IJDACR
ISSN: 2319-4863

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary Research
Website: www.ijdacr.com (Volume 4, Issue 2, September 2015)

A REVIEW ON RELIABLE IMAGE DEHAZING TECHNIQUES

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Abstract— This paper presents a survey on the different haze removal techniques. Haze is a trouble to many computer vision/graphics applications as it reduces the visibility of the scene in the images. Haze is formed due to the two fundamental phenomena such as attenuation and the air light. Attenuation decreases the contrast and air light increases the whiteness in the scene. Haze removal techniques will retain the color and brightness of the scene .These techniques are widely used in many applications such as underwater photography, satellite images etc. Haze removal is very difficult task because fog depends on the scenes depth information which are unknown. Fog effect is the function of distance between camera and object. There for the removal of fog requires the estimation of air light lamp the overall objective of this paper is to describe the various methods for efficiently removing the haze from remote sensing images .It also gives description of some filters used for dehazing.

Keywords: air light, attenuation, image dehazing, contrast enhancement, polarizers, ICA, depth DCP, guided filter.

I INTRODUCTION

The bad weather condition such as haze [22], fog, mist and smoke reduce the quality of the outdoor scene. It is a deep problem to photographers as it changes the colors and reduces contrast of daily taken photos; it diminishes the visibility of the scenes and is a harm to the reliability of many applications like outdoor surveillance system, object detection. It also decreases the clarity of satellite images and underwater photography. So removing haze from images is an accepted and broadly demanded area in computer vision and computer graphics related systems. The quality of images of outdoor scenes depends on the haze such as fog, mist and other bad weather condition. It is usually degraded by scattering of a light [12, 22]. Before reaching the camera due to these large quantities of particles (fog, haze, smoke impurities)in the atmosphere, it got degraded. This phenomenon affects the normal work of automatic monitoring system and outdoor recognition system racking and segmentation process and intelligent transportation system very often. Scattering is caused by two fundamental phenomenons such as attenuation [13, 22] and air light [13, 22] 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. Nowadays there are many methods available to remove haze from image like polarized images, independent component analysis, dark channel prior estimations, filters etc.

II LITERATURE SURVEY

This paper gives a survey on different haze removal methods. Haze removal methods can be classified into single image haze removal and multiple image haze removal, haze removal based on filtering.

[1] SINGLE IMAGE DEHAZING

This method only requires a single input image only [1, 20] .This method depends upon statistical assumptions [5] and the nature of the scenes taken and recovers the scene information based on the prior information from a single image taken. This method becomes more and more researcher's interest nowadays. The methods comes under this category are as follows.

A. DARK CHANNEL PRIOR

The dark channel prior [5] is mainly based on the outdoor haze-free images. It takes the idea that in most of the non –sky patches, at least one color (RGB) has very low intensity values at some pixels called dark pixels. These dark pixels provide the most estimation of haze transmission in the scene.

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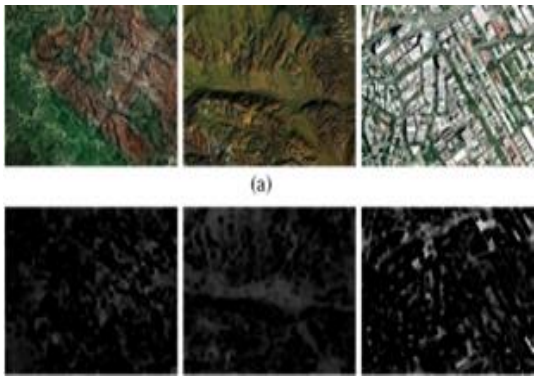

Fig1: Dark channel prior

B. ANISOTROPIC DIFFUSION;

Anisotropic diffusion [11] is a famous technique that reduces haze without removing image parts such as lines, edges and other details which are essential for understanding the image. It can permit the smoothing properties with image enhancement qualities as well. Tripathi [12] present an algorithm uses anisotropic diffusion for refining air light map from dark channel prior efficiently. It performs well in case of heavy fog also.

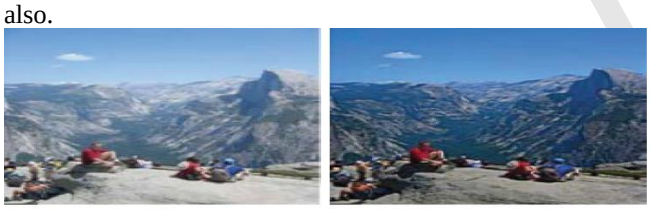

Fig 2: Anisotropic diffusion

C. CONTRAST MAXIMIZATION METHOD

Haze diminishes the contrast of the images. Removing the haze enhance the contrast. Contrast maximization [1] is the method that enhances the contrast, but the resultant images have large saturation rate values because these method does not physically improve the brightness or depth of the scene. Moreover, the result may contain halo effects at the depth discontinuities in deeper.

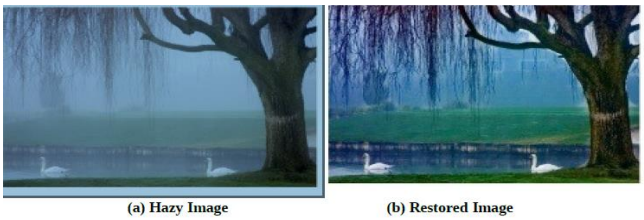

Fig3: Contrast maximization method

D. INDEPENDENT COMPONENT ANALYSIS (ICA)

ICA is a used to separate two additive components from a signal. Fatal [20] assumes that the transmission and surface shading are statically uncorrelated in local path pixels. This approach physically valid and can produce good results, but it is unreliable because this does not work well for dense haze situations. Here from the figure it is seen that after ICA image look better.

Fig4: Independent component analysis

[2] MULTIPLE IMAGE DEHAZINGMETHOD

In this haze removal, two or more images or multiple images [12, 14, 15, 23] of the same scene are taken .This method attains known variables and avoids unknowns as well. The methods comes under this category are explained as follows.

A. DEPTH MAP BASED METHOD

This method uses depth information for haze removal improvement. It uses a single image and assumes that 3D geometrical model [15, 16, 19] of the scene is provided by some data bases such as Google maps and also assumes the texture of the scene is given already .This 3D model then aligns with the hazy image and provides the scene depth [18] informations.This method requires user interaction for alignment with the scene and it gives accurate results. This method does not requires special equipment and it is not automatic. This method is to use the degree of interactive manipulation for dehazing but it needs an estimation of more parameters.

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Fig5: Depth based method

B. METHOD BASED ON DIFFERENT WEATHER CONDITIONS

This method have multiple images [12, 13, 15] taken from different weather conditions. The basic method is to take the difference of two or more images of the similar scene. Weather conditions make shadows also.

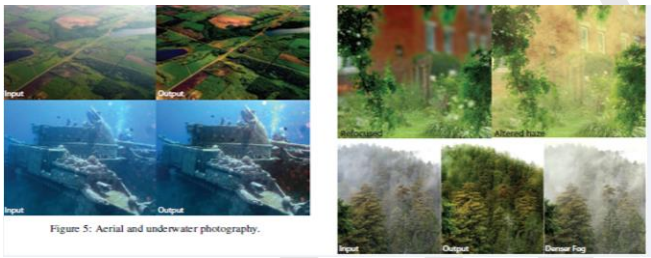

Fig6: Images on different weather conditions

This approach can significantly improve its ability to improve contrast, but it have to wait until the properties of the medium change. So for scenes that met before this method is unable to deliver the results .Moreover dynamic scenes cannot be handled.

C. METHODS BASED ON POLARIZATION

In this method polarization filters are used to take images [14, 17]. These images have different degrees of polarization, acquired by rotating a polarizing filter attached to the camera, but the dynamic scenes are not much good. It cannot be applied to dynamic scenes for which the changes are more speeder than the filter and not necessarily produce better results.

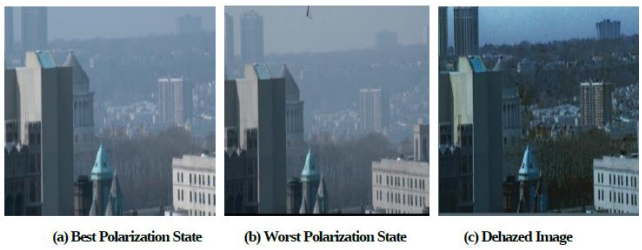

Fig7: Based on polarization

[3] DEHAZING BASED ON FILTER

A. WIENER FILTER

Wiener filtering [25] used to face the problems such as color distortion while using dark channel prior when the images with large white area is being processed. While using dark channel prior to preserve the edges, the value of media function is used which create halo effect in final image. So after the median function make accurate it can combine with wiener filter so that the image restoration problem is transformed into optimization problem quickly. The running time of algorithm is also less.

Fig9: (a) Input image (b) Defogged image (c) Image after filtering

B.BILATRAL FILTERS

This filtering [26] smooth images preserving edges, by the non-linear combination of nearby image' values. This filter replaces each pixel by weighted averages in its neighboring pixels. The weight assigned to enhance neighbor pixel decreases with both distance in the image plane and distance on the intensity axis in the local patch.

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This filter helps us to get result faster as compare to other filtering techniques.

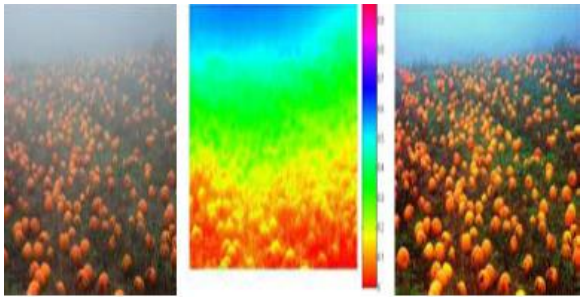

fig10. (a) Input image (b) corresponding air light map using bilateral filter(c) output image.

D.GUIDED JOINT BILATRAL FILTERS

The basic idea is to compute an accurate atmosphere veil respect with depth information of the underlying image combined. First obtain initial atmosphere scattering of light through median filtering, then redefining it by guided joint bilateral filtering to generate a new atmosphere veil which recovers the depth edge information .Finally, solve the scene radiance using the atmospheric attenuation model based on the scenario. Compared with exiting dehazing methods, this method could get a better dehazing effect with distant scenes where depth changes abruptly with images. Weighted guided also available now.

Fig11: (a) Input image (b) Dehazing result without filtering (c) Using Guided filter

C.GAUSSIAN FILTERS

It is used to produce more visually appealing dehazing images. It is used to refine the atmospheric veil. Mainly it avoids the halo artifacts in the restored image in correct depth. Actually smoothing is taken in the coarse atmospheric veil. It is a nonlinear filter that can smooth images. Currently using low pass Gaussian filters. The Gaussian function is using here. Sigma is the size of neighborhood used is used to smooth a pixel. X is the centered pixel.

III CONCLUSION

Haze removal algorithms become more useful in many computer vision applications.. This survey has shown that the presented methods have neglected the techniques to reduce the noise which may present in the output images of the existing fog removal algorithms. So it is required to work under more filtering methods.

IV ACKNOWLEDGMENT

I wish to acknowledge the support of many respected persons who provided me with many inspirations,valuable advices to complete my research work better. I would also like to thank Mr:Muhammed Nizar B.K and Ms:Rekha K S for their supporting me to survey under this paper.

V REFERENCES

[1] Tan,Robby T, ”visibility in bad weather from a single image “*IEEE Conference on computer vision and pattern Recognition*” CVRR pp. 1-8, year 2008

[2] Tarel J-P and Nicolas Hautie “Fast Visibility Restoration from a Single Color or Gray Level Image”, 12th *“International Conference On Computer Vision*” Pp2201-2208 Year 2009

[3] Yu, Jing, Chuangbai Xiao and Dapeng Li, “Physics-Based Fast Single Image Fog Removal”, “*10th IEEE International Conference On Signal Processing*” (CSP), Pp.1048-1052, Year 2010.

[4] Fang ,Faming, Fang Li,Xiaomei Yang,Chaomin Shen And Guixu Zhang, “Single Image Dehazing And De noising With Variational Method”, “*IEEE International Conference On Image Analysis And Signal Processing*” (IASP) ,Pp219-222,2010.

[5] He, Kaiming Jian Sun and Xiaoou Tang “Single Image Haze Removal Using Dark Channel Prior” *“IEEE Transactions”*, Year 2011

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary Research
Website: www.ijdacr.com (Volume 4, Issue 2, September 2015)

[6] Long Jiso,Zhenwei Shi And Wei Tang "Fast Haze Removal For A Single Remote Sensing Image Using Dark Channel Prior" , "*IEEE International Conference On Computer Vision In Remote Sensing*" (CVRS),Pp.132-135,2012

[7] Zhang,Yong-Qin,Yu Ding,Jin-Sensing Xiao,Jiaying Liu And Zongmoing Guo, "Visibility Enhancement Using Filtering Approach" , *"EURASIP Journal On Advances In Signal Processing ",*No. 1pp.1-6,2012.

[8] Xu, Haoran ,Jianming Guo, Qing Liu And Lingli Ye, "Fast Image Dehazing Using Improved Dark Channel Prior", *"IEEE International Conference On Information Science And Technology (ICIST)"* , PP.663-667,2012.

[9] Ullah E., Rnawaz And J Iqbal, "Single Image Haze Removal Using Improved Dark Channel Prior", "*Proceedings Of International Conference On Modeling, Identification &Control "(*ICMIC), PP 345-248,2013.

[10] Hitam, M S., W. N. J. H. W Yussof EA Awalludin And Z, Bachok "Mixture Contrast Limited Adaptive Histogram Equalization For Under Water Image Enhancement", "*IEEE International Conference On Computer Applications Technology*" (ICCAT), Pp. 1-5, 2013.

[11] Tripathi And S. Mukhopadhy, *"Single Image Fog Removal Using Anisotropic Diffusions"* Image Processing, Vol .6, No. 7, Pp.966-975,2012.

[12] Nayar, Shree K. And Srinivasa G. Narasimhan "Vision In Bad Weather" , The Proceedings Of The "*IEEE International Conference On Computer Vision*" ,Vol.2 Pp.820-827,1999.

[12] Nayar, Shree K. And Srinivasa G Narasimhan And Shree K.Nayar "Instant Dehazing Of Images Using Polarization", The Proceedings Of "*IEEE Conference On Computer Vision And Pattern Recognition*" (CVPR), Vol.1, Pp. I- 325, 2001.

[13] Narasimhan Srinivasa G. And Sree K.Nayar "Chromatic Frame Work For Vision In Bad Weather" The Proceedings Of "IEEE Conference On Computer Vision And Pattern Recognition" ,Vol. 1 , Pp.598-605,2000.

[14] Schechner , Yoav Y.,Srinivasa G Narasimhan And Shree K.Nayar "Instant Dehazing Of Images Using Polarization" ,The Proceedings Of "*IEEE Computer Society* Conference *On Computer Vision And Pattern Recognition*" (CVPR), Vol.1,Pp. I-325,2001.

[15] Narasimhan Srinivasa G. And Shree K.Nayar, "Contrast Restoration Of Weather Degraded Images" , "*IEEE Transactions On Pattern Analysis And Machine Intelligence*" ,Vol.25,No.6,Pp.713-724,2003.

[16] Narasimhan, Srinivasa G And K.Nayar "Interactive (De)Weathering And Photometric Methods In Computer Vision" Vol.6,No.6.4,P.1., France,2003of An Image Using Physical Models " *IEEE Workshop On Color".*

[17] Shwartz,Sarit,Namer And Yoav Schemer, "Blind Haze Separation" , "*IEEE computer Society Conference On Computer Vision And Pattern Recognition*" ,Vol.2,Pp.1984-1991,2006.

[18] Hautiere ,Nicolas,J-P.Tarel And Didier Aubert "Towards Fog-Free In-Vehicle Vision Systems Through Contrast Restoration" ,"*IEEE Conference On Computer Vision And Pattern Recognition*" ,(CVPR),Pp.1-8,2007.

[19] Kopf ,Johannes,Boris Netubert,Billy Chen Michael Cohen, Dainel Cohen-Or,Oliveer Sissusen, Matt Uyttendaele, And Dani Lischinski. "Deep Photo:Model-Based Photograph Enhancement And Viewing" *"In acm Transaction On Graphics"* (TOG),Vol.27,No5,.116,2008.

[20] Fatal,Rannan. "Single Image Dehazing " *In ACM Transactions On Graphic"*(TOG),Vol.27,No.3,P.27,2008.

[21] Xu,Zhiyuan,Xiaoming Liu And Na Ji ,"Fog Removal From Color Images Using Contrast Limited Adaptive Histogram Equalization", "*2nd International Conference On Image And Signal Processing*" (CISP),Pp.1-5,2009.

[22] Narasimhan Srinivasa G., And Shree K.Nayer. "Vision Atmosphere" .International Journal Of Computer Vision 48,No.3(2002):233-254.

[23] Tao,Zhang And Shao Changyan, "Atmospheric Scattering Based Multiple Images Fog Removal", " *4th International Conference On Image and Signal Processing*" (CISP),Vol.1,Pp.108-112,Year 2011.

[24] Xu,Zhiyuan,Xiaoming Liu,And Na Ji "Fog Removal From Color Images Using Contrast Limited

IJDACR
International Journal Of Digital Application & Contemporary Research

International Journal of Digital Application & Contemporary Research
Website: www.ijdacr.com (Volume 4, Issue 2, September 2015)

Adaptive Histogram Equalization Image And Signal Processing" (CIS),2012 8th "*International Conference On IEEE*",2012.

[25] Shauai, Yanjuan Rui Liu And Wenhazng He "Image Haze Removal Of Winer Filtering Haze Removal Based On Dark Channel Prior" Computational Intelligence And Security" (CIS),2012 8th" *International Conference On IEEE"* ,2009.

[26] Tripathi A.K,And S Mukhopadhyay "Single Image Fog Removal Using Bilateral Filter" Signal Processing Computing And Control(ISPCC),2012 *"International Conference On.IEEE"* ,2012.