A REVIEW ON ENHANCEMENT OF AN IMAGE SING IMAGE DEHAZING AND FILTERING TECHNIQUES

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ABSTRACT

Images are often degraded by the atmospheric haze, a phenomenon due to the particles in the air get scatter light. Haze induces a loss of contrast, its visual effect is blurring of distant object. Here in this paper an approach to remove the effect of the haze and noise from the input hazy images is being presented. Here two different techniques for enhancing the quality of an image are being presented. First one is the Single Image Dehazing and second one is the filtering techniques. Both the methods treats haze and noise separately, i.e. image dehazing is used for removing the haziness and filtering techniques is used for removal of noise and sharpness enhancement.

Keywords - Dehazing, Filtering, Dark Channel Prior, Guided Joint Bilateral Filter.

I. INTRODUCTION

Image enhancement is the process of enhancing the features of a digitally stored image by manipulating the image with the software. The principle objective of enhancement is to process an image so that the result is more suitable then the original image for specific application. It accentuates or sharpens image features such as edges, boundaries or contrast to make a graphic display more helpful for display and analysis. The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily. The greatest difficulty in image enhancement is quantifying the criterion for enhancement and therefore a large number of image enhancement techniques are empirical and require interactive procedures to obtain satisfactory results.

This papers deals with the enhancement of the foggy images by eliminating the fogginess and noise from that image. Here two different techniques are being used for improving the quality and visibility of the foggy images. They are as follows:

1.1 Image Dehazing

Image captured in foggy weather condition often suffers from the bad visibility. Whenever images are captured outdoors, haze tends to adversely impact the quality of the background. More specifically weather and other atmospheric phenomena such as haze greatly reduce the visibility of the distant regions in images of outdoor scenes. Haze tends to adversely affect the quality of the image resulting in the poor visibility, low contrast etc. Haze along with the fog and clouds are limiting factors for visual range in the atmosphere and heavily reduce contrast in the scenes.

Image dehazing is a highly interdisciplinary challenge involving optical physics as well as computer vision and computer graphics. Haze along with the fog and clouds are limiting factors for visual range in the atmosphere and heavily reduce the contrast in the scenes. The principle objective of the image dehazing is improvement of the visibility and recovery of the colors, as if imaging is done in clear conditions. The term dehazing mean to produce an image of a scene that does not contain haze effects, although the source of that image originally comprised haze.

Manipulating a digital image to remove the effect of the haze is termed as image dehazing. In order to solve such problem image dehazing is applied. Image dehazing is the process of eliminating the haziness from an image that is shot under either in foggy weather condition or any other obstacles in the air that destroy the clarity of the image. Manipulating a digital image to remove the effect of the haze is termed as image dehazing. The main aim here is to find a way to separate the haze content from the actual image content and then subtract that haze part from the image to end up with an original clear image.

1.2 Image Filtering

Images are often corrupted by the random variations in the intensity, illumination or have poor contrast. Image filtering is the process of enhancing or modifying the quality of the image by transforming the pixel intensity values to reveal certain characteristics in image. Image processing operations implemented with filtering includes smoothening, sharpening, edge enhancement and template detection.

Filtering is a key step in digital image processing and analysis. It is mainly used for amplification or attenuation of some frequencies depending on the nature of the application. Filtering can either be performed in the spatial domain or in a transformed domain. The selection of the filtering method, filtering domain, and the filter parameters are often driven by the properties of the underlying image. Filtering is generally used for image enhancement. Filtering can also be used for analysis.

II. EASE OF USE

The method implemented in this research paper will provide a proper solution for the haze and noise removal. Image dehazing techniques is used for separating the haziness, along with that filtering mechanism is also being used for enhancing the sharpness and elimination of the noise from that image. It will reduce the effect of the haze caused by the scattering of the light. It will be capable of providing a color correction through the airlight estimate and restoration of the color especially for the distant object will be possible.

III. METHODOLOGY

3.1 Using Guided Joint Bilateral Filter

Xiao in [1] proposed a new fastest method for single image based on filtering. The basic idea is to compute an accurate atmospheric viel that is not only smoother, but also respect with the depth information of the underlying image. Firstly an initial atmospheric scattering light is obtain through median filtering, then refinement is done by using guided joint bilateral filtering to generate a new atmospheric viel which removes the abundant textures information and recovers the depth edge information. Finally the scene radiance using the atmospheric attenuation model is being solved. This method is able to generate a better dehazing effect atdistant scene and places where depth changes abruptly. Furthermore this method can be performed in parallel, therefore it can further be accelerated using GPU(Graphical User Interface), which makes the method applicable for real-time system. Figure below depicts the result obtain using the guided joint bilateral filter.

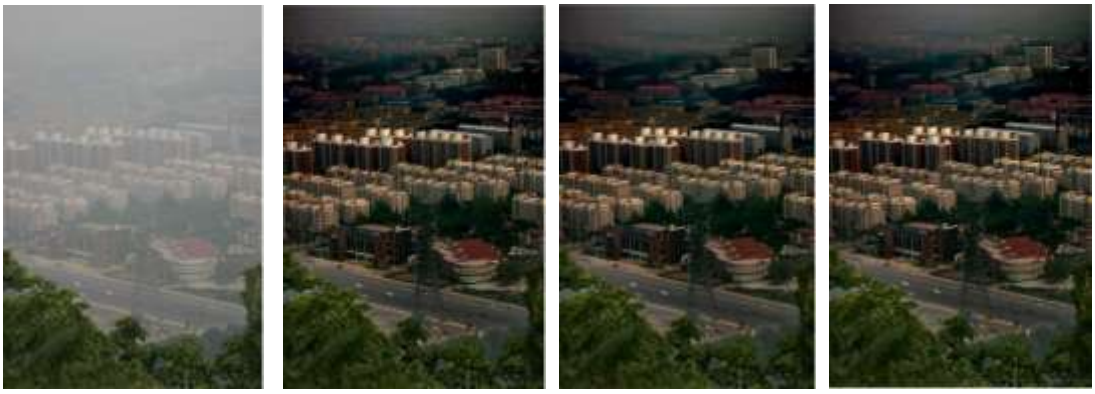
(a) (b)

In the above fig-1, (a) represents the input image whereas (b) represents the output.

3.2 Denoising and Dehazing

Images of the outdoor scene often contain degradation due to haze, resulting in the contrast reduction and color fading. For many reasons one may need to remove these effects. Haze removal is a difficult problem due to the inherent ambiguity between the haze and the underlying scene. Furthermore all images contain some noise due to sensor error that can be in the haze removal process if ignored.

In this paper [2] Matlin proposed two methods, both for removing haze and noise from an image. Two effective methods are being used for the final scene radiance recovery. The first approach is to denoise an image prior to dehazing. This approach is the adaption of the existing techniques, the dark channel prior, for estimating haze from a single hazy image. This serial approach essentially treats haze and noise separately. Second approach is proposed simultaneously to denoise and dehaze using an iterative, adaptive, non parametric regression methods. Finally the experimental results of both the methods are being compared. Result shows that when the noise level is precisely known, simply denoising prior to dehazing performs well. When the noise level is not given, latent error from either "under" denoising or "over" denoising can be amplified, and in this situation, the iterative approach yields the superior results. The quality of this approach is sensitive to inexact levels of noise. The proposed iterative method proved to be more robust, offering visually comparable results with other methods when the noise level is known and better preserving results when the noise level is estimated. Figure below depicts the example of the proposed methodology.



(a) (b) (c) (d)

In the above fig-2, (a) represents the input image, (b) represents direct Dehazing, (c) represents Denoise + Dehazed & (d) represents proposed method.

3.3 Dehazing: Combining PMB and NPMB Methods.

Zhang in [3] proposed a research algorithm for single image dehazing combining Physics Model Based (PMB) and Non Physics Model Based (NPMB) methods. Firstly based on a newly presented haze-free image prior - Dark Channel Prior and a common haze imaging model, for a single input image. The Dark Channel is used to calculate the atmospheric light. Secondly, Retinex algorithm is being constructed based on the two bilateral filters, which is applied to the brightness of the input hazy image, in order to obtain the new and enhanced brightness image and then get the anti-brightness image of the new brightness image. After that we obtain the transmission through an adaptive median filter. Finally the scene radiance is obtained through the atmospheric scattering model. The success of the physics model based method lies on the prior or assumption. In the non physical model, some algorithms are able to meet the real time requirements, but its performance is not ideal. Therefore it is necessary to combine these two methods, in order to achieve better results. A large number of experiments show that the proposed algorithm has significant effect on dehazing and has better performance in image quality and computational time.

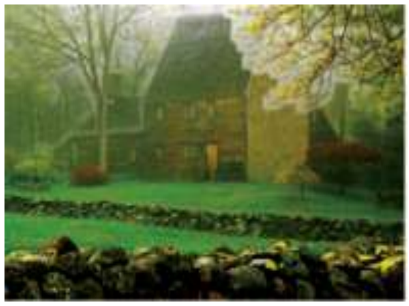
(a) **(b)**

In The Above Fig-3, (A) Represents The Input Image (B) Represents The Output By Combining The PMB &NPMB Methods.

3.4 Dark Channel Prior

Kaiming He in [4] proposed that the dark channel prior method is based on the prior assumption which is basically used for the single image dehazing process. This dark channel prior method is based on the statistics approach of the outdoor haze free images. It has been observed that in most of the regions which do not covered the sky; at that region some pixels are having very low value in at least one color (RGB) of the channel. These pixels are known as dark pixels. In hazy images the intensity of the dark pixels in the colored channel is basically contributed by the airlight. These dark pixels are used to estimate the haze transmission. Thus finally after estimating the transmission map for each pixel, combining it with the haze imaging model and soft matting technique to recover a high quality haze free image.

(a) **(b)**



(c) **(d)**

In The Above Fig-4, (A) Represents The Input Image, (B) Represents The Estimated Transmission Map, (C) Represents The Refined Transmission Map And (D) Represents The Output.

V. CONCLUSION

In this paper we have addressed the problem of simultaneously removing the haze and noise from a single image. Here two different techniques for enhancing the quality of an image are being presented. First one is the Single Image Dehazing and second one is the filtering techniques. Both the methods treats haze and noise separately, i.e. image dehazing is used for removing the haziness and filtering techniques is used for removal of noise and sharpness enhancement.

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