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A novel Edge-Aware Weighted Guided Image Filtering

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Abstract

Halo artifact is the main problem in existing techniques for filtering based image preserving as well smoothing techniques. Halo artifact is nothing but the uneven lightning conditions through the image. To solve the problems of existing techniques we implemented a novel weighted guided image filter (WGIF) which is integration of two techniques one is guided image filtering and other is edge aware weighting. The proposed integrated method is having two main advantages, one is the run time complexity of proposed WGIM is same as the GIF and the other advantage is the halo-artifacts present in existing technique is completely removed by this technique. The proposed work may be used for different applications like removal of haze from single image, image fusion for different exposed image as well as single image detailed enhancement.Matlab execution results will show that the proposed work is having ability to provide the best results for local and global smoothing filter advantages as well as the halo artifacts present due to uneven distribution of light is successfully removed from the image. We extended this implementation for videos as we know the video is nothing but number of frames. So the same implantation is applied for video and quality analysis is done.

Keywords: Halo artifacts, Guided Image Filtering (GIF), Run Time Complexity, Image Enhancement, Video (frames of images).

1. INTRODUCTION

Digital image processing is the evergreen branch which is growing day by day. Digital image is nothing but we are going to consider image in discrete format, which is nothing but digital image is made up of pixels. While acquising an image or while processing it number of degradations will include. But to work efficiently or with more reliability there is need to develop such algorithm that it will give the enhanced image for degraded image. As well there is need to develop an algorithm which can also be used for different degradations. In Matlab will consider the image is as pixels and those pixel ranges is also defined so processing is very easy as matrix format of pixel is considered. No of techniques are developed to get enhanced image also they are used to preserve the local as well as global characteristics but all the existing techniques having the drawback that they can't achieve the total requirement for enhancement. All the existing

techniques are discussed and the proper solution is given for development of this system.

We studied different algorithms which already exist; finally we concluded that there is need to develop this algorithm. Digital image process domain has totally different analysis fields and everyone these analysis fields have applications starting from low level to high level. Edge preservation all told these analysis fields attain attention and implementation of smoothing filters has ability to filter noise content by protective the sting info. Smoothing algorithms will be classified into two different varieties as given in (i) bilateral filter [3], tri-lateral filters [4], and at last guided image filter. International filters attain pictures with sensible quality however these filters are having extremely poor performance. (ii) Native filters are thought-about an alternate to international filters that are straightforward and value effective however fail to conserve the sharp edges info like international filters.

When native filters are forcefully adopts to sleek edges it results halo artifacts. Halo artifacts which is nothing but uneven distribution of light, created by bi-lateral filter and guided image filter are mounted in equipped approach victimization similarity parameter in terms of vary and spatial domain [3]. Bi-lateral filtering mechanism is accommodative filter and this accommodative mechanism helps to handle the halo artifacts and on negative aspect it destroys the 3D convolution kind as mentioned in [5]. A novel integrated technique named weighted guided image filtering (WGIF) theme is projected during this paper by combining the edge-based coefficient theme at the side of guided image filtering. Calculation of edge based mostly coefficient theme is calculated by victimization 3×3 native variance in a very guided image. This native variance theme of one individual component is normalized by all pixels native variance in guided image. The nonheritable normalized weights of all pixels are then adaptively tailored to weighted guided image filtering.

WGIF helps to avoid halo artifacts for wonderful visual quality which is further can be analyzed with the help of quality analysis parameters. The complexity of WGIF (weighted guided image filtering) is same as GIF (guided image filtering) .The proposed weighted guide image filtering (WGIF) is applied for multiple functions as single image haze or we can say fog removal, single image detail enhancement and totally different exposed pictures fusion.

2. EXISTING METHODS

(A) Bilateral filter

Bilateral filtering is one of the simplest filtering techniques for image enhancemet.This technique is having ability to work on neighboring pixels to restore and get modified simple outputs which outperform the existing systems. While working with this type filter we mostly have to focus on edges, because most of the image information is present at the edges.So, edge preserving technique we applied with the help of bilateral filter. These types of filter are mostly non-linear filter and the main problem is their efficiency.

(B) Non-average Filter

Edge preserving filters are most important for image enhancement. The median filter is one of the well known filters for image enhancement as well this special case of local histogram filters will provide low complexity in terms of time. In median filter for each pixel wise operation we are going to consider its mean value.

(C) Guided Image Filtering

Guided filter is one of the explicit image filters. The guided image filter is additionally a lot of generic conception on the far side smoothing technique. It will transfer the structures of the guidance image to the filtering output, facultative new filtering applications like dehazing and target-hunting feather. Moreover, the target-hunting filter naturally applied to non-approximate linear time algorithmic program, despite the kernel size and therefore the intensity vary. Currently, it's one among the quickest edge-preserving filters. This technique is having a lot of advantages which are considered for our proposed work and the drawbacks will be removed by this filter.

3. PROPOSED METHOD

In this we implemented a novel technique for filtering-out Digital image composed of three main contents particularly color component, shape of the object and texture nothing but pattern. Assessing the image data supported by the edges (gradient) has ability to perform the improvement tasks and fusion in reliable manner within the field of digital image processing. Feat the digital content of images for enhancement with sensible visual quality in machine photography and alternative applications with quality remains involved space as a result of several international filters yields high quality that show adverse impact on improvement of the quality from images degraded with blurriness like haze. In implementation of this paper, a method is enforced to boost the image contents supported edge data by incorporating the radio-controlled image filter (GIF) with novel edge primarily based weight theme to create weighted radio-controlled image filter with least quality and higher visual quality.

The edge information which is calculated by gradient plays an important role in implementing weighted guide image filtering algorithm for various applications. The main aim of proposed algorithm is to ensure a confined linear model between a guidance image (G) and filtering output ($\hat{J}$). The proposed linear model in this paper ensures filtering output ($\hat{J}$) 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 $\sigma^{2(P')}$. The edge based weighting scheme $\gamma G(P')$ is well defined by local variance of 3×3 local variance windows of all pixels which is given below,

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

Where, ε is small variable which is selected for input image dynamic range "L" and its value is$(0.001 \times L)$^2. All the guided image filtering techniques are used in the computation of $\gamma G(P')$.

The element P' importance is measured by coefficient mechanism with relevancy whole steering image. Coefficient mechanism is larger than one if P^' is at a

foothold and value is little if P^' is in an exceedingly flat space. The possible interference artifacts look are often expeditiously prevented within the final image and also the smoothing operation is applied at coefficient mechanism. The proposed weighted image filtering theme is incorporated with price operate and at last the decrease of variations between image to be filtered i.e. input image for filtering and filtered output as follows,

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

The values of ap' and bp' are calculated by using following equations,

$$ap' = \frac{\mu G \odot X, \varsigma 1(P') - \mu G.\varsigma 1(P')\mu X, \varsigma 1(P')}{\sigma^2 G, \varsigma 1(P') + \left(\frac{\lambda}{\gamma G(P')}\right)} \quad (3)$$

$$bp' = \mu X, \varsigma 1(P') - ap'\mu G, \varsigma 1(P') \quad (4)$$

Where, $\odot$ is the symbol for matrix by matrix multiplication with matrices mean values are also taken into consideration in order to get final output as below,

$$\hat{J}(p) = apG(P) + bp \quad (5)$$

For easier analysis both X and G are assumed to be same 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 shows that the results of WGIF are much better than existing techniques like GIF.

4. SIMULATION RESULTS

4.1 PROPOSED WORK

Below we applied proposed work for different applications like contrast enhancement and haze removal. The proposed work is shown the idea about image restoration or enhancement algorithm for degraded images by different ways like haze or blurriness. Proposed work is developed for images. So, as an input we will give degraded image and we will get output as enhanced image by weighted guided image filtering.

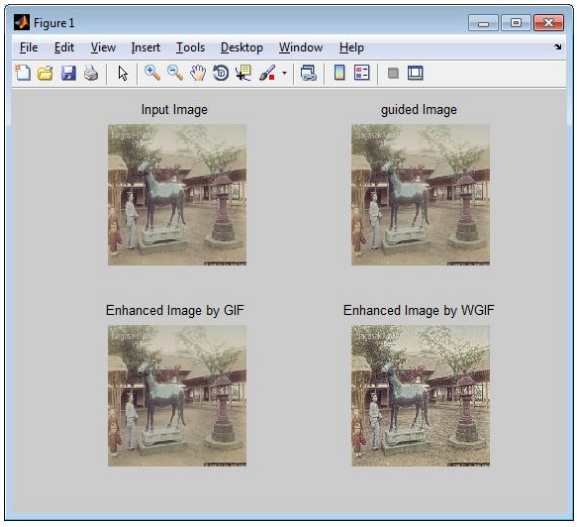

Fig. 1:comparision between (a) Input image for enhancement (b) Guided image for input image (c) Enhanced image by GIF (d) Enhanced image by WGIF

Here we selected a) input image, for processing on it,b)guided image for analysis and in c)Enhanced image by guided image filtering(GIF),this the existing method which we implemented for comparing proposed work with this existing technique.

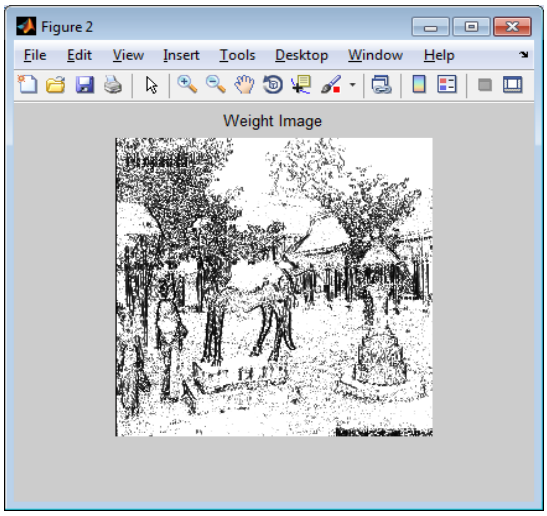

Fig. 2: Weighted image for input degraded image

For the input degraded input image we are going to calculate the weights.

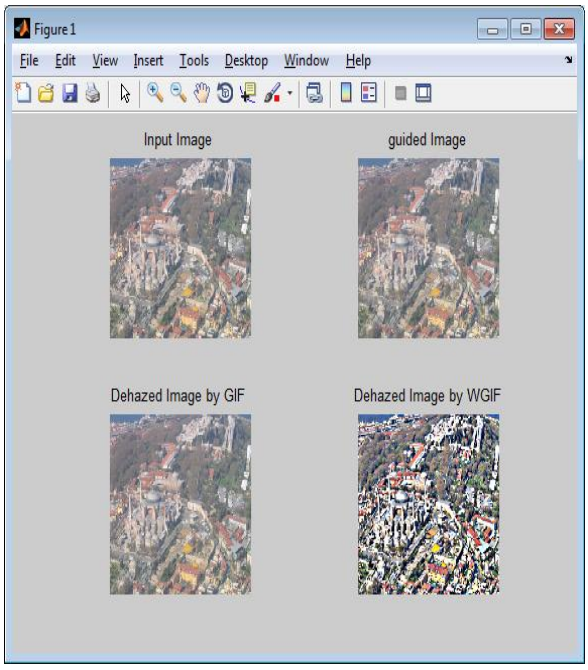

Fig. 3:comparision results (a) Input image for haze removal (b) Guided image (c) Dehazed image by GIF (d) Dehazed image by WGIF

For input degraded image having haze, we have to remove it by the application of weighted guided image filtering. So above we shown input image for haze removal which is selected by the user. Guided image is shown after that and in next figures we shown that compare to guided image filtering we are getting better results in weighted guided image filtering.

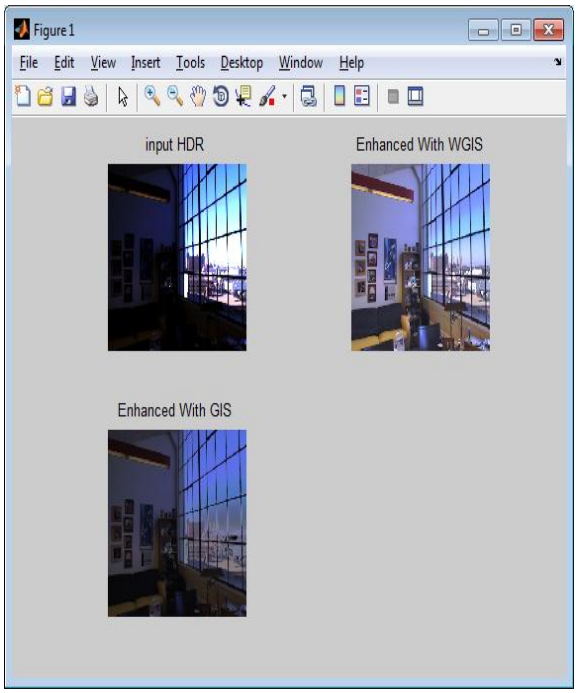

Fig. 4: comparison of enhancement algo.(a) Input HDR (b) Enhanced with WGIS (c) Enhanced with GIS

This is one of the applications of WGIF for image enhancemet.The proposed work is compared with different existing technique.

4.2 EXTENSION

The extension work we shown for video processing. Video is nothing but frames of images with lesser

time delay for display it.So we will take input video for processing except image, but from this video we will collect the number of frames. The number of frames again we converted into images for processing. We processed on total frames again we converted those images into frames and combined to get a video. This video is analyzed by subjective analysis to say the quality of enhanced video is better than the input degraded video.

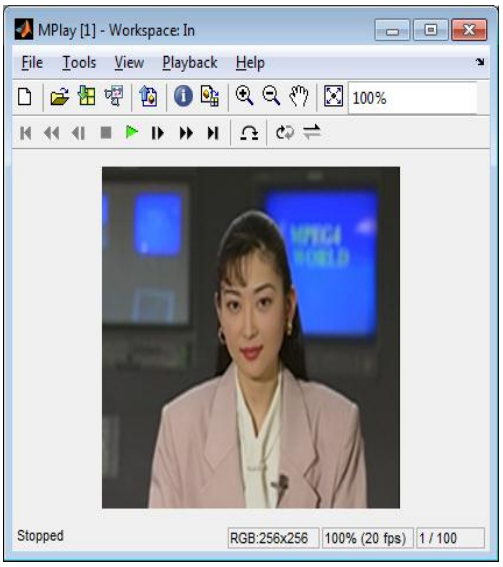

Fig. 6: Input degraded video for analysis

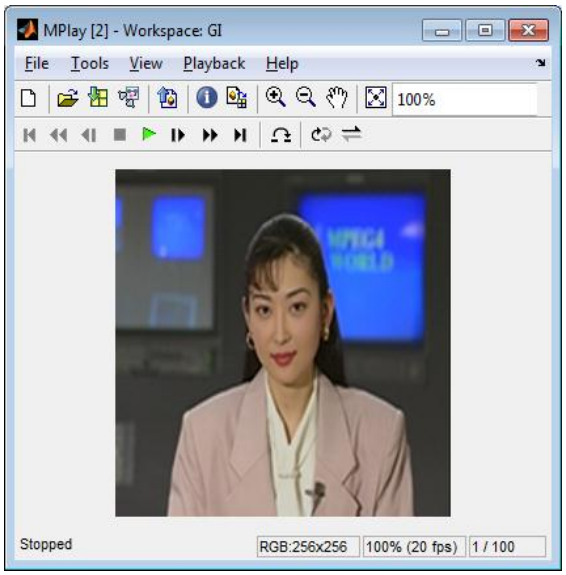

Fig.7: Guided approach for degraded videos

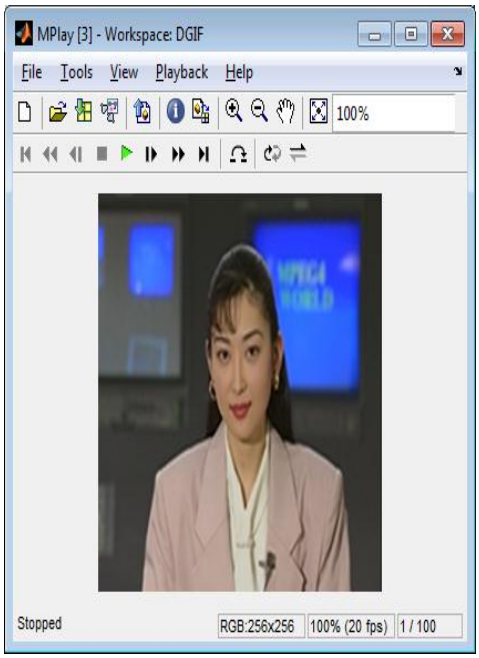

Fig. 8: Guided image filtering approach for enhancement videos

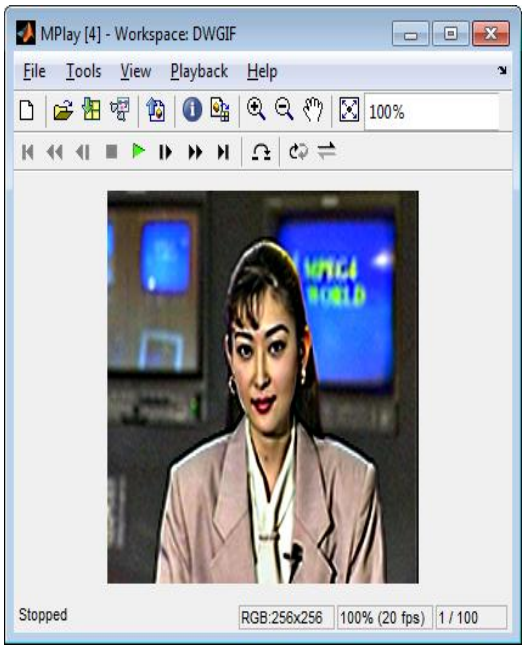

Fig. 9: Weighted Guided image filtering approach for enhancing quality of video

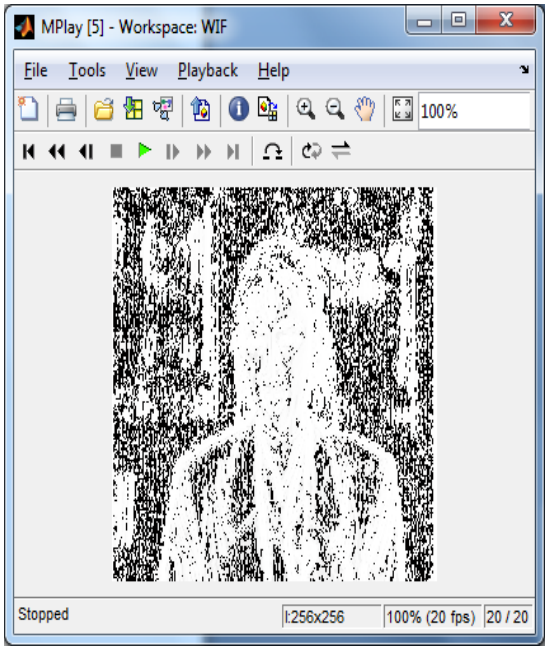

Fig.10: Applying weights for final video

5. CONCLUSION

An optimized framework is projected during this work by incorporating the sting based mostly coefficient theme with target-hunting image filtering to induce projected weighted guide image filtering (WGIF). WGIF theme yields low complexness as GIF and preserve the sharp gradient data. WGIF has ability to produce the native and international smoothing filters benefits and thriving to avoid the halo artifacts. This proposed work is having main three applications which are shown by therotically as well as experimentally.The reliability of proposed work is better compared to state of art of existing techniques.By subjective analysis we can prove that realiabily and accuracy of proposed work is high.

FUTURE SCOPE

Future imaging systems must be less expensive as well as provide peak level quality parameter which is used for satellite applications, remote sensing areas, astronomy as well in biomedical applications. In future this WGIF may be integrated with some other contrast enhancement techniques like multi-scale retinex, power constrained contrast enhancement and generalized equalization model to get low computation run time complexity, high accuracy and high reliability.

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