IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

Enhanced Vision of HAZY Images Using Improved Depth Estimation and Color Analysis

Priyanka P. Bhadane[1], Prof. Santosh G. Bari[2], Prof. Nitin Dawande[3]

ME (Signal Processing) From D.Y Patil School of Engineering Academy Ambi, Talegaon Pune, India[1]

HOD E&TC Dept. DYPSOEA, Ambi, Talegaon Pune, India[2,3]

Abstract: This paper presents visibility restoration of single hazy images using color analysis and depth estimation with enhanced refined transmission technique. Visibility of outdoor images is often degraded by turbid mediums in poor weather, such as haze, fog, sandstorms, and smoke. Optically, poor visibility in digital images is due to the substantial presence of different atmospheric particles that absorb and scatter light between the digital camera and the captured object. The hazy removal technique divided into three categories such additional information approaches, multiple image approaches, single-image approaches. The first two methods are expense one and high computational complexity. Recently single image approach is used for this dehazing process because of its flexibility and low cost. The restoration model is proposed with utilization of median filter and adaptive gamma correction technique and dark channel prior method. This approach overcomes the problems such as color distortion, artifacts and insufficient depth information. The dark channel prior is to estimate scene depth in a single image and it is estimated through get at least one color channel with very low intensity value regard to the patches of an image. The transmission map will be estimated through atmospheric light estimation. The median filter and adaptive gamma correction are used for enhancing transmission to avoid halo effect problem. Then visibility restoration module utilizes average color difference values and enhanced transmission to restore an image with better quality. Finally the simulated result shows that obtained restored image has better contrast and hazy free scene objects under various weather conditions and the performance measures such as Gaussian distribution function and measure of enhancement are evaluated.

Keywords: Dark Channel Prior, Contrast Enhancement Adaptive intensity transfer function, Adaptive gamma correction, color analysis, visibility image restoration.

I. INTRODUCTION

In fog degradation, invisibility is caused by two fundamental phenomena attenuation and air light. Light beam coming from a scene point, gets attenuated because of scattering by atmospheric particles. This phenomenon is termed as attenuation which decreases contrast in the scene. From the source coming light is scattered towards camera and adds whiteness in the scene. This phenomenon is termed as air light. Gamma Correction is a process of compensating the non-linearity in order to achieve correct reproduction of relative luminance. This can be obtained simply by using a varying adaptive parameter. The effect of outdoor surveillance systems is limited by fog. Under foggy weather conditions, the color and contrast of the images are drastically degraded. This degradation level increased with the distance from the camera to the object. Fog is a collection crystals of ice or droplets of water suspended in air at or near the surface of Earth's. Poor visibility not only degrades the quality of perceptual image but it also affects the computer vision algorithms performance for example tracking, object detection, segmentation and surveillance.

The images of outdoor scene are degraded by several reasons, but one source of the reasons is presence of bad weather conditions. Under foggy viewing conditions, image contrast is often degraded by atmospheric aerosols, which makes it difficult to quickly detect and track moving objects in intelligent transportation systems.

Recently, single image haze removal has made significant progresses. These approaches are based on either strong assumptions or robust priors, by which haze thickness is estimated by using only a single image.

Therefore, we propose a novel haze removal approach by which to avoid the generation of serious artifacts by the conjunctive utilization of the proposed dark channel prior module with Edge-Preserving Contrast Enhancement Using Adaptive Intensity Transformation and the proposed color analysis (CA) module, and the proposed visibility restoration (VR) module.

The proposed technique can effectively conceal the color distortion, artifacts & insufficient depth information problems. The proposed technique can more effectively remove haze from single images captured in real-world conditions than other state-of-the-art techniques [10]–[11]

II. ANALYSIS OF EXISTING METHODS

To improve visibility in hazy images, haze removal techniques have been recently proposed. These can be divided into two principal classifications, i.e., the given depth [1]–[3] and unknown depth [4]–[6] approaches.

K. Tan [1] they rely on the assumption that the depth is given. Given depth Approaches use additional information. By using the given depth information to

 DOI 10.17148/IJARCCE.2016.5508

restore hazy images. This information is acquired from additional operations or interactions, such as applying information pertaining to the altitude, tilt, and position of the camera.

Narasimhan and Nayar [2], and Kopf et al. [3] proposed on Depth-based methods require some depth information From user inputs or known 3D models. This information is acquired from additional operations or through manual Approximation of the distance distribution of the sky area and vanishing point in a captured image [2]. This proposal is not suitable for all application. It is not easy to provide the approximate depth-map of the scene geometry from the point of view of the driver all along its road path for camera based Advanced Driver Assistance System application.

Kopf et al. [3] approach proposed to tackle the visibility restoration based on the given depth information, such as through an approximate 3-D geometrical model of the captured scene [3]. To remove the haze, they utilize the 3D models and texture maps of the scene. Such additional information may come from Google Earth and satellite images. Our technique can generate comparable results from a single image without any geometric information.
However, these three given depth approaches [1][2][3]are not suitable for haze removal in real-world applications because the depth information needs to be provided by the user, yet it is scarcely given.

Many studies have proposed the estimation of an unknown depth to recover scene radiance in hazy images. These can be divided into two major categories,
1) Multiple images [4]–[6]
2) A single image [7]–[11].

Schechner et al. [4] and Narasimhan and Nayar [5], [6] proposed haze removal techniques that estimate the unknown depth by using multiple images to restore a hazy image. Specifically, the method proposed by Schechner et al. [4] uses two or more images of the same scene with different polarization degrees by rotating a polarizing filter to estimate the depth of a scene and then remove haze.
Narasimhan and Nayar [5], [6] more constraints are obtained from multiple images of the scene depth from two or more images in different weather conditions, in which the scene radiance of a hazy image can be restored.
However, these methods usually require either a complex computation or the use of additional hardware devices. This leads to high restoration expense. Because of this expense drawback, recent research has focused on single-image restoration.

Recent investigations [7]–[11] have examined the use of single images to estimate the unknown depth without using any additional information or requires either excessive hardware expense and special devices to recover scene radiance in hazy images.

R.Tan [7] proposed a single-image haze removal approach obtained haze-free image must have higher contrast compared with the input hazy image and he removes haze by maximizing the local contrast of the restored image radiance based on an observation, that captured hazy images have lower contrast than restored images. This approach can produce a satisfactory result for haze removal in single images, but the restored results feature artifact effects along depth edges.. The output are visually compelling but may not be physically valid.

Another work proposed by Fattal [8] restores the visibility of hazy images by estimating the albedo of a scene and inferring the transmission medium under the assumption that the transmission and the surface shading are locally uncorrelated. This approach is physically sound and can produce impressive results. the captured image is not heavily obscured by fog. In other words, it cannot handle heavily hazy images well and may fail in the cases where the assumption is broken.

He et al. [10] developed a haze removal algorithm via the dark channel prior technique. In this method by observation, with the exception of sky regions, an outdoor haze-free image features at least one spectrum in the RGB color channels that exhibits a very low intensity value within patches of the image. dark channel prior (DCP) method by which to effectively estimate the thickness of haze information and further restore scene radiance. Until now, the approach of He et al. [10] has attracted the most attention due to its ability to effectively remove haze formation while only using single images. Xie et al. proposed an improved haze removal algorithm by employing a scheme consisting of the dark channel prior and the multiscale Retinex technique to quickly restore hazy images[11].

However, the scene radiance recovered via the dark-channel-prior-based techniques. These DCP-based techniques proposed in [10] [11]focus on refining the transmission map and can effectively produce high-quality haze-free images without generation of any block effects for hazy image captured in foggy weather conditions. However, they usually fail in restoring the visibility of images whose haze is the result of capture during sandstorm conditions. This is due to the hindrance of restoration ability by color cast problems and insufficient estimation of haze thickness. The techniques based on the dark channel prior[10], [11] cannot produce satisfactory restoration results.

Drawbacks of previous dark channel prior is that, The transmission t is wavelength dependent if the particles in the atmosphere are small (i.e., the haze is thin) and the Objects are kilometers away [12] In this situation, the transmission is different among color channels. This is why the objects near the horizon appear bluish . As the haze imaging model (10) assumes common transmission for all color channels, our method may fail to recover the true scene radiance of the distant objects and they remain bluish. This problem is solved by presenting this novel proposed method.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

Improved DCP with histogram specification [13] has been proposed to improve the contrast of the recovered image which involves rebuilding the histogram of image with following advantages.

1) Firstly, prevents reduction of the image contrast.
2) Secondly, DCP method don't underestimates the attenuation of the foreground irradiance though haze.
3) Thirdly, if the haze image has large background area or low contrast then also it prevents from merges the scene with the thick haze. Due to the above advantages, Improved DCP with histogram specification has been proposed to improve the contrast of the recovered image which involves rebuilding the histogram of image.

Problem occurred If the haze in the image is not removed clearly, this method will increase the thickness of the haze. The entire approach is discussed in the following sections. In section-III, proposed method is discussed, in section-IV the methodology, in section-V the advantages; in section-VI the application, in section-VII the Conclusion and in section-VIII the references has described.

III. PROPOSED METHOD

Image enhancement techniques help in improving the visibility of any portion or feature of the image suppressing the information in other portions or features. The modification of digital data for improving the image qualities with the aid of computer. The processing helps in maximizing clarity, sharpness and details of features of interest towards image enhancement.

Recently, single image haze removal has made significant progresses These approaches are based on either strong assumptions or robust priors, by which haze thickness is estimated by using only a single image.

Therefore, we propose a novel haze removal approach by which to avoid the generation of serious artifacts by the conjunctive utilization of the proposed dark channel prior module with Edge-Preserving Contrast Enhancement Using Adaptive Intensity Transformation and the proposed color analysis (CA) module, and the proposed visibility restoration (VR) module.

The proposed technique can effectively conceal the color distortion, artifacts & insufficient depth information problems. The proposed technique can more effectively remove haze from single images captured in real-world conditions than other state-of-the-art techniques [10]–[11] An algorithm for local visibility enhancement named Dark Channel Prior was proposed in [10].

Dark channel prior method estimates transmission map and air-light to recover original one from foggy image. To estimates the transmission map, it uses the lowest intensity pixel of image in 3 color planes in patch size of different variations, after which soft matting and morphological filter operation are performed to get final defogged image.

For gray level images, the DCP algorithm consists first in applying a morphological erosion or opening with a structuring element of size sv, which removes all white objects with a size smaller than vs. . Then, the atmospheric light is set as a percentage p of the opening result. algorithm using a morphological operator as filter and an erosion or an opening does not preserve accurate complex borders along depth discontinuities. In [10], a matting algorithm is used to restore complex borders in atmosphere estimation .The visibility enhancement obtained by the DCP algorithm then a final fixed gamma mapping is used to attenuate the brightness and darkness of image.

In this paper, we have presented a novel Image Enhancement alters the visual impact that the image has on the interpreter in a fashion that improves the information content contrast enhancement method for remote sensing images using dark channel prior method and adaptive intensity transformation. The proposed algorithm First step is take a single color image, convert an RGB image into Red, Green and Blue plans. Estimate atmospheric light using dark channel prior on RGB component and decomposes this red, blue and green plans into low-, middle-, and high-intensity layers by analyzing the log-average luminance of the corresponding layer. The adaptive intensity transfer functions are computed by combining the knee transfer function and the gamma adjustment function. Apply adaptive intensity transfer functions to separately each red plan, green plan, and blue plan of low-, middle-, and high intensity layer. Finally All the intensity enhanced layers are fused with an appropriate smoothing, to estimate transmission map using dark channel prior on RGB component and The proposed algorithm can effectively enhance the overall quality and visibility of local details better than existing state-of-the-art methods Experimental results demonstrate that the proposed algorithm can enhance the low-contrast satellite images and is suitable for various imaging devices such as consumer camcorders, real-time 3-D reconstruction systems, and computational cameras.

Introduce dehazing algorithm, which is based Dark channel prior Estimation on selected region to estimate the atmospheric light, and obtain more accurate result. Here, It describes the formation of a haze image as follows:

$$I(x) = J(x)t(x) + A(1 - t(x)) \quad \text{..................(1)}$$

Where I is the observed haze image, J is the scene radiance, A is the global atmospheric light, and t is the medium transmission. It describes the portion of the light that is not scattered and reaches the camera. The goal of haze removal is to recover J, A, and t from I.

Dark Channel Prior Estimation: we propose a Dark Channel Prior, for single image haze removal. Dark channel prior method can produce a natural haze free image. However, because this approach is based on a statistically independent assumption in a local patch, it requires the independent components varying significantly. The dark channel prior is based on the following observation on haze free outdoor images: in most of the non-sky patches, at least one color channel has very low intensity at some pixels. In other words, the minimum intensity in such a patch should have a very low value. Formally, for an image J, we define:

$$J^{dark}(x) = \min_{c\in\{r,g,b\}}\left(\min_{y\in\Omega(x)}(J^c(y))\right) \quad \text{.....................(2)}$$

Where J' is a color channel of J and Q(x) is a local patch centered at x. Our observation says that except for the sky region, the intensity of Jdark is low and tends to be zero, if J is a haze-free outdoor image. We call Jdark the dark channel of J, and we call the above statistical observation or knowledge the dark channel prior. The low intensities in the dark channel are mainly due to three factors: a) Shadows. e.g., the shadows of cars, the shadows of leaves, b) Colorful objects or surfaces. e.g., any object (for example, green grass/tree/plant, blue water surface; b); c) Dark objects or surfaces. e.g., dark tree trunk and stone.

Estimating the Atmospheric Light: The atmospheric light was estimated from haze image by using dark channel prior with a fixed patch size. This method is efficient in a variety of images. But in some special images, for example images with multiple light sources, the estimation will be invalid. If the min filtering is done with a too small window, then it may pick up light sources in the image, which can corrupt the estimation The red pixels show the group of pixels the algorithm finds the max R, G, and B values amongst to assemble the atmospheric light estimate.

Estimating the Transmission: In Enhanced and Redefined Transmission Map, this step estimates the transmission in following way, here assume that the transmission in a local patch Q(x) is constant. We denote the patch's transmission as l(x). Taking the min operation in the local patch on the haze imaging Equation (1), we have:

$$\min_{y\in\Omega(x)}(I^c(y)) = t(x)\min_{y\in\Omega(x)}(J^c(y)) + (1-t(x))A^c \quad \text{..................(3)}$$

Notice that the min operation is performed on three color channels independently. The estimated transmission map from an input haze image is roughly good. But it contains some block effects since the transmission is not always constant in a patch. Scene Recovery: With the transmission map, we can recover the scene radiance according to Equation (1). But the direct attenuation term J(x) t(x) can be very close to zero when the transmission t(x) is close to zero.

The directly recovered scene radiance J is prone to noise. Therefore, we restrict the transmission t(x) to a lower bound t0, which means that a small amount of haze are preserved in very dense haze regions. The final scene radiance J(x) is recovered by:

$$\mathbf{J}(\mathbf{x}) = \frac{\mathbf{I}(\mathbf{x}) - \mathbf{A}}{\max(t(\mathbf{x}), t_0)} + \mathbf{A}. \quad \text{.......................(4)}$$

A typical value of t0 is 0.1.Since the scene radiance is usually not as bright as the atmospheric light, the image after haze removal looks dim. So, we increase the exposure of J(x) for display.

IV. METHODOLOGIES

- Depth Estimation
- Adaptive Gamma Correction
- Color Analysis
- Visibility Restoration

V ADVANTAGES

- It avoids halo effect and insufficient transmission estimation problems.
- It recovers better image quality under various weather condition changes.
- Less algorithm complexity.
- Its processing time is low.

VI. APPLICATION

- Advanced Driver Assistance System
- Video Surveillance systems
- Obstacle Detection systems
- Outdoor Object recognition systems

VII. CONCLUSION

This project provides solution on visibility restoration of single hazy images base on existing methods issues, like Difficulties to acquire scene depth information, Low performance in restoration of image quality, It degrades image quality after restoration due to blocking artifacts, It doesn’t provide optimal transmission which causes halo effect and color distortion problems. To avoid these problems, a design is proposed to enhance.

The visibility restoration of single hazy images using color analysis and depth estimation with enhanced refined transmission technique. single image approach is used for this dehazing process because of its flexibility and low cost, this method avoids halo effect and insufficient transmission estimation problems. It recovers better image quality under various weather condition changes, Less algorithm complexity and processing time is low comparatively to previous methods.

The proposed algorithm decomposes the input RBG image into three separate Red plan Blue plan and Green plan and decomposes these plans into low-, middle-, and high-intensity layers by analyzing the log-average luminance of the corresponding layer.

The adaptive intensity transfer functions are computed by combining the knee transfer function and the gamma adjustment function. All the contrast enhanced layers are fused with an appropriate smoothing.. The proposed algorithm can effectively enhance the overall quality and visibility of local details better than existing state-of-the-art methods.

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

REFERENCES

[1]. K. Tan and J. P. Oakley, "Enhancement of color images in poor visibility conditions," in Proc. IEEE ICIP, Sep. 2000, vol. 2, pp. 788–791.
[2]. S. G. Narasimhan and S. K. Nayar, "Interactive (De) weathering of an image using physical models," in Proc. ICCV Workshop Color Photometer. Methods Compute. Vis., Oct. 2003, pp. 1387–1394.
[3]. J. Kopf et al., "Deep photo: Model-based photograph enhancement and viewing," ACM Trans. Graphics, vol. 27, no. 5, pp. 116:1–116:10, Dec. 2008.
[4]. Y. Y. Schechner, S. G. Narasimhan, and S. K. Nayar, "Polarization based vision through haze," Appl. Opt., vol. 42, no. 3, pp. 511–525, Jan. 2003.
[5]. S. G. Narasimhan and S. K. Nayar, "Contrast restoration of weather degraded images," IEEE Trans. Pattern Anal. Mach. Intell., vol. 25, no. 6, pp. 713–724, Jun. 2003.
[6]. S. K. Nayar and S. G. Narasimhan, "Vision in bad weather," in Proc. 7th IEEE Int. Conf. Compute. Vis., Jun. 1999, vol. 2, pp. 820–827.
[7]. R. Tan, "Visibility in bad weather from a single image," in Proc. IEEE Conf. Compute. Vis. Pattern Recognition., Jun. 2008, pp. 1–8.
[8]. R. Fattal, "Single image dehazing,"
[9]. W. J. Li, B. Gu, J. T. Huang, S. Y. Wang, and M. H. Wang, "Single image visibility enhancement in gradient domain,"
[10]. K. He, J. Sun, and X. Tang, "Single image haze removal using dark channel prior," IEEE Trans. Pattern Anal. Mach. Intell., vol. 33, no. 12,
[11]. B. Xie, F. Guo, and Z. Cai, "Improved single image dehazing using dark channel prior and multi-scale Retinex," in Proc. Int. Conf. Intell. Syst. Des. Eng. Appl., Oct. 2010, pp. 848–851.
[12]. S.G. Narasimhan and S.K. Nayar, "Contrast Restoration of Weather Degraded Images," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 25, no. 6 pp. 713-724, June 2003.
[13]. X. Jin and Z.-Y. Xu, "Speed-up single image dehazing using double dark channels", Proceedings of Fifth Int.

 DOI 10.17148/IJARCCE.2016.5508