A Comparative Study on Image Dehazing

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Abstract- Images and videos captured in hazy weather often yield low contrast and offer limited visibility due to the presence of haze in the atmosphere. Hazed images and videos, which suffer from biased colour contrast and poor visibility, unavoidably degrade the performance of various computer vision applications that require robust detection of image and video features, such as photometric analysis, object recognition and target tracking. Dehazing is a process of restoring the true appearance, i.e. recovering what the scene should have looked like on a clear day, by enhancing the colour contrast and sharpening the details.Therefore, the restoration of hazed images and videos has attracted increasing attention in the last few years. Dehazing is a process of restoring the true appearance, i.e. recovering how the scene would have looked on a clear day, by regulating the colour contrast and sharpening the details. This examination work presents an extensive survey of literature on learning a patch quality comparator for single image dehazing.

Keywords- Image Processing, Image Restoration, Image Dehazing, Noise Rejection, Visibility Enhancement,Computer Vision.

I. INTRODUCTION

Nowadays, outdoor applications of media such as broadcasting winter sport events, camera monitoring, and driver assistance systems are often exposed to bad weather due to the presence of atmospheric particles causing fog or haze. At the same time, fog or haze could have some benefits in the artistic domain through simulation or painting for instance. Often contain an atmospheric perspective - known also as aerial perspective - of a background scene, where further scene points were painted brighter and bluer. The term ethereal point of view was first utilized by Leonardo Da Vinci in his Treatise on Painting, in which he stated: "Colors wind up more fragile in extent to their separation from the individual who is taking a gander at them.". Additionally called climatic viewpoint, aeronautical point of view is a technique for making the fantasy of profundity, or retreat, in a sketch or attracting by balancing color to mimic changes affected by the air on the shade of articles saw from more remote away. It is clear, at that point, that if painters use dimness or mist to give the profundity impact on their canvas, haze is quite important for one to perceive a scene as natural.

Images of outside scenes regularly contain haze, fog, or different kinds of barometrical corruption brought about by particles in the climatic medium retaining and dispersing light as it ventures out from the source to the spectator. While this impact might be attractive in an aesthetic setting, it is now and then important to fix this debasement. For instance, numerous PC vision algorithms depend on the supposition that the information image is actually the scene brilliance, for example there is no unsettling influence from haze. At the point when this presumption is abused, algorithmic errors can be cataclysmic. One could without much of a stretch perceive how a vehicle route framework that did not produce this results into record could have perilous outcomes. Appropriately, finding viable techniques for haze expulsion is a progressing territory of enthusiasm for the image processing and PC vision fields.

A widely used model for haze formation is:

$$I(x) = R(x)t\,(x) + a_\infty\big(1 - t\,(x)\big) \dots\dots\dots.(1.1)$$

where x is a pixel location, I is the observed image, R is the hidden scene brilliance, a∞ is the environmental light (or airlight), and t is the transmission coefficient. Instinctively, the image gotten by the observer is the raised blend of a weakened rendition of the basic scene with an additive haze layer; here the atmospheric light represents the color of the haze. A definitive objective of haze evacuation is to discover R, which likewise requires learning of a∞ and t. From this model, it is clear that haze expulsion is an under-obliged issue. In a grayscale image, for every pixel there is just 1 imperative yet 3 questions; for a RGB color image, there are 3 limitations yet 7 questions (accepting t is the equivalent for each shading channel). Basically, one must purpose the uncertain inquiry of whether an item's shading is an aftereffect of it being far away and blended with haze, or if the article is near the spectator and just the correct color.

Computer vision is a discipline that provides innovative technologies for a wide spectrum of applications, including feature detection, surveillance, target tracking and telecommunica- tions, by making the best use of visual data, i.e. images and videos. Nowadays, cameras are ubiquitous and the number of images and videos generated is overwhelming. In recent years, automatic image and video processing has attracted extensive research interest.

Figure: 1.3 Image dehazing (a) hazed image (b) dehazed image.

Although computer vision systems have achieved great success in controlled and structured indoor environments, they have limitations when deployed outdoors, especially in hazy weather, because most computer vision systems are designed for clear weather images and videos and they assume the input is the unaltered scene radiance. Suspended haze particles in the atmosphere can scatter, refract and absorb light, and consequently lead to poor visibility; low contrast and colour offset in the images and videos captured in hazy conditions (see Fig.1.1 (a)). In order to successfully deploy computer vision systems outdoors, a robust dehazing process for hazed images and videos is essential. Fig.1.1 (b) gives an example of the dehazed result for the hazed image in Fig.1.1 (a). The first step in dehazing process is to investigate and model the physical process that generates a hazed image and video.

II. IMAGE DEHAZING

A number of developments in computer vision are there to enhance the visibility of outdoor images by reducing the undesirable effects due to scattering and absorption caused by the atmospheric particles. This could be a pre-step of other applications, which assume that input is exactly the scene radiance. Otherwise, these algorithms would generate inaccurate results.

Dehazing is needed for human activities and in many algorithms like recognition, track- ing and remote sensing and sometimes in computational photography. Applications that are of interest in this scope: fully autonomous vehicles typically use computer vision for land or air navigation, monitored driving, outdoor secu- rity systems, or remote surveillance systems. In bad visibility environments, such applications no longer function efficiently. An extra layer of processing should be added.

Image dehazing is a transdisciplinary challenge, as it requires knowledge from different fields: meteorology to model the haze, optical physics to understand how light is affected by this haze and computer vision as well as image and signal processing to recover the parameters of the scene. Researchers have been always searching for an optimal method to get rid of degradation by light scattering along aerosols. Many methods have been proposed and compared to each other. Although today we have a varied collection of approaches, they are limited and they do not meet efficient recovery requirements.

Throughout dehazing process, many modifications are introduced, affecting the image features. These modifications might lead to have a better or a worse rendering to the whole image, while knowing that image features are affected differently. The rendering level depends directly on the method hypothesis and the distortions introduced by the viewing and capture conditions.

The physical model used in our approaches that are presented in the Fig., is similar to the one employed in previous single image dehazing methods. When examining an outdoor scene from an elevated position, features gradually appear lighter and fading as they are closer towards the horizon. Only a percentage of the reflected light reaches the observer as a result of the absorption in the atmosphere. Furthermore, this light gets mixed with the airlight color vector, and due to the scattering effects the scene color is shifted (illustrated in Fig. 2.1).

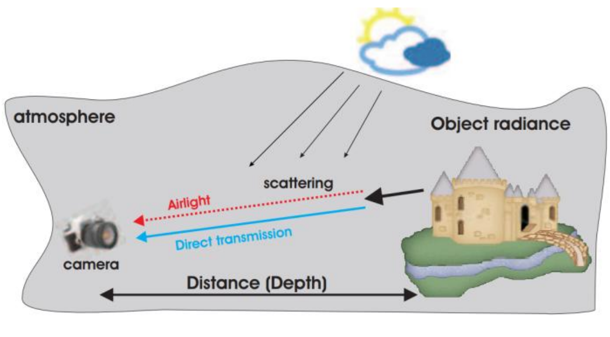

Fig. The optical model for the atmospheric phenomenon of haze.

III. LITERATURE REVIEW

SR.NO.	TITLE	AUTHOR	YEAR	APPROACH
1	Learning a Patch Quality Comparator for Single	S. Santra, R. Mondal and B. Chanda	2018	Reported a method that dehazes a given image by comparing various output patches with the original hazy version and then

	Image Dehazing			choosing the best one
2	Efficient real-time single image dehazing based on color cube constraint,	E. A. Kponou, Z. Wang and P. Wei	2017	A simple but effective prior, a variation of distance (VoD) prior has developed to estimate the transmission map and remove haze from a single input image
3	Single image dehazing using non-symmetry and anti-packing model based decomposition and contextual regularization,	Y. Zheng, Z. Xie and C. Cai	2017	A scheme of improved single image dehazing based on NAM (Non-symmetry and Anti-packing Model)-based decomposition and contextual regularization is reported
4	Learning deep transmission network for single image dehazing	Z. Ling, G. Fan, Y. Wang and X. Lu	2016	A deep transmission network for robust single image dehazing has been developed.
5	Single Smog Image Dehazing Method	W. Rui and W. Guoyu	2016	A novel dehazing method based on propagating deconvolution and dark-channel prior has been reported.
6	Single image dehazing with varying atmospheric light intensity	S. Santra and B. Chanda	2015	Reported a method that works under the relaxed assumption that the color of atmospheric light is constant but its intensity may vary in the image
7	Single image dehazing based on maximizing local contrast,	H. Dong and C. Zhao	2015	A fast and efficient method based on local contrast maximization and atmospheric scattering model has reported

S. Santra, R. Mondal and B. Chanda, [1] In terrible climate conditions, for example, fog and haze, the particles present in the environment disperse episode light in various ways. Thus, the image taken under these conditions experiences decreased perceivability and absence of differentiation, and subsequently, it seems drab. An image dehazing technique attempts to recuperate a sans haze depiction of the given murky image. In this work, propose a strategy that dehazes a given image by contrasting different output patches and the first dim form and afterward picking the best one. The correlation is performed by our proposed dehazed patch quality comparator based on the convolutional neural system. To choose the best dehazed patch, utilize parallel inquiry. Quantitative and subjective assessments demonstrate that our technique accomplishes great outcomes in the greater part of the cases, and are, on a normal, practically identical with the cutting edge strategies.

E. A. Kponou, Z. Wang and P. Wei, [2] Image debased by haze is a basic perspective in the present condition while getting a great without haze image remains a vital assignment in PC vision. In ongoing year, numerous works have been done to enhance the perceivability of image taken under terrible climate. Customary structures utilize different image or potentially single image to manage haze expulsion. In this work, utilize a basic yet viable earlier, a variety of separation (VoD) earlier, to estimate the transmission guide and expel haze from a solitary information image. The VoD earlier is produced based on the possibility that the open air perceivability of images considered under murky climate conditions important diminished when the separation increments. The thickness of the haze can be estimated adequately and a without haze image can be recuperated by receiving the VoD earlier and the new haze imaging model. Our strategy is steady to image neighborhood locales containing objects in various profundities. Our trials demonstrated that the proposed technique accomplished preferable outcomes over a few best in class strategies, and it very well may be actualized rapidly. Our strategy because of its quick speed and the great special visualization is appropriate for continuous applications. This work affirms that assessing the transmission delineate the separation data rather the shading data is a pivotal point in image improvement and particularly single image haze expulsion.

Y. Zheng, Z. Xie and C. Cai, [3] as the need of individuals seeking after the great nature of photographs is becoming quicker in nowadays, there are heaps of impacts which have been done to enhance the visual of the image taken in terrible climate, for example, the fog. In this work, a plan of enhanced single image dehazing based on NAM (Non-symmetry and Anti-pressing Model)- based deterioration and contextual regularization is proposed. Right off the bat, presented the essential thought of the Non-symmetry and Anti-pressing Model. And after that the foggy image is disintegrated utilizing NAM for the dehazing procedure. At long last, the limit requirement and contextual regularization are utilized for the scene transmission. The trial results displayed in this examination demonstrated the enhancement of the dehazing impact by our proposed technique.

Z. Ling, G. Fan, Y. Wang and X. Lu, [4] Best in class single image dehazing algorithms have a few difficulties to manage images caught under complex climate conditions in light of the fact that their suspicions for the most part don't hold in those circumstances. In this work build up a profound transmission arrange for hearty single image dehazing. This profound transmission organize at the same time adapts to three shading channels and neighborhood patch data to consequently investigate and abuse haze-important features in a learning structure. Further investigate diverse system structures and parameter settings to accomplish tradeoffs among execution and speed, which demonstrates that shading channels data is the most helpful haze-significant component as opposed to nearby data. Investigation results show that the proposed algorithm outflanks cutting edge techniques on both manufactured and genuine world datasets.

W. Rui and W. Guoyu, [5] Images in fog or exhaust cloud corrupt frightfully, despite the fact that there were many image dehazing strategies, which were not exceptionally viable to brown haze images. This work proposed a novel dehazing strategy based on spreading deconvolution and dim channel earlier. Spreading deconvolution went for recuperating brown haze image to dispose of the exhaust cloud before the scene, it could travel the "brown haze image" to "fog image". While dull channel earlier could upgrade the subtleties and enhance the complexity. The outcomes demonstrates that this strategy exhibitions better in exhaust cloud image recuperation.

S. Santra and B. Chanda, [6] Images taken in terrible climate conditions like haze and fog experience the ill effects of loss of complexity and shading shift. The item brilliance is weakened in the air and the climatic light is added to the scene brilliance making a cloak like semi-straightforward layer called airlight. The techniques proposed till now expect that the climatic light is consistent all through the image space, which may not be genuine dependably. Here propose a technique that works under the casual presumption that the shade of air light is steady yet its force may differ in the image. Utilize the shading line model to estimate the commitment of airlight in each patch and add at spots where the estimate isn't solid. Apply turn around activity to recoup the haze free image.

H. Dong and C. Zhao, [7] So as to reestablish perceivability from a solitary corrupted image, propose a quick and proficient strategy based on nearby complexity expansion and environmental dissipating model. As indicated by the qualities of open air imaging and the hypothesis of chart cuts, the first technique based on nearby differentiation augmentation was enhanced and advanced. This work prepared various debased outside images to check the viability of our algorithm. The trial results demonstrate that this technique contrasted and the first has favorable position of processing pace, and it tends to most likely show signs of improvement dehazing output. Our technique astoundingly enhances the solidness and unwavering quality of open air imaging gadgets.

IV. PROBLEM DESCRIPTION

There exist today plenty of algorithms and many work about dehazing or de- fogging enhancing images taken in hazy or foggy conditions. To our knowledge none of them has yielded a significant result for both dense and non-dense haze1 image at the same time. In this examination, we will try to solve this issue. Our expectation comes from our observations in dense hazy image that the framework gives a more pleasing result when compare it with since they have a denser haze, we hope that the proposed dehazing algorithm will give us some interesting results or at least open the door to some interesting new investigations in the field.This examination work addresses the problem of recovering the underlying scene radiance of a single noisy, hazy image. The main contributions are as follows. First is an investigation on the effect of noise on an existing single image haze estimation method.

V. CONCLUSION

In this examination,extensive review on learning a patch quality comparator for single image dehazing has reported.A number of problems are addressed that hamper normal functioning of computer vision applications by making the performance and the reliable evaluation of dehazing not straightforward based on literature survey.This work consisted to apprehend first the natural physical phenomena and to model them to whether reproduce real-world or to recover useful information, which are likely to be deteriorated. All of this should be done while keeping a closeness to the real situation and maintaining a high perceived quality. Therefore, retain from this work the importance to model accurately the real situation and to consider methods, which deal with it. The accuracy of modeling depends mainly upon the data type. Color images, being limited in wavelength band, do not provide sufficient data to retrieve objects hidden with a thick fog layer.

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