Image Dehazing Techniques in Image Processing

Rauki[1], Parmendra Singh[2]
[1]M. tech Scholar, [2]Assistant Professor
Sachdeva Institute of Technology , Mathura, UP, India

***Abstract* -** In this paper we are studying Image Dehazing Techniques in Image Processing. The dehazing techniques is the process of removing haze from a captured image. Over the previous century, many scientists have dedicated themselves to the question of how to achieve a high-quality picture. In order to enhance the precision and preserve the actual picture content in Globally Guided Image Filtering, it is crucial to identify appropriate filtering methods to enhance the method. Haze causes many computer vision / graphics apps to fail as it decreases the scene's visibility. Because of the two basic phenomena of attenuation and air light, Haze is created. Haze removal also known as dehazing relates to various techniques aimed at reducing or removing the degradation of the picture that happened while the digital image was acquired during inclement weather.

***Keywords* -** Image Dehazing, Globally Guided Image Filtering, phenomena, degradation, inclement weather

I. INTRODUCTION

Images acquired outdoors are sometimes degraded by a decrease in visibility caused by small particles suspended in the atmosphere. This physical phenomenon is known as haze or fog, and its main effect is the attenuation of the radiance along its path towards the camera [1]. acquired images and videos suffer from loss of contrast and colour quality degradation, limiting visibility on far away areas in the scene. This lack of visibility can hinder the performance of computer vision systems designed to operate on clear conditions and also decreases visual pleasantness of image contents for users of standard consumer cameras [1]. Haze removal or dehazing is highly required in computer vision applications and in computational photography. Removing the haze layer from the input hazy image can significantly increase the visibility of the scene. The haze free image is basically visually pleasing in nature. Many vision algorithms suffer from low-contrast scene radiance. In Computer Vision area haze removal is one of the challenging problem or tasks as because the haze is dependent on unknown depth [2]. Bad weather condition such as haze, mist, fog and smoke degrade the quality of the outdoor scene. It is an annoying problem to photographers as it changes the colours and reduces the contrast of daily photos, it diminishes the visibility of the scenes and it is a threat to the reliability of many applications like outdoor surveillance, object detection, it also decreases the clarity of the satellite images and underwater images. So, removing haze from images is an imperative and broadly demanded area in computer vision and computer graphics [3]. The outdoor images captured in inclement weather are degraded due to the presence of haze, fog, rain and so on. Images of scenes captured in bad weather have poor contrasts and colours. This may cause difficulty in detecting the objects in the captured hazy images. Due to haze there is a trouble to many computer vision applications as it diminishes the visibility of the scene [4].

Single-image dehazing approaches were introduced to overcome this obstacle. A single-image dehazing technique assumes no external knowledge of the scene an image depicts. However, since haze is a depth-dependent phenomenon, the resulting image degradation is spatially-variant, with different areas of the image being more affected. In this situation, unavailable depth information is typically alleviated by resorting to physical models of haze formation. Unfortunately, even simplified physical models need to hold depth information, either implicitly or explicitly. As a result, most existing single-image dehazing methods impose prior information on the image the user expects to obtain, e.g. an increased contrast or less attenuated colors [5].

II. LITERATURE REVIEW

The task of restoring the visual quality of weather-degraded images has been increasingly drawing attention in recent years. In this context, the image processing problem concerned with removing the effect of foggy conditions is known as image dehazing. The availability of effective image dehazing techniques can have a positive impact in computer vision tasks that need to be performed in outdoor scenarios, such as surveillance, remote sensing, or autonomous driving under bad-weather conditions. Haze degradation is known to increase with respect to depth in the imaged scene. However, due to the ambiguity introduced by the lack of depth information in two-dimensional images, early solutions to remove haze relied on external sources of information. Unfortunately, this external information is not usually available in generic situations, limiting the applicability of this kind of techniques [1]. Haze removal or dehazing is highly required in computer vision applications and in computational photography. Removing the haze layer from the input hazy image can significantly increase the visibility of the scene. The haze free image is basically visually pleasing in nature. Many vision algorithms suffer from low-contrast scene radiance. In Computer Vision area haze removal is one of the challenging problem or tasks as because the haze is dependent on unknown depth. For a single input hazy image, the haze removal problem is under constrained problem. Haze is an atmospheric phenomenon where dust, smoke and other dry particles obscure the clarity of the sky. The process of removing haze from image is called dehazing. Haze is an atmospheric phenomenon which causes degradation of outdoor images and weakening of both colour and contrast images. The bad weather conditions may demean the quality of the images of outdoor scene [2]. The image quality of outdoor scene in the haze, fog, mist and other bad weather condition is usually degraded by the scattering of a light before reaching the camera due to these large quantities of suspended particles (e.g. fog, haze, smoke, impurities) in the atmosphere. This phenomenon affects the normal work of automatic monitoring system, outdoor recognition system, tracking & segmentation and intelligent transportation system. Scattering is caused by two fundamental phenomena such as attenuation and air light. Haze attenuates the light reflected from the scenes, and further blends it with some additive light in the atmosphere. The target of haze removal is to improve the reflected light (i.e., the scene colors) from the mixed light. The constancy and strength of the visual system can improve by the usage of effective haze removal of image [4]. While capturing the outdoor image during bad weather condition, the radiance received by the camera from the scene is attenuated along the line of sight. The incoming light is mixed with the light coming from all other directions called the Air light. It adds whiteness in the image.

Hazy and Dehazed images:-

Figure 1: Hazy Image(trees)

Figure 2: Dehazed Image(trees)

It adds whiteness in the image. And the second component Attenuation is the gradual loss in intensity. Due to this the there is significant decay in the colour. Amount of scattering depends on the distance between the scene points and the camera. So, the degradation is spatially variable. Dehazing is highly required in consumer photography and computer vision applications. Because many computer vision applications are suffer from low- contrast scene radiance. For example, there is a problem of haze in under water images. There are many methods available to remove haze from outdoor image [4].

Traditional techniques Of Dehazing: A haze removal approach with multiple images of the same scene under different weather conditions provides different algorithms.

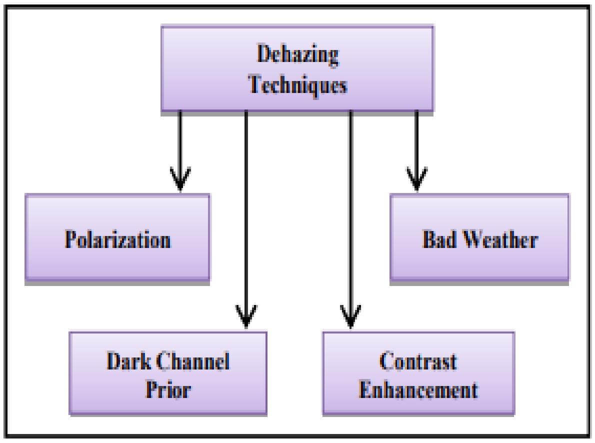

Figure 3: Traditional Approaches of Dehazing Techniques

Polarization: In the partial polarized approach for easily removing the effects of haze from passively acquired images. The proposed approach based on the fact of usually the natural illuminating light scattered by atmospheric particles air light is partially polarized. Bad Weather: Outdoor imaging is cursed by poor visibility conditions due to atmospheric scattering, mainly in haze. A severe problem is varying spatially reduction of contrast by stray radiance (air light), which is scattered by the haze particles towards the camera. Dark Channel Prior: A simple but very effective image prior i.e. dark channel prior to remove haze from a single image given as input. The dark channel prior approach is a statistic of the hazefree outdoor images. It is based on a key observation mostly; local patches in the haze-free outdoor imaging contain some pixels which have very low intensities in at least one colour channel. Contrast Enhancement: An approach of block-overlapped histogram equalization system for enhancing contrast of image sequences is explained [8]. Bad weather conditions such as haziness, mist, foggy and smoky degradation in the quality of the outdoor scene. It is an annoying problem to photographers as it changes the colors and reduces the contrast of daily photos, it diminishes the visibility of the scenes and it is a threat to the reliability of many applications like outdoor surveillance, object detection, it also decreases the clarity of the satellite images and underwater images. So, removing haze from images is an imperative and broadly demanded area in image processing [10]. In theory, image dehazing removes unwanted visual effects and is often considered as an image enhancement technique. However, it differs from traditional noise removal and contrast enhancement methods since the degradation to image pixels that is induced by the presence of haze depends on the distance between the object and the acquisition device and the regional density of the haze. The effect of haze on image pixels also suppresses the dynamic range of the colors [7].

Classification of Dehazing Method:

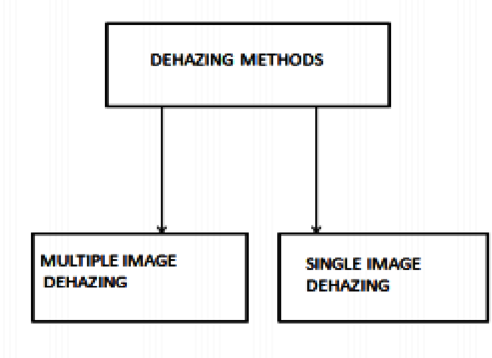

Figure 4: Classification of Dehazing Method

These atmospheric conditions are used to blur the captured scene. The air is added some misted particles. Which are scattered around the reflected light is also scattered. These scattered events mainly classified into two types such as attenuation and air light. Dehazing methods can be classified into two as given in Figure 4. 1)Multiple Image Dehazing 2) Single Image Dehazing. Multiple Image Dehazing Method. In This Haze Removal, Two Or More Images or Multiple Images of The Same Scene Are Taken. This Method Attains Known Variables and Avoids the Unknowns. Single image Dehazing has become a challenging task for a variety of image processing and computer applications. Experimental results on real and synthesized hazy images demonstrate an improved performance in the proposed method when compared to existing state-of-the-art methods [9]. The main contribution of this paper is an alternative single image dehazing method that employs physical models of haze formation only as an inspiration to understand characteristics of the image we expect to obtain. We consider single-image haze removal as a spatially-varying contrast and saturation enhancement problem on which different areas of the image require distinct levels of processing. Hence, a new image dehazing technique aiming at increasing visual quality only on those areas is built. This is achieved by artificially underexposing the hazy image through a series of gamma-correction operations. The resulting set of progressively underexposed images contains regions with increased contrast and saturation. To further account for the spatially varying nature of weather degradation, a simple and efficient multi-scale fusion scheme is applied in order to collect from each image the best-quality areas and combine them into a single haze-free output [5].

III. CONCLUSION

For many vision apps, haze removal algorithms become more helpful. It is discovered that most current scientists have overlooked many problems; i.e. for distinct types of conditions, no method is precise. Pre-based dehazing of colour attenuation provides better dehazing outcomes and enhances the image contrast very well compared to other pre-based dehazing methods and this dehazing method can be improved by adding an edge attenuation procedure so that a better dehazing outcome can be achieved. For many computer vision apps, dehazing algorithms are very helpful. Poor visibility due to atmospheric phenomena in turn leads failure in computer vision apps such as outdoor object recognition systems, barrier detection systems, video surveillance systems, and smart transport systems. Visibility recovery methods were created and play a main role in many computer vision apps operating under different weather conditions.

IV. REFERENCES

[1]. Galdran et al., “Image Dehazing by Artificial Multiple-Exposure Image Fusion” March 26, 2018

[2]. Angitha P V et al., “A Review on Image Dehazing Techniques” Vol. 5, Issue 4, April 2017

[3]. Ruchika Sharma et al., “A Review on Different Image Dehazing Methods” Volume VI, Issue III, June 14

[4]. Shruti P. Patel et al., “A Review on Methods of Image Dehazing” Volume 133 – No.12, January 2016

[5]. Wencheng Wang et al., “Recent Advances in Image Dehazing” IEEE/CAA Journal of Automatic Sinica, Vol. 4, No. 3, July 2017

[6]. Ms. Titiksha N et al., “Image Dehazing Techniques: A Review of Research Trends” Vol. 5, Issue 4, April 2016

[7]. Khitish Kumar Gadnayak et al., “A Survey on Image Dehazing Methods” Vol. 2 Issue 10, October – 2013.

[8]. Dr. Vinod Shokeen et al., “A Study on Haze Removal Techniques for Image Processing” Vol. 5, Issue 5, May 2016

[9]. Zhengning Wang et al., “A Comprehensive Study on Fast Image Dehazing Techniques” Vol. 2, Issue. 9, September 2013, pg.146 – 152

[10]. Raanan Fattal et al., “Single Image Dehazing” 2007. Multiscale shape and detail enhancement from multi-light image collections. In ACM SIGGRAPH, 51.