ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

A Review on Image Dehazing Techniques

Angitha P V, Santhini K A

M. Tech Scholar, Dept. of CSE., Model Engineering College, Thrikakkara, Kerala, India

Assistant Professor, Dept. of CSE, Model Engineering College, Thrikakkara**,** Kerala, India

ABSTRACT: Dehazing plays a dominant role in many image processing applications. The visibility of outdoor images is often degraded due to the presence of haze, fog, sandstorms, and so on. Poor visibility caused by atmospheric phenomena causes failure in image processing applications. Haze leads to failure of many computer vision/graphics applications as it diminishes the visibility of the scene. Haze is formed due to the two fundamental phenomena that are attenuation and the air light.Haze removal also known as dehazing refers to different methods that aim to reduce or remove the image degradation that have occurred while the digital image was being obtained during inclement weather conditions. This paper gives a brief idea about different image dehazing techniques and also provides an idea about an advanced colour attenuation prior based dehazing technique.

KEYWORDS: Dehazing, Dark Channel Prior, Colour Attenuation Prior

I. INTRODUCTION

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 task 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 phenomena which causes degradation of outdoor images and weakening of both colour and contrast images. The bad weather conditions may demeans the quality of the images of outdoor scene.

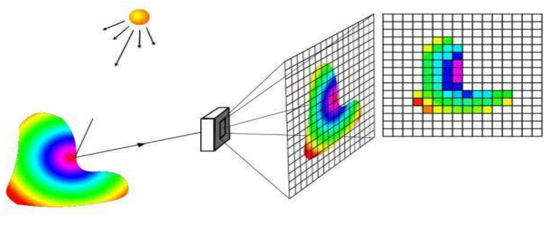

Fig. 1.Imaging During Sunny Weather

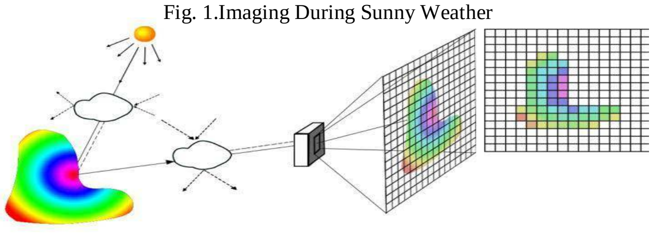

FIG. 2. IMAGING DURING HAZY WEATHER

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

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. Fig. 1 and Fig. 2 shows imaging during different weather conditions. Dehazing methods can be classified into two as given in Fig 3

- Multiple Image Dehazing
- Single Image Dehazing

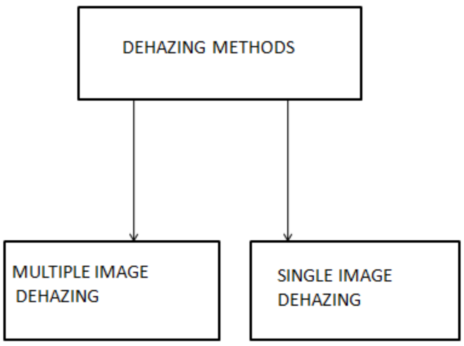

FIG. 3. CLASSIFICATION OF DEHAZING METHOD

II MULTIPLE IMAGE DEHAZING

In this type dehazing two or more images of a scene are taken. Multiple Image Dehazing[10] can be classified in three as shown in Fig 4

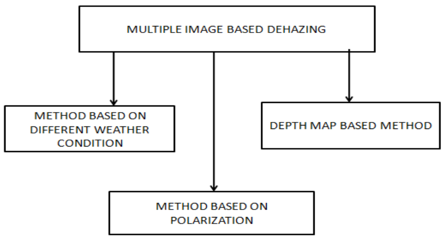

FIG. 4.MULIPLE IMAGE DEHAZING METHODS

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
(An ISO 3297: 2007 Certified Organization)
Website: www.ijircce.com
Vol. 5, Issue 4, April 2017

FEATURES OF DIFFERENT MULTIPLE IMAGE BASED DEHAZING METHODS

MULTIPLE IMAGE BASED DEHAZING	
METHODS	**FEATURES**
METHOD BASED ON DIFFERENT WEATHER CONDITION	• Two or more images of the same scene are taken. • The basic idea is to take the differences of two or more images of the similar scene
METHOD BASED ON POLARIZATION	• In this method two or more images of the same scene are taken with different polarization filters. • The basic idea is to take multiple images of the same scene that have different degrees of polarization.
METHOD BASED ON DEPTH MAP	• This method uses depth information for haze removal. • User interaction is required to align 3D model with the scene.

III **SINGLE IMAGE DEHAZING**

Single image dehazing[11] requires only requires a single input image. This method relies upon statistical assumptions or the nature of the scene and recovers the scene information based on the prior information from a single image. Dehazing methods that comes under this category are given in Fig 5

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

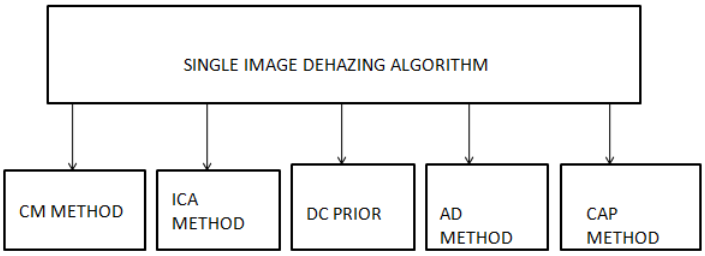

Fig 5: Single Image Dehazing Methods

FEATURES OF DIFFERENT SINGLE IMAGE DEHAZING METHODS

SINGLE IMAGE DEHAZING METHODS	
METHODS	**FEATURES**
Contrast Maximization Method	• Contrast maximization is a method that enhances the contrast. • The resultant images have larger saturation values because this method does not physically improve the brightness but it just enhances the visibility.
Independent Component Analysis	• ICA is a statistical method to separate two additive components from a signal. • This approach is physically valid and can produce good results, but may be unreliable because it does not work well for dense haze.
Anisotropic diffusion	• Anisotropic diffusion is a technique that reduces haze without removing image parts such as edges, lines or other details that are essential for the understanding of the image. • Its flexibility permits to combine smoothing properties with image enhancement qualities.

IV **DARK CHANNEL PRIOR**

The dark channel prior [1] is based on the statistics of outdoor haze-free images. In most of the non-sky patches, at least one colour channel (RGB) has very low intensity at some pixels (called dark pixels). These dark pixels provide the estimation of haze transmission. This approach is physically valid and work well in dense haze. When the scene objects are similar to the air light then it is invalid. The dark channel prior [1] is based on the statistics of haze-free outdoor images. In case of local regions which do not cover the sky, it is very often that some pixels (called dark pixels) have very low intensity in at least one color (rgb) channel. In the haze image, the intensity of these dark pixels in that

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

channel is mainly contributed by the airlight. Therefore, these dark pixels can directly provide accurate estimation of the hazes transmission. By combining a haze imaging model and a soft matting interpolation method, a high quality haze-free image can be recovered and produce a good depth map (up to a scale).Applying the prior into the haze imaging model, single image haze removal becomes simpler and more effective. Since the dark channel prior is a kind of statistic, it may not work for some particular images. When the scene objects are inherently similar to the atmospheric light and no shadow is cast on them, the dark channel prior is invalid.DCP algorithms work effciently even when haze is dense. Its only one drawback is the sky region. The DCP fails to remove haze in the sky region. Edge collapse based dark channel dehazing method uses Koschmieder's model[8] . In terms of hazy image, the DCP algorithm is a better solution because it is very fast, accurate and easy to implement.Fig 6 shows DCP dehazing process.

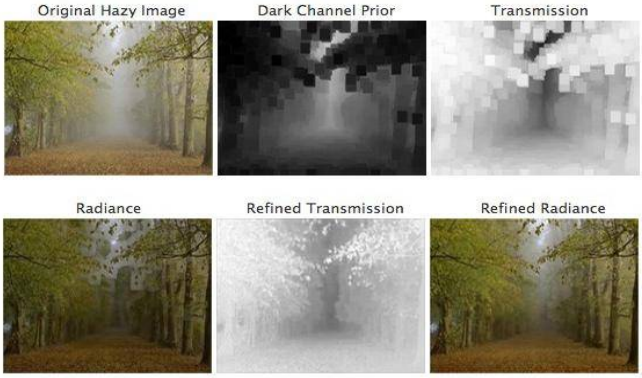

Fig 6: Dark Channel Prior Based Dehazing Process

III. RELATED WORKS

Different dark channel prior based dehazing methods and there comparative study is given here we can see that edge collapse based dark channel prior dehazing is most efficient in case of dehazing heavy haze particles and it attenuates and preserves the edge of transmission map and thereby obtain a better dehazing result.Different DCP based dehazing methods are listed below

- Simple dark channel prior based dehazing
- Improved dark channel prior based dehazing
- Improved dark channel prior based dehazing by guided filter
- Dark channel prior based dehazing by histogram specification
- Dark channel prior based dehazing by edge collapse algorithm

COMPARISON OF DIFFERENT DARK CHANNEL PRIOR BASED DEHAZING PROCESS

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

Dark Channel Prior Based Dehazing Techniques	**ADVANTAGES**	**DISADVANTAGES**
Dark Channel Prior	• Estimates the haze thickness • Transmission map is estimated accurately	• Air light estimation is poor • It produces some Halo effects on the resultant images
Improved Dark Channel Prior	• Estimation of air light is accurate and Less computation time Is required	• It produces Halo effects and Transmission map is not estimated accurately

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

Dark Channel Prior Based Dehazing Techniques	**ADVANTAGES**	**DISADVANTAGES**
IDCP using Guided Filter	• In this method Halo effects is removed efficiently. • Refining of transmission map is done by guided filter so it gives good result.	• Estimation of air light is not done accurately. • It doesn't improve the contrast.
DCP with Histogram Specification	• Haze is removed efficiently from the large background and low contrast images	• This method gives poor contrast image.
DCP Based On Edge collapse based algorithm	• Removes thick haze particles efficiently	• Contrast enhancement is not efficient

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

V. Colour Attenuation Prior

Colour attenuation prior [7] is based on the difference between the brightness and the saturation of the pixels within the hazy image. Repairs transmission map and restores visibility. By creating a linear model for modelling the scene depth of the hazy image under this novel prior and learning the parameters of the model by using a supervised learning method, the depth information can be well recovered The need of feature selection is to select most sensitive features which make changes in image quality. The main goal is haze removal by depth map estimation. The advantages of this prior is as follows

- This simple and powerful prior can help to create a linear model for the scene depth of the hazy image.
- The bridge between the hazy image and its corresponding depth map is built e ectively.
- With the recovered depth information it is possible to remove the haze from the single hazy image easily.

As very small information about the scene structure is available it is very difficult to detect or remove the haze from a distinct image in computer vision, In spite of this, the human brain can quickly recognize the hazy area from the natural scenery without any extra information. It seems that the three properties (the brightness, the saturation and the difference) are prone to vary frequently in a sole hazy image according to this observation. In the haze- free condition, the scene element reflects the energy that is from the lighting source, a portion of energy is lost when it reaches the imaging system. The imaging system collects the inward energy reflected from the scene part and focuses it onto the image plane. Without the effect of haze, outdoor images are typically are of different colours. In hazy conditions, in contrast, the situation becomes more difficult. The denser the haze is, the stronger the influence of the air light would be.Guided filter [9] is used for refinement. Since the concentration of the haze increases along with the change of the scene depth in general, make an assumption that the depth of the scene is positively correlated with the concentration of the haze and it gives.Figure 4 shows colour attenuation prior based dehazing process.

To detect or remove the haze from a single image is a challenging task in computer vision, because little information about the scene structure is available. In spite of this, the human brain can quickly identify the hazy area from the natural scenery without any additional information. The brightness and the saturation of pixels in a hazy image vary sharply along with the change of the haze concentration. In a haze-free region, the saturation of the scene is pretty high, the brightness is moderate and the difference between the brightness and the saturation is close to zero.

Fig 7: Colour Attenuation Prior Based Dehazing Process

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 4, April 2017

VI CONCLUSION AND FUTURE WORK

Colour attenuation prior based dehazing gives a better dehazing results and enhances the contrast of the image very well compared to other prior based dehazing techniques and this dehazing technique can be enhanced by adding a edge attenuation operation so a better dehazing result can be obtained. Dehazing algorithms is very useful for many computer vision applications. It is found that most of the existing re-searchers have neglected many issues; i.e. technique accurate for different kind of circumstances. Poor visibility caused by atmospheric phenomena in turn causes failure in computer vision applications, such as outdoor object recognition systems, obstacle detection systems, video surveillance systems, and intelligent transportation systems. In order to solve this problem, visibility restoration techniques have been developed and plays a key role in many computer vision applications that operate in various weather conditions.

REFERENCES

1. K. He, J. Sun, and X. Tang, Single Image Haze Removal Using Dark Channel Prior, IEEE Trans.PatternAnal.Machine Intell., vol. 33, no. 12, pp. 2341-2353, Dec. 2011

2. Shih-Chia Huang, Member, Ieee, Jian-Hui Ye, And Bo-Hao Chen, An Advanced Single Image Visibility Restoration Algorithm For Real-World Hazy Scenes "Ieee Conf. , Pp.1, Oct. 2014.

3.Qingsong Zhu ; Shuai Yang ; Pheng Ann Heng ; Xuelong Li; An Adaptive And E ective Single Image Dehazing Algorithm Based On Dark Channel Prior "Ieee Conf. , Pp. 1796-1800, Dec. 2013.

4. Xiangdong Zhang,Peiyi Shen,Lingli Luo, Liang Zhang, Juan Song; Enhancement And Noise Reduction Of Very Low Light Level Images; Ieee Conf. , Pp. 2034-2037, Nov. 2012.

5. Sun Kang, Wang Bo, Zheng Zhihui; Fast Single Image Dehazing Using Iterative Bilateral Filter Ieee Conf. , Pp.1-4, 2010.

6. B. H. Chen and S. C. Huang, "Edge Collapse-Based Dehazing Algorithm for Visibility Restoration in Real Scenes," in Journal of Display Technology, vol. 12, no. 9, pp. 964-970, Sept. 2016.

7.Q. Zhu, J. Mai, and L. Shao, A Fast Single Image Haze Removal Algorithm Using Color Attenuation Prior, IEEE Trans. Image Processing, vol. 24, no. 11, pp. 3522-3533, Nov. 2015.

8. H. Koschmieder, Theorie der horizontalen sichtweite, in Beitrage zur Physik der Freien Atmosphare. Munich, Germany: Keim Nemnich, 1924.

9. K. He, J. Sun, and X. Tang, Guided Image Filtering, IEEE Trans. Pattern Anal. Machine Intell., vol. 35, no. 6, pp. 1397-1409, Jun. 2013.

10 Sharma R., and V. Chopra. 2014. A review on different image dehazing methods. International Journal of Computer Engineering and Applications, Volume 6, Issue 3

11 Shruti P. Patel, Manish Nakrani,"A Review on Methods of Image Dehazing" International Journal of Computer Applications (0975 – 8887) Volume 133 – No.12, January 2016