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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 6, June 2014

Comparative Study on Fusion Based Image Dehazing

Chhamman Sahu[1], Rajkumar Sahu [2]

ME Student, Dept. of ECE, Chhattrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India [1]

Associate professor, Dept. of ECE, Chhattrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India[2]

Abstract: Image processing techniques improve the quality of an image or enhance the maximum information from the degraded image. Image Fusion is a technique of enhancing the quality of image from given images. It is the process of combining two or more images into a single image; method is a fusion-based strategy that derives from two original hazy image inputs by applying a white balance and a contrast enhancing procedure. Then the resulting image will be more clear and enhanced from the prior. Many development and research is being done in these field areas of Computer Vision, Automatic object detection, Image processing, parallel and distributed processing, Robotics and remote sensing. This thesis reports a detailed study performed over a set of image fusion algorithms regarding their implementation. The thesis demonstrates the utility and effectiveness of a fusion-based technique for dehazing based on a single degraded image. The method performs in a per-pixel fashion, which is straightforward to implement. The thesis finally concludes with an assessment made on the various image fusion algorithms, identifying the Pyramid Fusion algorithm.

Keywords: Single image dehazing, Fusion based, Pyramid method, Dwt.

I. INTRODUCTION

Image Fusion is a mechanism to improve the quality of information from a set of images. By the process of image fusion the good information from each of the given images is fused together to form a resultant image whose quality is superior to any of the input images. This is achieved by applying a sequence of operators on the images that would make the good information in each of the image prominent. The resultant image is formed by combining such magnified information from the input images into a single image.

Image Fusion finds it application in vast range of areas. It is used for medical diagnostics and treatment. A patient's images in different data formats can be fused. These forms can include magnetic resonance image (MRI), computed tomography (CT), For example, CT images are used more often to ascertain differences in tissue density while MRI images are typically used to diagnose brain tumours. Image fusion is also used in the field of remote sensing wherein multivariate images like thermal images, IR Images, UV Images,

II. LITERATURE REVIEW

A. Codruta Orniana Ancuti and Cosmin Ancuti (2013)

Codruta Orniana Ancuti et al. proposed single image dehazing by multi-scale fusion. They approach a method that is a fusion-based strategy that derives from two original hazy image inputs by applying a white balance and a contrast enhancing procedure. To blend effectively the information of the derived inputs to preserve the regions with good visibility. They filter their important features by computing three measures (weight maps): luminance, chromaticity, and saliency [1]. This proposed work to minimize artifacts introduced by the weight maps, Ancuti approach is designed in a multi-scale fashion, using a Laplacian pyramid representation. That is the first to demonstrate the utility and effectiveness of a fusion-based technique for dehazing based on a single degraded image. The method performs in a per-pixel fashion, which is straightforward to implement. The experimental results demonstrate that the method yields results comparative to and even better than the more complex state-of-the-art techniques, having the advantage of being appropriate for real-time applications.

B. Dr. H.B. Kekre et al.(2013)

Dr. H.B. Kekre et al. proposed a review on image fusion techniques and performance evaluation parameters.in this paper image fusion is to integrate corresponding information from different sources into one new image. The idea is to lessen uncertainty and minimize redundancy in the output while maximizing relevant information particular to an application or task. This paper discusses the basics of image fusion, various pixel level algorithms for image fusion and methods for evaluating and assessing the performance of this fusion algorithms.proposed and improvement to the priority order in addition with an edge detection algorithm. Fusion algorithm must satisfy two main requirements. Firstly, they must identify the most significant features in the input images and transfer them without loss of detail into the fused image. Secondly, the fusion method should not bring in any inconsistencies or artifacts which would distract the human observer or following processing stages. This paper proposed the fusion process consists of three basic stages: Image Acquisition, Image Registration and Image Fusion. Image Acquisition is the process of acquiring images from one or several image sensors. Image registration is the process of establishing a point-by-point correspondence

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

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 6, June 2014

between multiple images depicting the same scene or different scene. Before the image fusion algorithm is applied to the source images, image registration is used to ensure the correspondence between the pixels in the input images. Lastly, the image fusion process is used to combine the relevant information from the set of source images, into a single image. Image fusion has been extensively used for various applications like computer vision, automatic object detection, remote sensing, robotics, medical imaging, image classification, military and law enforcement, etc. [2].

C. M.A. Mohamed and B.M. El-Den(2010)

M.A. Mohamed et al.proposed implementation of image fusion techniques using fpga. They combine the data from two or more source images from the same scene to generate one single image. In this thesis shown the deal with multi-focus images, in which fused two images by different techniques which present in this research, Quality assessment of fused images with above methods, Comparison of different techniques to determine the best approach and Implement the best technique by using *FPGA*. In addition experimental results are quantitatively evaluated by calculation of Root Mean Square Error *RMSE*, Entropy; Mean square error *MSE*, signal to noise ratio *SNR* and peak signal to noise ratio *PSNR* measures for fused images and a comparison is accomplished between these methods. Then we chose the best techniques to implement them by *FPGA [3]*.

D. Raanan. Fattal (2008)

R. Fattal et al. proposed a method on single image dehazing; in this paper describe the method for estimating the optical transmission in hazy scenes given a single input image. Based on this estimation, the scattered light is eliminated to increase scene visibility and recover haze-free scene contrasts. In this approaches formulate a refined image formation model that accounts for surface shading in addition to the transmission function. This allows us to resolve ambiguities in the data by searching for a solution in which the resulting shading and transmission functions are locally statistically uncorrelated.

This proposed paper a similar principle is used to estimate the color of the haze. In this model, the degraded image is factored into a sum of two components the airlight contribution and the unknown surface radiance. Algebraically these two, three-channel color vectors are convexly combined by the transmission coefficient which is a scalar specifying the visibility at each pixel. This requires the shading component to vary significantly compared to the noise present in the image. We use a graphical model to propagate the solution to pixels in which the signal-to-noise ratio falls below an admissible level that we derive analytically in the Appendix. The airlight color is also estimated using this uncorrelation principle. This new method is *passive*; it does not require multiple images of the scene, any light-blocking based polarization, any form of scene depth information, or any specialized sensors or hardware. The new method has the minimal requirement of a *single* image acquired by an ordinary consumer camera. Also it does not assume the haze layer to be smooth in space, i.e., discontinuities in the scene depth or medium thickness is permitted. As shown in Figure 1, despite the challenges this problem poses, this new method achieves a significant reduction of the airlight and restores the contrasts of complex scenes [4].

E. Robby T. Tan (2008)

Robby T. Tan et al. proposed visibility in bad weather from a single image. In environment fog and haze, can significantly degrade the visibility of a scene. In computer vision, the absorption and scattering processes are commonly modelled by a linear combination of the direct attenuation and the air-light. Based on this model, a few methods have been proposed, and most of them require multiple input images of a scene, which have either different degrees of polarization or different atmospheric conditions.

This requirement is the main drawback of these methods, since in many situations it is difficult to be fulfilled. To resolve the problem, we introduce an automated method that only requires a single input image. This method is based on two basic observations: first, images with enhanced visibility have more contrast than images plagued by bad weather; second, air-light whose variation mainly depends on the distance of objects to the viewer, tends to be smooth. Relying on these two observations, we develop a cost function in the framework of Markov random fields, which can be efficiently optimized by various techniques, such as graph-cuts or belief propagation. The method does not require the geometrical information of the input image, and is applicable for both color and gray images [5].

F. K. He, J. Sun, and X. Tang(2009)

K. He, J. Sunet al. proposed single image haze removal using dark channel prior. The 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, can directly estimate the thickness of the haze and recover a high quality haze-free image. Results on a variety of outdoor haze images demonstrate the power of the proposed prior. Moreover, a high quality depth map can also be obtained as a by-product of haze removal.

Haze removal (or dehazing) is highly desired in both consumer/computational photography and computer vision applications. First, removing haze can significantly increase the visibility of the scene and correct the color shift caused by the airlight. In general, the haze-free image is more visually pleasuring. Second, most computer vision algorithms, from low-level image analysis to high-level object recognition, usually assume that the input image (after radiometric calibration) is the scene radiance. The performance of vision algorithms (*e.g.*, feature detection, filtering, and photometric analysis) will inevitably suffers from the biased, low- contrast scene radiance. Last, the haze removal can produce depth information and benefit many vision algorithms and advanced image editing.

Haze or fog can be a useful depth clue for scene understanding. The bad haze image can be put to good use. However, haze removal is a challenging problem because the haze is dependent on the unknown depth information. The problem is under-constrained if the input is only a single haze image. Therefore, many methods have been proposed by using multiple images or additional information[6].

G. L. Kratz and K. Nishino(2009)

L. Kratz and K. Nishino et al. a novel of factorizing scene albedo and depth from a single foggy image. In this paper, introduce a novel probabilistic method that fully leverages natural statistics of both the albedo and depth of the scene to resolve this ambiguity. The idea is to model the image with a factorial Markov random field in which the scene albedo and depth are two statistically independent latent layers. This proposed method show that can be exploit natural image and depth statistics as priors on these hidden layers and factorize a single foggy image via a canonical Expectation Maximization algorithm with alternating minimization.

Restoring the true scene color from a single weather degraded image is, however, an inherently ill-posed problem that cannot be analytically solved unless one of the two constituents, either the scene depth or colors, is known. This is due to the inherent bilinearlity between scene albedo and depth as can make explicit in this paper. To this end, as in any other ill-posed computer vision problem encounter, past work has focused on imposing additional constraints to resolve the ambiguity [7].

H. J.-P. Tarel, N. Hautiere (2009)

J.-P. Tarel and N. Hautiere et al. proposed fast visibility restoration from a single color or gray level image. Introduce a novel algorithm and variants for visibility restoration from a single image. The main advantage of the proposed algorithm compared with other is its speed its complexity is a linear function of the number of image pixels only. This speed allows visibility restoration to be applied for the first time within real-time processing applications such as sign, lane-marking and obstacle detection from an in-vehicle camera.

Another advantage is the possibility to handle both color images and gray level images since the ambiguity between the presence of fog and the objects with low color saturation is solved by assuming only small objects can have colors with low saturation. The algorithm is controlled only by a few parameters and consists in atmospheric veil inference, image restoration and smoothing, tone mapping. A comparative study and quantitative evaluation is proposed with a few other state of the art algorithms which demonstrate that similar or better quality results are obtained. Finally, an application is presented to lane-marking extraction in gray level images, illustrating the interest of the approach.

Difficulties when processing by an algorithm designed for clear weather images. Instead of extending each of algorithms from clear to foggy weather, it seems more adequate to perform on each input image a visibility restoration pre-processing. This pre-processing can be applied only when fog is detected[8].

H. S. Narasimhan, S. Nayar (2000)

S. Narasimhan, S. Nayar et al. proposed chromatic framework for vision in bad weather in this paper, develop a geometric framework for analysing the chromatic effects of atmospheric scattering. First, study a simple color model for atmospheric scattering and verify it for fog and haze. Then, based on the physics of scattering, that derive several geometric constraints on scene color changes, caused by varying atmospheric conditions. Finally, using these constraints develop algorithms for computing fog or haze color, depth segmentation, extracting three dimensional structure, and recovering "true" scene colors, from two or more images taken under different but unknown weather conditions.

Ultimately, vision systems must deal with realistic atmospheric conditions to be effective outdoors. Several models describing the visual manifestations of the atmosphere can be found in atmospheric optics. These model scan be exploited to not only remove bad weather effects, but also to recover valuable scene information. In this paper, develop a general chromatic framework for the analysis of images taken under poor weather conditions. The wide spectrum of atmospheric particles makes a general study of vision in bad weather hard. So, limit is ourselves to weather conditions that result from fog and haze. Begin by describing the key mechanisms of scattering [9].

III. CONCLUSION

In this paper we review the different algorithms for dehazing the haze and foggy images. This review work to minimize artifacts introduced by the weight maps, multi-scale fashion, and Laplacian pyramid representation method performs in a per-pixel fashion. We discuss a variety of image fusion techniques, grey scale level, pyramid approaches, rgb colour approaches. From this survey, a number of shortcomings and limitations were highlighted in each and every technique. The analysis proved that the fusion based image dehazing will create better results for any other techniques. This survey we also studied different kind of priors/regularization methods and corresponding optimization techniques for multi-scale fusion and improve the quality of haze image. If apply this approaches for further processing would be obtain better result in video processing.

REFERENCES

[1] Codruta Orniana Ancuti and Cosmin Ancuti "single image dehazing by multi- scale fusion" ieee transactions on image processing, vol. 22, no. 8, august 2013.

[2] Dr. H.B. Kekre et al.” review on image fusion techniques and performance evaluation parameters” International Journal of Engineering Science and Technology (IJEST) Vol. 5 No.04 April 2013.

[3] M.A. Mohamed1 and B.M. El-Den Implementation of Image Fusion Techniques Using FPGA IJCSNS International Journal of Computer Science and Network Security, VOL.10 No.5, May 2010.

[4] R. Fattal, “Single image dehazing,” ACM Trans. Graph., SIGGRAPH, vol. 27, no. 3, p. 72, 2008.

[5] R. T. Tan, “Visibility in bad weather from a single image,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2008, pp. 1–8.

[6] K. He, J. Sun, and X. Tang, “Single image haze removal using dark channel prior,” in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2009, pp. 1956–1963.

[7] Louis Kratz Ko Nishino Factorizing Scene Albedo and Depth from a Single Foggy Image” in *Proc. IEEE Int. Conf. Comput. Vis.*, Sep.–Oct. 2009, pp. 1701–1708.

[8] J. Tarel, N. Hauti, Fast visibility restoration from a single color or gray level image, Proceedings of IEEE Internation Conference on Computer Vision (ICCV), Kyoto, Japan: IEEE Computer Society, 2009, pp. 2201-2208.

[9] srinivasa g. Narasimhan and shree k. nayar contrast restoration of weather degraded images ieee transactions on pattern analysis and machine intelligence, vol. 25, no. 6, june 2003.

[10] Chavez, “An improved dark-object subtraction technique for atmospheric scattering correction of multispectral data,” *Remote Sens. Environ.*, vol. 24, no. 3, pp. 459–479, 1988.

[11] G. D. Moro and L. Halounova, “Haze removal and data calibration for high-resolution satellite data,” *Int. J. Remote Sens.*,pp.2187–2205,2006.