Guided Image Filtering With Adopting Adaptive Weights

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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 the normal content area is concerned. Image enhancement attains attention due to its high application applicability. A novel framework is proposed in this paper by combining 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. Experimental results provide low complexity and high performance over traditional state of art methods.

Keywords: Guided image filter, Halo artifacts, Low complexity, Image enhancement

1. INTRODUCTION

The digital image is defined as “An image is not an image without any object in it”. The human visual system has ability to perceive the objects in digital image using edges in an 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 different research fields and all these research fields have applications 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 (i) global filters such as bilateral filter [3], tri-lateral filters [4], and finally guided image filter [11]. Global filters attain images with good quality but these filters are highly expensive. (ii) Local filters are considered an 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 [3]. Bi-lateral 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 [5]. 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 33 local variance in a guidance image. This local variance scheme of one individual 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 artifacts in accurate manner for excellent visual quality. The intricacy of WGIF is same as GIF [14]. 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.

2. EXISTING METHODS

(A) Bilateral filter

The bilateral filter is considered as simplest filtering scheme which has ability to perform filtering at every pixel by performing the average of nearby pixels. The filtering operation is carried out in both spatial and range distance. The smoothing operation is performed to save the edge information but attains instability when similar pixels values acme as outcome and efficiency is another drawback of bilateral filter.

(B) **Non-average Filter**

Edge preservation has great imporstnce4 in applications and it is performed with ease by non average filters. The median filter is considered as famous edge preserving approach and typically special case of local histogram filters with low complexity in terms of time using a bilateral grid but these filters are expensive

3. PROPOSED METHOD

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 scheme is well defined by local variance of 33 local variance windows of all pixels as follows

(1)

Where

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

(2)

The computation of and are as follows

(3)

(4)

Where is represented as two matrices element by element product and along with matrices mean values are also taken into consideration in order to yield final value as

(5)

To make the analysis easy both X and G are assumed to be same for perfection and when we consider a pixel with a edge has value larger than 1 and in WGIF it is close to 1 is better than GIF value. The above analysis show better edge information is obtained by WGIF than GIF

4. SIMULATION RESULTS

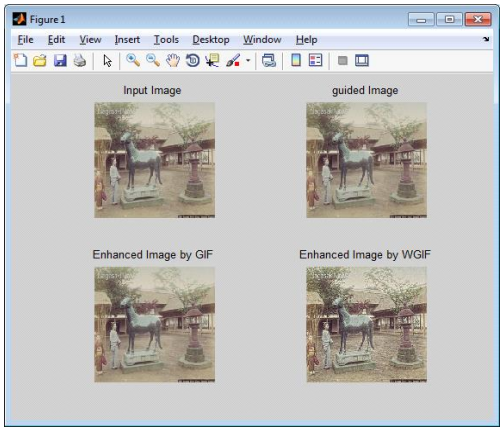

Figure 2: (a) Input image (b) Guided image (c) Enhanced image by GIF (d) Enhanced image by WGIF

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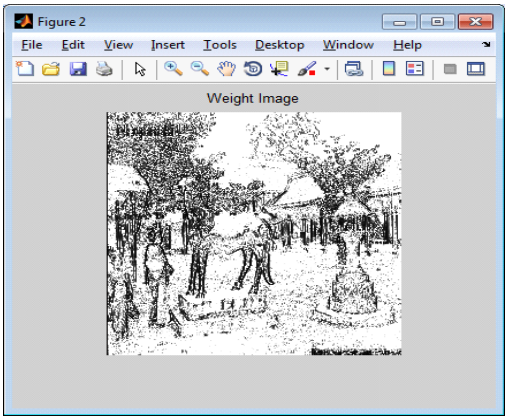

Figure 3: Weighted image

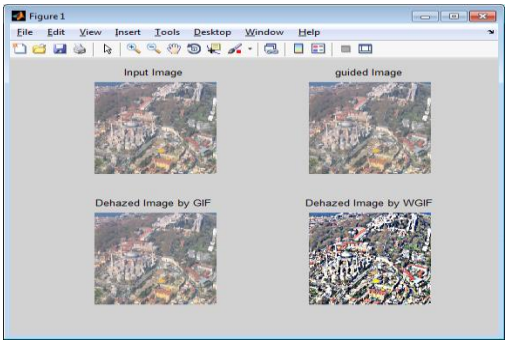

Figure 4: (a) Input image (b) Guided image (c) Dehazed image by GIF (d) Dehazed image by WGIF

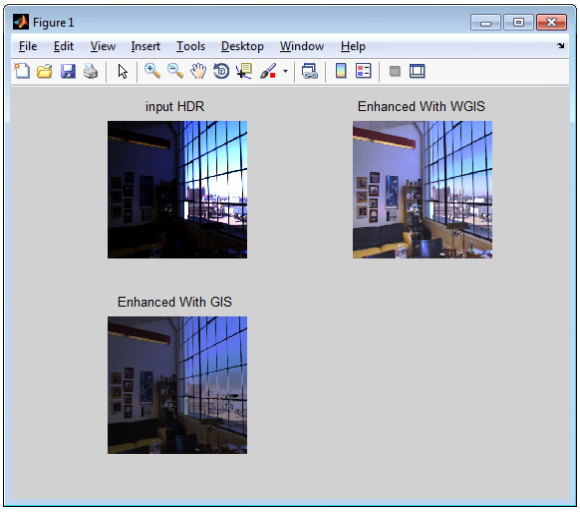

Figure 5: (a) Input HDR (b) Enhanced with WGIS (c) Enhanced with GIS

EXTENSION:

The extension work is performed on videos, where this video consists of no. of frames. Each frame is converted into image, because filtering on frame is impossible due to its change of pixel rate. Each image is filtered by WGIF technique to avoid halo artifacts and to reduce the complexity. After then each image is again converted into frame and then video. The improved quality of video is shown in below results.

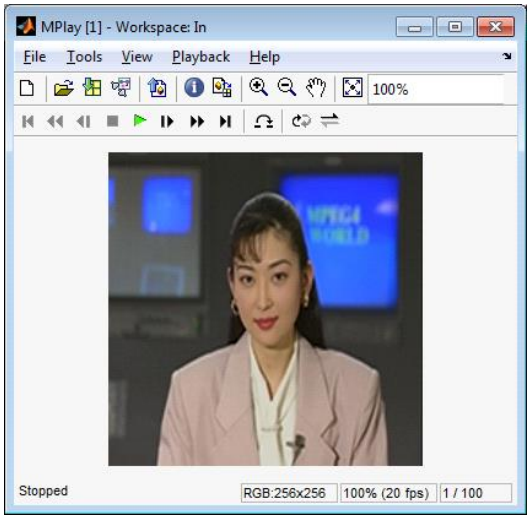

Figure 6: Input video

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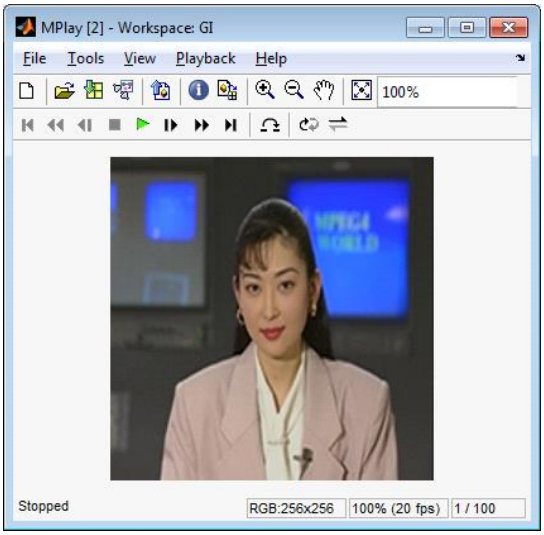

Figure 7: Guided approach for videos

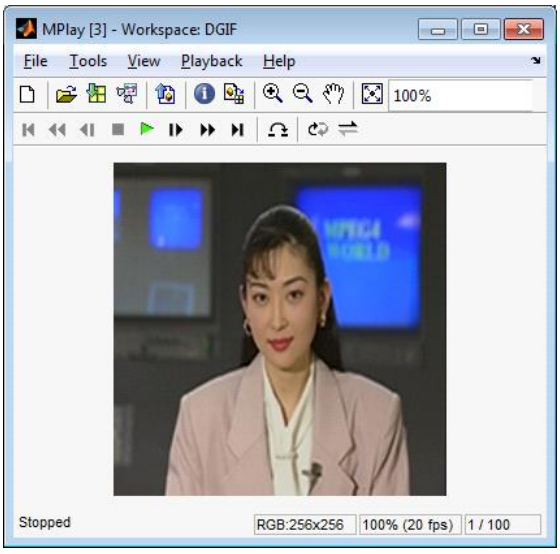

Figure 8: Guided image filtering approach for videos

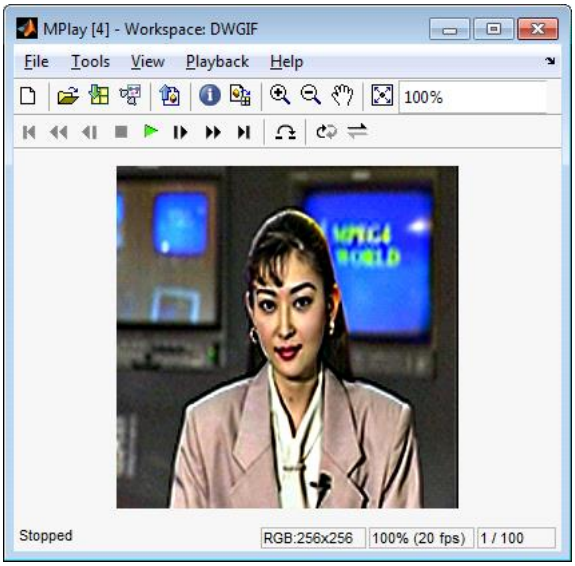

Figure 9: Weighted Guided image filtering approach for videos

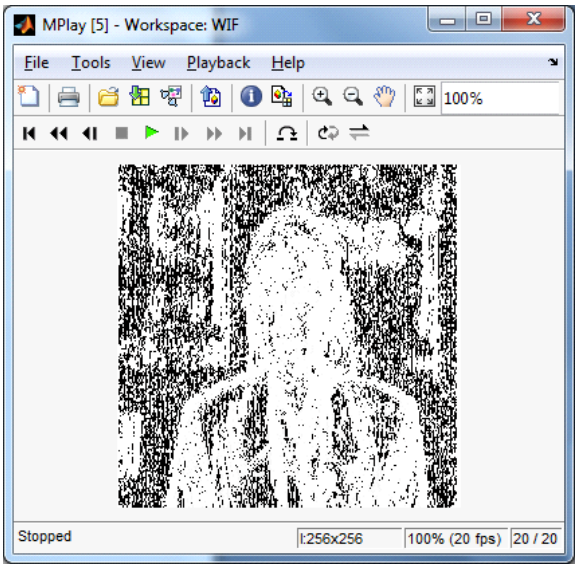

Figure 10: Applying weights for videos

5. CONCLUSION

An optimized framework is proposed in this work by incorporating 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

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