A Review on Video and Image Defogging Algorithms Image Restoration Enhancement

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***Abstract*— In this paper, we propose a simple but effective image prior - dark channel prior to remove haze from a single input image. The dark channel prior is a kind of statistics of the haze-free outdoor images. It is based on a key observation - most local patches in haze-free outdoor images contain some pixels which have very low intensities in at least one color channel. Using this prior with the haze imaging model, we can directly estimate the thickness of the haze and recover a high quality haze-free image. Another downside is that the captured hazy road image contains localized lightweight sources or color-shift issues owing to duster conditions. the target of this work is to implement the Road Scenes Captured by Intelligent Transportation Systems mistreatment Hybrid technique. to reinforce the pictures mistreatment completely different filters, restoration and improvement techniques.**

***Index Terms*— Scene restoration , Depth estimation, Hazy Images , Scene radiance, Transmission etc.**

I. INTRODUCTION

Haze and fog are a typical marvel ashore and sea. In foggy and dim climate, there are numerous environmental particles of noteworthy size. They not just assimilate and dissipate the reflected light of the scene, additionally disseminate some environmental light to the camera. In this manner, the picture procured by the camera is debased and for the most part has low complexity and poor perceivability [1]. This will truly impact the visual framework particularly the unmistakable light visual framework. Because of the debasement of the picture, the objectives and hindrances of the picture are hard to distinguish. This is terrible for robotized video preparing, for example, highlight extraction, target following, and acknowledgment of articles. This is additionally one of the principle purposes behind mischance noticeable all around, on the ocean, and out and about. So it is vital to plan a picture defogging calculation to enhance the natural versatility of the visual framework. With the advancement of PC innovation, the video and picture defogging calculations have gotten much consideration and are generally connected in common and military fields, for example, remote detecting, target recognition, and activity reconnaissance. [2] utilized the picture defogging calculation to improve the perceivability of the vehicle visual framework, which can viably counteract auto collisions. For pictures of outside scenes, examined the visual indications of various climate conditions, for example, dimness, mist, cloud, and rain [3], and after that built up a physical imaging model taking into account the barometrical disseminating wonder for picture defogging [4, 5].Because the existing defogging or dehazing algorithms have no clear boundaries, in this we use image defogging to refer to algorithms that have the ability to remove fog or haze from the image. Many improved defogging algorithms based on the physical model were proposed for outdoor scenes. Some video and image defogging algorithms were also proposed for real-world traffic surveillance scenes [6-9]. In order to improve the visibility of the unmanned surface vehicle (USV) visual system, Ma et al. presented an improved image defogging algorithm based on the dark channel prior to foggy sea image restoration, and the proposed single image defogging algorithm was also extended to fast video defogging [10]. Under poor visibility conditions such as foggy weather, it is difficult to find runways and hazards from the visual system of a flight. In order to solve this problem, a contrast enhancement algorithm based on the Retinex theory which can effectively improve the visibility of the foggy image acquired by the flight visual system [11]. Most existing defogging algorithms also aim at removing fog from land images. However, there are few studies of the sea and air. The above applications all demonstrate that the video and image defogging algorithms are significant and well worth studying.

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II. DETECTION AND CLASSIFICATION OF FOGGY IMAGES

Existing video and picture defogging calculations are dependably specifically connected to the picture paying little heed to the vicinity or nonappearance of mist. Be that as it may, for true applications, it is important to know whether the picture gained in the present environment should be prepared by a defogging calculation. The fundamental reason is as per the following: perceivability of the restored picture acquired by the defogging calculation might be more regrettable than the first picture if no judgment is made. Additionally, the utilization of the defogging calculation is tedious, which is not gainful to understand the constant target identification, following, and acknowledgment. There are two strategies which can judge whether the present scene has mist or not. The principal system is the mist recognition strategy which respects the undetectable zone of the picture as the foggy region. The second strategy is the foggy picture grouping technique. A. Discovery of foggy zones in pictures Two techniques can recognize the foggy zones of the picture. The primary strategy depends on the semi-reverse picture, and the second technique depends on the meteorological perceivability separation. 1) Foggy territory location in light of the semi-converse picture initially proposed a foggy region discovery calculation in view of the 'semi-backwards' picture 5 [3]. The semi-reverse picture S is acquired by selecting the most extreme of the first picture pixel and its converse picture pixel which is defined as

$$S^c(x) = \max[I^c(x), 1 - I^c(x)],$$

where c denotes one of the RGB channels, I is the original image, and 1 -I^c denotes the inverse image of the original image. After renormalizing the inverse image, detected the foggy areas in the channel of the L_{ch} color space, and regarded the pixels which have a large difference between the semi-inverse image and original image as clear pixels, and regarded the remaining pixels as foggy pixels. This foggy area detection method is based on the fact that the intensity values of pixels in the foggy area of the image are usually much bigger than those of pixels in the clear area. In the sky or foggy areas of an image, pixels usually have a high intensity in all color channels. Thus, the semi-inverse image will have the same value as the original image in these areas. However, in clear areas, there is at least one channel of the semi-inverse image where pixel values will be replaced by the inverse image. In other words, the output of Eq.(1) is respectively the original image in foggy areas and the inverse image in clear areas. Then the foggy area can be easily detected by the difference between the original image and its semi-inverse image. This algorithm is simple and effective for detection of foggy areas in foggy images, but it is not suitable for the judgment of whether the current scene has fog or not. This is because the sky area or white area of a clear image will be mistaken for a foggy area via this algorithm.

2) Foggy area detection based on the meteorological visibility distance

The International Commission on Illumination (CIE) characterized the meteorological perceivability separation of a picture and its estimation strategy [2]. The meteorological perceivability separation of a picture is generally connected in the field of foggy picture recognition of a vehicle visual framework [3].

For a foggy picture, proposed a daytime foggy range recognition calculation by means of figuring the meteorological perceivability separation [4]. They initially utilized the Canny-Deriche channel to separate the picture forms in order to highlight the edges of roadways. At that point the locale developing calculation was performed to discover the street surface layer. Third, they set up four conditions to acquire the objective locale. At long last, the perceivability separation of the picture was gotten by ascertaining the estimation data transfer capacity. An even line to signify the perceivability separation. For the vehicle camera framework, the locale over the even line more often than not has low difference and can be viewed as the foggy zone or undetectable range. Bronte et al. likewise distinguished the foggy region of a picture by means of evaluating the perceivability separation [5].

The mist discovery technique in view of the meteorological perceivability separation partitions the foggy picture into two locales: unmistakable range and undetectable territory. In spite of the fact that the haze recognition calculation can distinguish the foggy region of pictures, it likewise has a few inadequacies. The undetectable region over the level line of the picture does not implies that it ought to be completely doled out to the foggy territory. Some removed scenes of common clear pictures additionally look hazy and might be mixed up for undetectable regions or foggy regions by the mist location calculation. Besides, for some foggy pictures with inhomogeneous haze circulation, it is elusive an even line to particular the foggy range and clear territory. In any case, the meteorological perceivability separation can be utilized to judge which zone has dainty mist or thick mist. This might be useful to appraise the parameters of defogging calculations.

III. IMAGE DEFOGGING BASED ON IMAGE RESTORATION

In 1976, McCartney first proposed the atmospheric scattering physical model based on the Mie scattering theory [5]. Fig.1 shows the physical atmospheric scattering model under foggy weather. The physical model is composed of the airlight model and direct transmission model. Fig.4 also shows the degradation reason of images under foggy conditions. In the direct transmission model, the light for imaging will be attenuated by atmospheric scattering, which leads to the degradation of edge details and object textures of the image. In the airlight model, some sunlight will also be scattered by the atmosphere and transmitted to the camera, and these lights are not the scene lights and can be considered as the fog component of the image whose influence is similar to that of a veil to hide the objects in the image. For a clear image, the direct transmission model makes up a large proportion in the imaging model. With an increase of the concentration of the fog, the proportion of the direct transmission model will decrease while the proportion of the airlight model will increase and visibility of the image will decrease. In other words, the airlight model is the main reason that leads to an image acquired under foggy conditions being a fuzzy image with low contrast and visibility. Regarded that the scattering coefficient is not relevant to the wavelength of visible light in the homogenous atmosphere and presented a simplified physical model for image restoration:

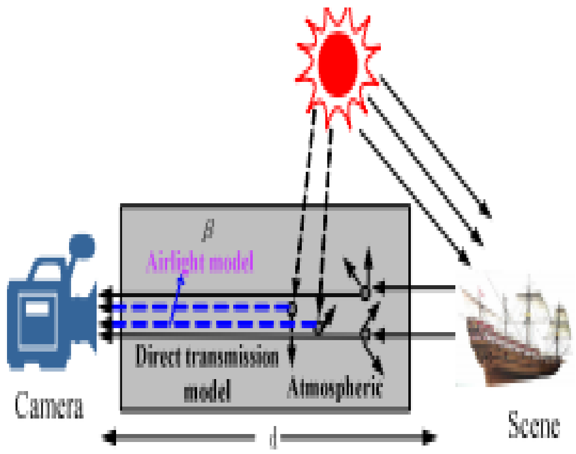

Fig.1 Physical atmospheric scattering under foggy conditions

I. LITERATURE SURVEY

I studied so many papers and some of them are given below:

Yong Xu et.al. [2014] have presented Video and images acquired by a visual system are seriously degraded under hazy and foggy weather, which will affect the detection, tracking, and recognition of targets. Thus, restoring the true scene from such a foggy video or image is of significance. The main goal of this paper was to summarize current video and image defogging algorithms. We first presented a review of the detection and classification method of a foggy image. Then, we summarized existing image defogging algorithms including image restoration algorithms, image contrast enhancement algorithms, and fusion-based defogging algorithms. We also presented current video defogging algorithms. We summarized objective image quality assessment methods that have been widely used for the comparison of different defogging algorithms, followed by an experimental comparison of various classical image defogging algorithms. Finally, we presented problems of video and image defogging which need to be further studied.[5]

Shih-Chia Huang et.al [2014] have presents The visibility of images of outdoor road scenes will generally become degraded when captured during inclement weather conditions. Drivers often turn on the headlights of their vehicles and streetlights are often activated, resulting in localized light sources in images capturing road scenes in these conditions. Additionally, sandstorms are also weather events that are commonly encountered when driving in some regions. In sandstorms, atmospheric sand has a propensity to irregularly absorb specific portions of a spectrum, thereby causing color-shift problems in the captured image. Traditional state-of-the-art restoration techniques are unable to effectively cope with these hazy road images that feature localized light sources or color-shift problems. In response, we present a novel and effective haze removal approach to remedy problems caused by localized light sources and color shifts, which thereby achieves superior restoration results for single hazy images. The performance of the proposed method has been proven through quantitative and qualitative evaluations. [1].

Ivan et.al [2014] have studied work deals with multi-label classification of traffic scene images. We introduce a novel labeling scheme for the traffic scene dataset FM2. Each image in the dataset is assigned up to five labels: settlement, road, tunnel, traffic and overpass. They propose representing the images with (i) bag-of-words and (ii) GIST descriptors. The bag-of-words model detects SIFT features in training images, clusters them to form visual words, and then represents each image as a histogram of visual words. On the other hand, the GIST descriptor represents an image by capturing perceptual features meaningful to a human observer, such as naturalness, openness, roughness, etc. We compare the two representations by measuring classification performance of Support Vector Machine and Random Forest classifiers. Labels are assigned by applying binary one-vs-all classifiers trained separately for each class. Categorization success is evaluated over multiple labels using a variety of parameters. They report good classification results for easier class labels (road, F1 = 98% and tunnel, F1 = 94%), and discuss weaker results (overpass, F1 < 50%) that call for use of more advanced methods. [2].

Ajay Raghavan et.al [2012] have presented Unattended camera devices are increasingly being used in various intelligent transportation systems (ITS) for applications such as surveillance, toll collection, and photo enforcement. In these fielded systems, a variety of factors can cause camera obstructions and persistent view changes that may adversely affect their performance. Examples include camera misalignment, intentional blockage resulting from vandalism, and natural elements causing obstruction, such as foliage growing into the scene and ice forming on the porthole. In addition, other persistent view changes resulting from new scene elements of interest being captured, such as stalled cars, suspicious packages, etc. might warrant alarms. Since these systems are often unattended, it is often important to automatically detect such incidents early.[3].

Fan-Chieh Cheng et.al [2011] have proposed a novel background subtraction approach in order to accurately detect moving objects. The method involves three important proposed modules: a block alarm module, a background modeling module, and an object extraction module. The block alarm module efficiently checks each block for the presence of either a moving object or background information. This is accomplished by using temporal differencing pixels of the Laplacian distribution model and allows the subsequent background modeling module to process only those blocks t at were found to contain background pixels. Next, the background modeling module
is employed in order to generate a high-quality adaptive background model using a unique two-stage training procedure and a novel mechanism for recognizing changes in illumination. The overall results show that our proposed method attains a substantially higher degree of efficacy, outperforming other state-of-the-art methods by *Similarity* and *F*1 accuracy rates of up to 35.50% and 26.09%, respectively. [4].

IV. PROBLEM FORMULATION

The problem undertaken for the dissertation is a novel and effective haze removal approach to remedy problems caused by localized light sources and color shifts, which thereby achieves superior restoration results for single hazy images. The Road image degradation can cause problems for intelligent transportation systems such as traveling vehicle data recorders and traffic surveillance systems, which must operate under a wide range of weather conditions. Another problem is that the captured hazy road image contains localized light sources or color-shift problems due to sandstorm conditions. Motion detection is known to be one of the greatest problem areas. There is darkness problem in the road scene images due to sandstorms.

V. METHODOLOGY

The dissertation is to improvement in Road Scenes Captured by Intelligent Transportation Systems. It is based upon GUI (graphical user interface) in MATLAB. It is an effort to further grasp the fundamentals of MATLAB and validate it as a powerful application tool. There are basically different files. Each of them consists of m-file and figure file. An effective approach for the haze removal of single images captured during different environmental conditions that not only avoids the generation of artifact effects but also recovers true color. Our approach involves three proposed modules, i.e., an HDCP module, a RGB module, and a VR module and enhancement techniques and filters. The proposed HDCP module designs an effective transmission map to circumvent halo effects in the recovered image and estimates the location of the atmospheric light to avoid underexposure. In order to recover the true color of scenes featuring a wide range of weather conditions, we propose the RGB module. This RGB module determines the intensity statistics for the RGB color space of a captured image in order to acquire the color information.

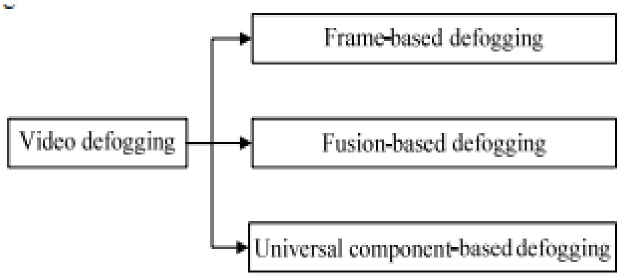

Fig.4.1 The categories of video algorithms

The following steps are proposed for this work:
Step 1: Read the image and video that includes the road scenes.
Step 2: Apply the preprocessing technique to process the image and video.
Step 3: Apply the hybrid technique to enhance the road scenes.
Step 4: Apply the enhancement technique to enhance the image and video and road scenes.
Step 5: Remove the darkness of the images and video.
Step 6: repeat the step for multiple road scenes.
Step7: calculate the parameters.
Step 8: Stop.

VI. CONCLUSION

In this paper, we have proposed a very simple but powerful prior, called dark channel prior, for single image haze removal. The dark channel prior is based on the statistics of the outdoor images. Applying the prior into the haze imaging model, single image haze removal becomes simpler and more effective. In this paper totally different papers are studied by the various researchers to boost the videos and therefore the pictures of the road scenes. We tend to summarized existing image defogging algorithms as well as image restoration algorithms, image distinction sweetening algorithms, and fusion-based defogging algorithms. We tend to additionally given current video defogging algorithms. Our work also shares the common limitation of most haze removal methods - the haze imaging model may be invalid.

REFERENCES

[1] Shih-Chia Huang et.al "An Efficient Visibility Enhancement Algorithm for Road Scenes Captured by Intelligent Transportation Systems" IEEE Transactions On Intelligent Transportation Systems, Vol. 15, No. 5, OCTOBER 2014.

[2] Ivan et.al "Multi-Label Classification of Traffic Scenes "Proceedings of the Croatian Computer Vision Workshop, Year 2 September 16, 2014,.

[3] Ajay Raghavan et.al "Detection of Scene Obstructions and Persistent View Changes in Transportation Camera Systems "2012 15th International IEEE Conference on Intelligent Transportation SystemsAnchorage, Alaska, USA, September 16-19, 2012.

[4] Fan-Chieh Cheng et.al " Accurate Motion Detection Using a Self-Adaptive Background Matching Framework "IEEE Transactions On Intelligent Transportation Systems, Vol. 13, No. 2, JUNE 2012

[5] Yong Xu et.al. "Review of video and image defogging algorithms and related studies on image restoration and enhancement" Translations and content mining are permitted for academic research only. Personal use is also permitted, but republication/redistribution requires IEEE permission IEEE 2015.

[6] J.-E. Ha et.al , "Foreground objects detection using multiple difference images," Opt. Eng., vol. 49, no. 4, p. 047 201,Apr. 2010.

[7] [F. Barranco et.al "Visual system based onartificial retina for motion detection," IEEE Trans. Syst., Man, Cybern.B, Cybern., vol. 39, no. 3, pp. 752–762, Jun. 2009.

[8] A. Doshi et.al "Smoothing of optical flow using robustifieddiffusion kernels," Image Vis. Comput., vol. 28, no. 12, pp. 1575–1589,Dec. 2010.

[9] C. Stauffer et.al "Adaptive background mixture modelsfor real-time tracking," in Proc. IEEE Comput. Vis. Pattern Recog., 1999,pp. 246–252.