A Novel Method for Image and Video Dehazing based on Contrast Enhancement

Dipali Bhajibhakre, Deepa Pawar, Poonam Pawar, Arjun Nichal

Abstract— As the revolution in the computational photography and computer vision applications facilitates fast and reliable information,quality of scene and visual perception and is being inceasingly used in various fields like, public safety,traffic accident analysis,crime forensics,remote sensing area and military surveillance. We make an investigation of dehazing effect of scene affected by weather phenomenon. 'Dehazing' has emerged as a promising technology to recover the clear image and video from an input hazy scene, such that the quality can be significantly enhanced. A scene captured in outdoor environment affected by haze like,fog mist and dust particles in the atmosphere. We are utilizing a 'Dehazing algorithm, to remove this unwanted haze from videos and Real-time video. Also remove haze from images, for this we uses a novel method of video dehazing based on contrast enhancement. From our oobservation it is conclude that hazy image and video has low contrast, so we estimate transmission map to maximize the contrast of output scene. And we uses depth estimation process to detect or identify hidden parameters from the scene, and also creates a corresponding haze scene with high fidelity. Finally we reconstruct or restore the seen without changing its originality. Hence dehazing performance with fewer artifacts and better coading efficiency and demonstrate that the proposed algorithm can remove haze efficiently and recover the parameters of original scene.

Index Terms — Real-time video dehazing, image dehazing, restoration, contrast enhancement, airlight estimation, transmission maps, gamma correction, depth maps.

1 INTRODUCTION

Recently there has been going intrest in the analysis of video affected by weather phenomenon. Haze removal (Dehazing) is highly desired in consumer, computer vision application, from working normally, such as intelligent vehicles, outdoor objective recognition, and mostely in the field of digital photography techonology. Recording videos and capturing images has become popular lifestyle. However, it is a challenge for professional photographer to capture high quality video in low-light level and foggy environment. Hence the process of removing haze can significantly increases the visibility of scene and correct the shift caused by the airlight. Video captured in poor environmental condition fails to present visual effectively. It can be classified into two categories, namely enhancement-based approach and restoration based approach. More precisely, the enhancement-based approach attempts to enhance the visibility of hazy images without considering the reasons for image degradation, Dehazing is the process of removing haze from video and enhancing the video quality so; the main object of our technique is to enhance the poor visibility of the video, which applicable in the field of public safety, traffic accident analysis, crime forensics, remote sensing area and military surveillance. The three main objectives of video enhancement techniques are, to explore the hidden details in the video; the effect such as flickering and uneven exposure should be avoided; the video should be temporally consistent. To achieve all this objectives we propose a contrast enhancement algorithm. Contrast Enhancement commonly used for surveillance applications because the viewing environment is outside the control of the observer. By using this method, unexpected flickers are effectively eliminated. Optical scattering produces an unnecessary exposure on a video and image which known as 'airlight'.It happens because of light coming from the source (sun) is scattered to words the observer. The airlight is firstly estimated in given input scenes (video, image).To compute the scene depth there are several approaches for example scene depths are estimated from two or more image and video which are captured in different environmental and weather conditions. For this we divide an input scene into multiply blocks and then estimate the optimal transmission for that block's. So, the contrast of image and video increased. Finally we apply gamma correction technique which is used to optimize the usage of bits encoding an image and video. It is an effective tool for manipulating the histogram of an image that is either over an under exposed. In addition to manual control, gamma correction can be also automatically adjusted to compensate for change in the scene. In analog video system, gamma correction is performed with analog circuitry and is adjusted manually. With digital video system, gamma correction can be provided using mathematical operations in a digital circuitry. In summary, our work makes the following three main contributions:

- We develop a novel method for image dehazing which can make hidden details perceptually noticeable while avoiding inducing visual artifacts and also compares result from previous traditional method.
- We introduce Video dehazing technique which clears the video already saved in the database.
- We extend our method to several practical applications, such as Real-time video dehazing, video denoising and clear video and attempt reconstruction.

Thus we dehaze an image and video using contrast enhancement algorithm from hazy video and image to achieve haze free image and video which is clearly visible for human eyes and greatly impact the accuracy of the message and visual perception. The experimental results demonstrate the superior consistency of subjective and objective evaluation of the

proposed method.

2. METHODOLOGY

2.1 Block Diagram

In this paper we proposed a methodology that improves the visibility of haze image and video. The Methodology uses the depth estimation concept to restore the degraded image and video. The input image and video which are captured in the outdor scenes subjected to atmospheric troubles such as haze, fog and heavy rain etc. In order to identify the color temperature and the contrast levels the input image and video is converted into the two individual inputs such as white balance input and contrast enhancement. White balance basically means color balance. It is a function that gives the camera reflection to 'true white'. Since white light is sum of all other colors. The camera will then display all colors correctly. Contrast enhancement process is used to make image and video features more clear. Contrast manipulation involves a scene in oredr to increase the contrast. These two individual image and video are then applied to depth estimation process a depth estimation method based on geometric and edge information is proposed. This method first creates three kinds of depth templates, and a vanishing point detection algorithm based on road extraction is provided to perform the sub-regional depth assignment to the images involves various segments such as finding the weight maps of individual image and video (for both white balance and contrast enhancement), normalization of weight maps and application of pyradmids.A gamma correction factor has been applied to the depth estimation process in order to improve visibility which is perfect scene to human eye. The gamma correction enhance contrast level of the image and video and hence even in the high atmospheric troubles we get a visually perfect image and video. Finally we obtain a haze free image and video which clearly visible for human eye and greatly impact the accuracy of the message and visual perception.

2.2 Depth Estimation Process

Chromatic weight map controls the saturation gain in image and video, the Salience weight maps defines the quality whuch contributes to degress of conspicuousness with respect to the neighdorhood region. The output pf each weight maps are normalized (change the range of pixel intensity value), and then applied to Gaussian pyramid of length five. The image and video is a data structure designed to support efficient scaled convolution through reduced image and video representation. It consist of a sequence of copies of an original image and video in which both sample density and resolution are described in regular steps. The Laplacian pyramid has been described as a data structure composed of band pass copies of an image and video that is well suited for scaled image and video analysis. But the pyramid may also be viewed as an image and video transformation, or code. The pyramid nodes are then considered code elements, and the equivalent weight function are sampling function that give node values when convolved with the image and video.

The proposed block biagram shows different blocks like, white balance input, contrast enhancement, depth estimation, gamma correction and transmission map.

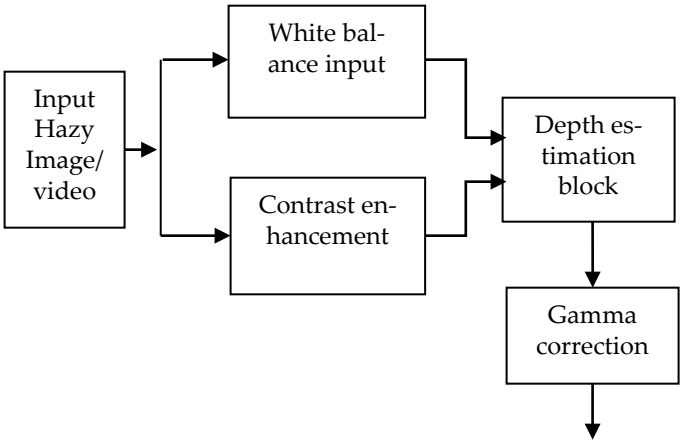


Figure 1: General Block Diagram of Video Deahzing

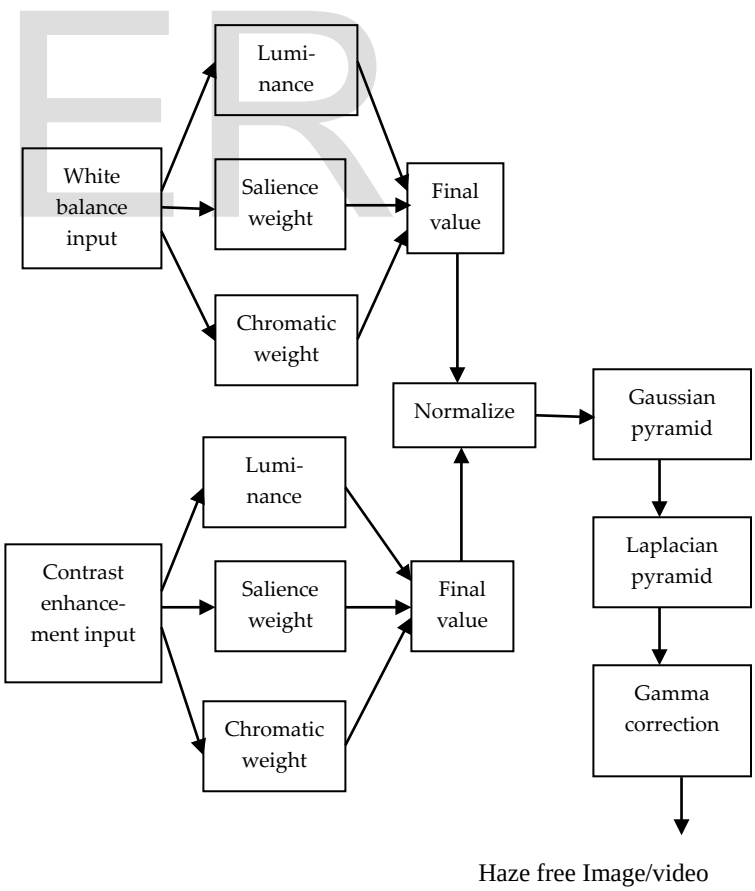


Figure 2: Depth Estimation Process

3. Literature Summery

In [8], Contrast enhancement algorithm is proposed, to estimate a space varying transmission map to dehaze an image. In [10], Dark-channel-prior method is proposed to realize a fast dehazing system targeting outdoor video streams. In [1], Bilateral filtering and non iterative technique is proposed and applicable for images. In [2], Polarization technique is proposed, which is helpful in the field of photography and remote sensing. In [3], Physical- based method is proposed to recover blind parameter. This method is applicable for gray scale, RGB color, multispectral, IR image. In [4], Polarization technique is proposed. Dehazing showed significant improvement of visibility and color, reactive to the raw data. In [5], Physical based method technique is proposed which is applicable for both black and white and color images. In [6], automated method is given to Solely based on single images, without requiring the geometrical structure. In [7], Dark-channel-prior method algorithm is proposed to remove haze from single input image. In [9], View-based cluster segmentation algorithm is proposed to avoid the color distortion in sky region and make the sky and white object be clear.

4. Result

4.1 Quality Parameters

To analze or compare the result we check some quality parameters as follows:

1. PSNR
2. MSE
3. Elapsed Time

4.1.1. PSNR (Peak Signal to Noise Ratio)

The PSNR is most commonly used as a measure of quality of reconstruction of lossy compression codec's (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codec's it is used as an approximation to human perception of reconstruction quality, therefore in some cases one reconstruction may appear to be closer to the original than another, even though it has a lower PSNR (a higher PSNR would normally indicate that the reconstruction is of higher quality).

4.1.2. MSE (Mean Square Error)

Mean Square Error (MSE) ,is the cumulative squared error between the compressed and the original image. Where I(x,y) is the original image, I'(x,y) is the approximated version (which is actually the decompressed image) and M,N are the dimensions of the images. A lower value for MSE means lesser error.

4.1.3. Elapsed Time

Elapsed time is the total required time required to process on the hazy scene captured in different environmental conditions. Scalar double representing the time elapsed between tic and toc commands, in seconds. 'toc' reads the elapsed time from the stopwatch timer started by the 'tic' function. The function reads the internal time at the execution of the toc command, and displays the elapsed time since the most recent call to the tic function that had no output, in seconds.

5. Actual Implementation of Results

The performance of the proposed image dehazing algorithmis evaluated on various test images. In this section, we use test images, which have complicated depth structuresras and transmission map. Thus, we provide the results of the dehazing algorithm only.In Fig. 5.1, we see that the proposed algorithm removes haze from the input image and reconstruct the ſne details of foggy flower clearly.

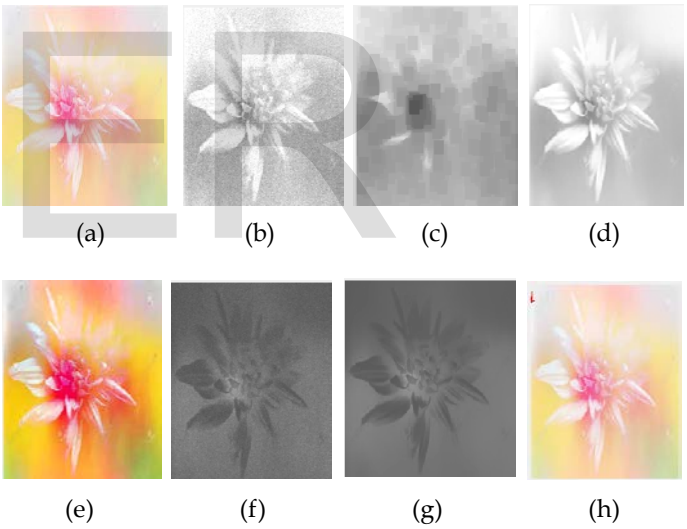
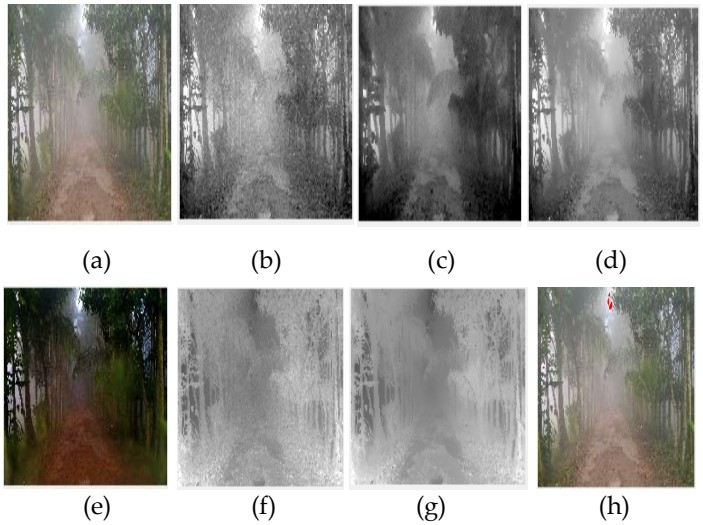


Figure 5.1. Some of the dehazing results

The sample hazy input image (a), Depth map-1 (b), Depth map-2 (c), Depth map- 3 (d), The Dehazed image (e), Transmission map -1 (f), Transmission map -2 (g), Position of atmospheric light (h).

Another analysis of contrast enhancement based dehazing algorithm shows the result taken for the foggy forest. Hence we have comparative results that show how the dehazing algorithm is more effective than traditional algorithms.

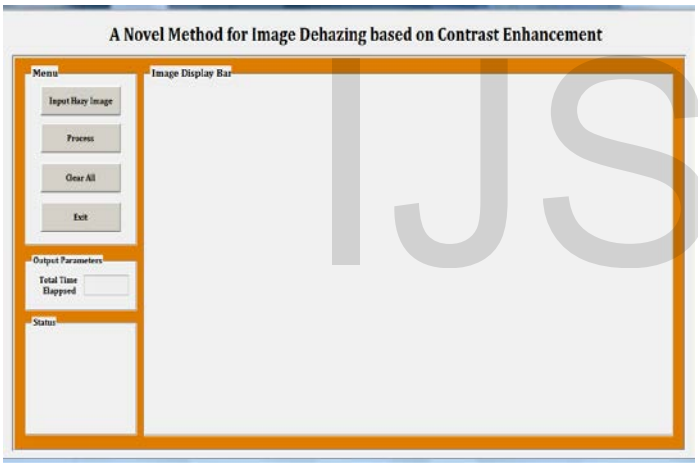


(a) (b) (c) (d)

(e) (f) (g) (h)

Figure 5.2. Some of the dehazing results.

The sample hazy input image (a), Depth map 1 (b), Depth map 2 (c), Depth map 3 (d). The Dehazed image (e), Transmission map 1 (f), Transmission map 2 (g), Position of atmospheric light (h).



Figure, 5.3. A blank GUI window for Image Dehazing based on contrast enhancement

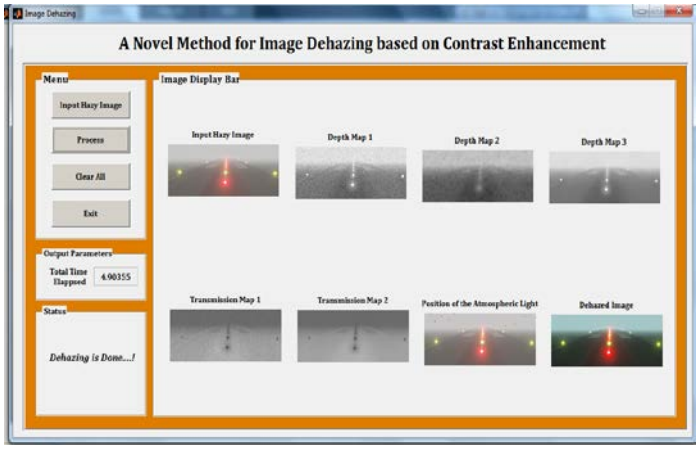
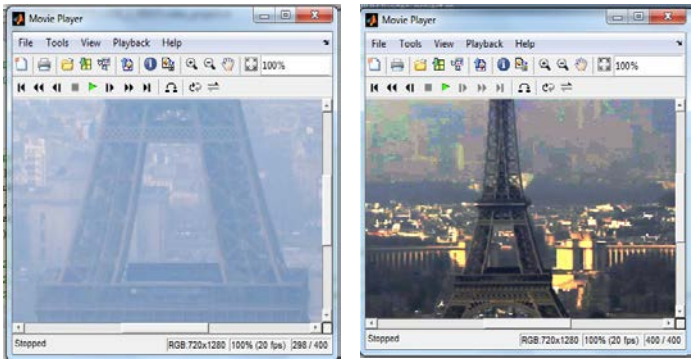
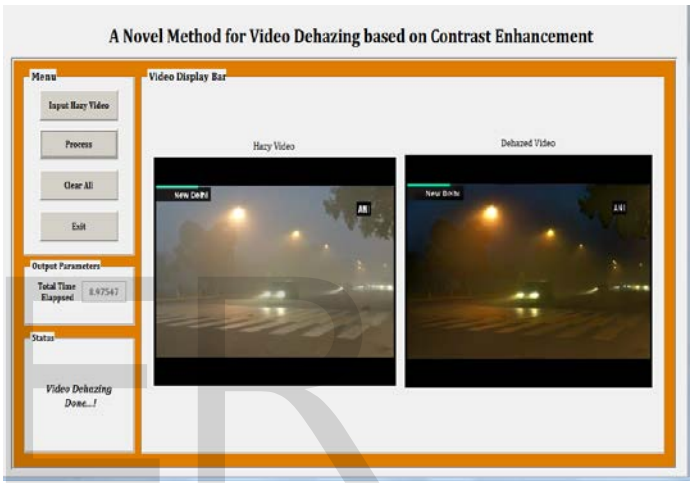


Figure.5..4. A complete GUI window for Image Dehazing based on contrast enhancement



Figure, 5.5. A Comparitive Result Showing Video Dehazing



Figure, 5.6. A GUI window for Video Dehazing after performing dehazing process.

5. CONCLUSION

Analysis of Video and Image affected by weather phenomenon and environmental conditions (nothing but Haze), an algorithm is proposed as, 'Contrast Enhancement'. Contrast enhancement is a process that makes the video and image features stand out more clearly by making optimal use of the colours available on the display or output device. This algorithm is applied to the Image and video and then we moving towards the Real-time video, which can be used in surveillance system, in the field of Public safety. Video and Image quality can be clear by estimating the airlight. Then, the depth estimation process is used to identify the depth information of given input. Finally gamma correction technique is used to clear the quality or visual perception of image and video. Hence finally we have a result of pure, clear image and video which is visible to human eye.

ACKNOWLEDGMENT

I owe my sincere thanks towards my Project Guide **Prof. A. R. Nichal** for his constant guidance during my project paper work and for encouraging me to do selective project work. With his guidance I have overcome, all the intricacies that I camea cross during the course of time. He has always kept up the work environmentfull of zeal and enthusiasm, right from beginning to end, without letting me gointo the resilient mode. I am thankful to college, especially to the Electronics andTelecommunication Department for providing facilities.

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