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Review of Image Haze Removal Techniques at a Glance

Anupama
Vivekanand Institute of Technology and science

Lavi Tyagi
Monad University

Abstract: **Haze in images creates problems to various computer vision and computer graphics applications. So, image haze removal has become very important step in computer vision, due to vast development and increasing demand of various applications. Mostly images are captured outdoor. Some times in bad weather conditions so images can contain haze as well as some noise. Noise and haze both degrade the quality of an image. Haze is formed due to the combination of attenuation and airlight. Attenuation reduces the image contrast and air light increases the whiteness in the image, Hence, making the images unclear. So the objective of this paper is to give a brief review of various image haze removal techniques.**

Keywords: Image denoising, Image dehazing, Color attenuation prior, Adaptive mean filter, Atmospheric scattering model, Image enhancement, Image restoration etc.

I. INTRODUCTION

Open air pictures taken in awful climate conditions lost shading and differentiation. Awful climate conditions, for example, dimness, fog and haze corrupt the nature of pictures in light of the fact that such conditions changes the shading and complexity of pictures which is a troublesome issue to picture takers. It is a risk to many picture preparing applications. poor atmosphere conditions additionally diminish the nature of satellite and underwater pictures.

Effective haze removal is very widely demanded area in computer vision and graphics applications. Concentration of haze is different from place to place. Quality of image in haze weather condition is reduced due to scattering of light. This may affect the normal working of many systems like automatic monitoring systems, transportation systems, outdoor recognition systems and tracking systems. Scattering of light is mainly due to 2 atmospheric phenomena: air light and attenuation. Haze attenuates the reflected light from scene and some additive lights are mixed. Haze removal helps to improve reflected light from mixed light. By using effective haze removal techniques stability and effectiveness of visual system can be improved.

Haze image and haze free image both are shown below[1]

Figure 1: Input Haze Image

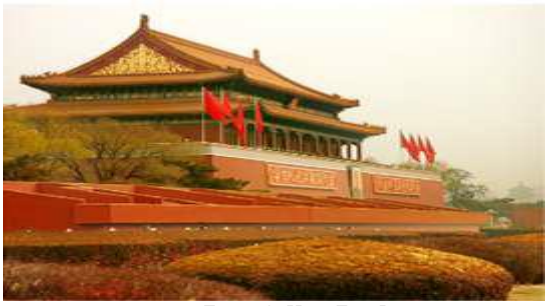

Figure 2: Haze Free Image

Haze removal needs depth map and transmission map estimation. In haze removal image enhancement and restoration techniques are used. Picture dehazing utilizing our strategy to enhance the nature of dim picture and restore visibility of pictures.There are haze removal techniques like polarization,independent component analysis and dark channel prior. early works for haze removal use multiple images of the same scene.[1]

II. LITERATURE REVIEW

Sreekutty K* et al. said that Haze brings difficulties to many computer vision and computer graphics applications. Single image haze removal is a challenging task. In order to solve this problem a simple but powerful method to remove haze from single image is proposed. It uses a color attenuation prior model for haze removal. A linear model is build for modeling the depth of the scene and using depth map we can easily estimate transmission map and outlook radiance, thus effectively removing haze from single image. In the haze free image some confidential data like time at which images are taken and temperature of the place from where the images are taken can be made hidden and this secret message can be recovered whenever necessary [1].

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Prashant Rajaram Sawant et al. introduced Transmission of Visual information in the form of digital image is becoming a major method of communication in the modern age but still the image received after transmission is corrupted with some noise, so the received image requires processing before it can be used in application. Our aim is to remove the noise from noisy laser image because it include several types of noises like random noise, speckle noise, Gaussian noise, salt and pepper noise, Brownian noise etc. Image Denoising is involved manipulation of image data to produce a visually high quality image. Proposed method in this paper is used to improve the quality of image by improving its features. The laser image processing area has received considerable attention in the last decades. Using some special type of filter it is possible to denoise the image. The filter we will employ is homomoprphic & Gaussian low pass filter for smoothing the image. Image denoising is required for various researcher in laser community for their research activity. Thus laser image denoising is very important factor for various domains like medical &Engineering applications. There are various methods or algorithms are available for denoising of image like spatial domain filtering, nonlinear filtering, wavelet domain, etc. In all of these wavelet transform have some advantages like.
a) wavelet offer a simultaneous localization in time and frequency domain.
b) it is computationally very fast.
c) one of the most important advantage of wavelet transform is that it separate the fine details in a signal, very small wavelet can be used to separate very fine details in a signal while very large wavelet can identify course details [2].

Angitha P V et al. has introduced that dehazing plays a dominant role in many image processing applications. The visibility of outdoor images is often degraded due to the presence of haze, fog, sandstorms etc. Poor visibility occured by atmospheric phenomena causes failure in image processing applications. Haze leads to failure of many computer vision or graphics applications as it decreases the visibility of the scene. Haze is formed due to the two fundamental phenomena that are attenuation and air light. Haze removal also known as dehazing refers to different methods that aim to reduce or remove the image degradation that occurred while the digital image was being obtained during inclement weather conditions. This paper gives a brief idea about different image dehazing techniques and also provides an idea about an advanced color attenuation prior based dehazing technique. Colour attenuation prior based dehazing provides a better dehazing results and enhances the contrast of the image very well in comparison to other prior based dehazing techniques and this dehazing technique can be enhanced by adding a edge attenuation operation so a better dehazing result can be achieved. [3].

Figure 3: Color Attenuation Prior Based Dehazing Process

Lakshmi Raj et al. said Image haze removal has become an important research direction in the field of computer vision because of the immense development and increasing demand of its applications. Outdoor images that are captured in poor weather are degraded due to factors like noise and haze. These factors seriously affect the visibility of the image. Images may contain impulse noise which is produced by the sensor and circuitry of image-capturing devices like cameras. Images may also contain haze, which is appeared due to the combination of two fundamental phenomena namely: attenuation and airlight. Attenuation reduces the image contrast and air light increases the whiteness in the image, thereby making the images unclear. This work presents a hybrid approach for denoising and dehazing a single noisy and hazy image. First, the input image is passed through an adaptive median filter to remove the impulse noise. Then the resultant image is dehazed using simple color attenuation prior. The experimental results showed that the visual quality of the output images are much better than the original input images, which proves the efficiency of this method [4].

Ms Munira A Jiwani* et al. has introduced that Visibility in bad weather condition is severely reduced by scattering of light due to suspended particles in the atmosphere such as haze and fog. In this paper, authors have proposed defogging method from a single image based on depth estimation using blur. Formation of fog is the function of the depth. Estimation of depth information is under constraint problem if single image is available for defogging. Hence removal of fog requires assumptions or prior information. The accurate thickness of haze or fog from a single image in these poor environment is still a challenging task. In this paper a method is proposed to estimate the depth of the image based on blur estimation. The main origins of blur are objects being out of focus, shadows casted by objects or objects having a physical surface that is perceived as blur. An object out of focus will

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produce a blur just because it is too far away from the focal plane. This already hints to distance or depth. The amount of blur that is in a part of such an image increases with depth. Therefore in this method if we can estimate the amount of blur we can estimate the relative depth. In an image that includes objects in focus and out of focus are perceived with various blur. Measure of blur can be used for segmentation of image in terms of depth [5].

(a) (b)

Figure 4: (a) Original foggy image (b). Restored Image

Surabhi Deshpande et al. focused on implementing image processing for human understanding in low visibility using different image processing techniques, high-speed processors, employing the BBB board in designing embedded systems and rules with their comparative study. They have proposed a system called as "image processing for human understanding in low visibility". The purpose of this application is to overcome the problem of Low-visibility conditions for Navigation of vehicles, Driving at night, in blizzards, in sand storms or in fog form an obvious set of challenging conditions. The main motive is to solve the problem of low visibility by advanced image processing technique purpose to improve the perceptual quality of images that lack the
contrast or color depth perceived by the human visual system. This paper provides the use of high-speed infrared cameras and advanced image processing techniques to deal with the problem of low visibility [6].

Snehal O. Mundhada et al. has introduced Image enhancement is the task of applying certain alterations to an input image like as to obtain a more visually pleasing image. The alteration usually needs interpretation and feedback from a human evaluator of the output resulting image. Image enhancement is to improve the image quality so that the resultant image is superiorthan the original image for a specific application or set of objectives. Enhancement techniques such as alpha rooting operate on the transform domain. The transform domain enables operation on the frequency content of the image and therefore high frequency content such as edges and other precise information can easily be enhanced. However these techniques bring about tonal changes in the images and can also generate unwanted artifacts in many cases, as it is not possible to enhance all parts of the image in balanced manner [7].

Khitish Kumar Gadnayak et al. said one of the important problem in the area of image processing is the restoration of the images those are corrupted due to several degradations. Images of outdoor scenes captured in a poor weather conditions contain atmospheric degradation such as haze, fog, smoke occured by the particles in the atmospheric medium absorbing and scattering as the light travels from the scene point to the observer. Due to the presence of these atmospheric particles there is a resultant decay in the color and contrast in the captured image in the bad weather conditions. This may cause difficulty in detecting the objects in the captured hazy images. Now a days due to the recent development of the computer vision area itis possible to improve the outdoor hazy images and remove the haze from the images. This paper describes the different haze removal processes to remove the haze in the captured hazy images to recover a better and improved quality haze free images [8].

III. CONCLUSION

In this paper we have addressed different method in which the haze can be estimated from the captured hazy images. Most of the techniques are useful for altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in many cases produces undesirable results. There are various techniques available which produce highly balanced and visually appealing results for a diversity of images with different qualities of contrast and edge information.

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