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IMAGE DEHAZING BASED ON DARK CHANNEL PRIOR AND HISTOGRAM EQUALISATION

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ABSTRACT

The visuality and quality of an image is highly required in the fields of surveillence and avionics. Due to turbid medium in atmosphere the images get vague and need to be processed to get haze feee images.Significant work has been done in this field. Dark Channel Prior has been the major breakthorugh in the field of image dehazing however it has a large scope for improvements. Purpose of this paper is to explore the Dark Channel Prior based image dehazing algorithms and suggesting some verified modifications which help in improving the statistical parameters (Mean,variance,entropy) of the ouput haze free image.

Keywords*: Dark Channel Prior,downsample,Polarization ,upsample.*

I. INTRODUCTION

There has been an increasing demand for intelligent surveillance systems and cameras,for monitoring private and public areas. For example, advanced driver assistance system based on cameras can help drivers in keeping vehicle between lane markers or inform them of the appropriate speed etc. In the intelligent transportation system, these cameras keep track of the driving situations and roads to examine the traffic flow or to record data related to vehicle accidents automatically. However, due to inadequate weather conditions or low atmospheric light,the insufficient visibility causes the intelligent system to be inoperative. Many image preprocessing algorithms are integrated to handle this problem such as denoising, illumination adjustment, and haze removal. In such a surveillance system, fast enough and low complexity haze removal algorithm is required.

Haze comes as a result of some atmospheric phenomena, and images captured by a digital camera can be uniformly corrupted by a large percentage of haze particles. These images usually look hazier and more faded as compared with haze-free versions. Image corruption due to haze has significantly harmed many outdoor computer vision techniques, hindering their ability to achieve their image analytic tasks, such as tracking,people counting and crowds analysis ,action recognition, human-machine interaction , license plate recognition , and so on. By using an effective haze removal algorithm, the stability and robustness of the visual system can be improved.

1.1 Classification of Dehazing Methods

The image dehazing methods can be classified as below given two classes:

(a) Physical model and

(b) Non-physical based (NMB) [1]

Methods based on the atmosphere transmission model (ATM) are Physical Model based,these analyze the factors by which the quality of image is affected through atmosphere, and the image is recovered by inversing the transmission process.

On the other hand Non-physical based method do not take into account the process of image transmitting in atmosphere medium, on the contrary, in these methods haze is removed by subjective visual feeling or image enhancement.

II. PREVIOUS WORK

He [2] proposed a simple algorithm based on Dark Channel Prior. The dark channel prior is animage statistics of outdoor haze-free images based on the fact that most local patches in outdoor hazy images contain some pixels where intensity value is very low in at least one color channel(R/G/B). Using this Preprocessing mechanism with the haze imaging model, haze thickness can be directly estimated and haze-free image can be recovered. This method achieves impressive results but it is invalid for real time applications because it takes so much time. S.K.Nayar [3] presented a method to eliminate the fog effects from images. The Principle on which this method works is based on the polarization propery of the airlight.Airlight scattered by atmospheric particles is polarized.This approach works well under a wide range of atmospheric conditions. First they analyze the image formation process, taking intoaccount polarization effects of atmospheric scattering and then invert the process to enable the removal of haze from images. Shree K. Nayar and Srinivasa G. Narasimhan [4]presented three simple algorithms for recovering the structure of the scene from one or two images.This method doesnot take into account nay kind of prior knowledge of atmospheric conditions.Tang [5] proposed a novel image filter called guided filter. It is Derived from a local linear model. Guided Filter gives the output by considering the content of a image, which can be the input image itself or another image. The guided filter can be used as an edge-preserving smoothing filter.Moreover, the guided filter has a fastlinear time algorithm, irrespective of the kernel size and the intensity range. Currently, it is one of the fastest edge-preserving filters. Yadwinder Singh, Er. Rajan[6] found that most of the existing researchers have overlookedmany issues like noise reduction and uneven illumination which will be presented in the output image of the existing haze removal algorithms. They have proposed a new haze removal technique HDCP which will integrate dark channel prior with CLAHE to remove the haze from color images and bilateral filter is used to reduce noise from images. Xia Lan [7] purposed a three-stage algorithm for haze removal, considering sensor blur and noise. In the first step they preprocessed the degraded image to denoise it from blur. In the second step, they estimated the transmission and atmospheric light by the dark channel prior method. Last step gives a method to recover the underlying image. Experimentalresults with both simulated and real data demonstrate that the proposed algorithm is effective, based on both the visual effect and quantitative assessment. Linting Bai et al, [8] developed a novel methodwhich uses a new kind of filter called guided filter to optimize the medium transmission.They made a real time haze removal algorithm using dark channel prior. Time is reduced to a greater extent. In addition, the method uses down sampling and interpolation method to reduce the number of pixels and hence it reduces the pixels to be worked upon resulting in reduced time.

III.ANALYSIS OF SINGLE IMAGE HAZE REMOVAL USING DARK CHANNEL PRIOR AND REAL TIME HAZE REMOVAL

The algorithm in [2] uses Dark Channel Prior Method to dehaze the images. The Results of this method are very promising.Dark Channel Prior has been the major discovery in image dehazing algorthims But the drawbacks of this algorithm are:

1. It doesn't suit real time applications as it takes around 19 seconds to compute the results.

2. It is highly Complex

3.Parameters such as entropy,time and variance can be improved further

All the above mentioned limitations of Dark Channel Prior were covered in [8] where downsampling/upsampling and guided filter are used along with Dark Channel Prior. The computational time of this algorithm is less than 50 ms so it is well suited for Real-Time Applications.

Figure 1 First: Input Image, Second : Result of [2] ,third: Result of [8]

TABLE 1. SOME METRICS OF IMAGES IN (FIG1.) [8]

	Input Image	Result of [2]	Result of [8]
Mean	143.6	64.6778	137.4140
Variance	492.2272	2594.7	2950.9
Entropy	4.5392	5.0324	4.8195
Time	-	19.2s	0.047s

IV.PROPOSED ALGORITHM

After analyzing the two algorithms mentioned in [2] and [8] we propose an algorithm which is expected to achieve better results in terms of statistical parameters of the image and will be relatively simpler.

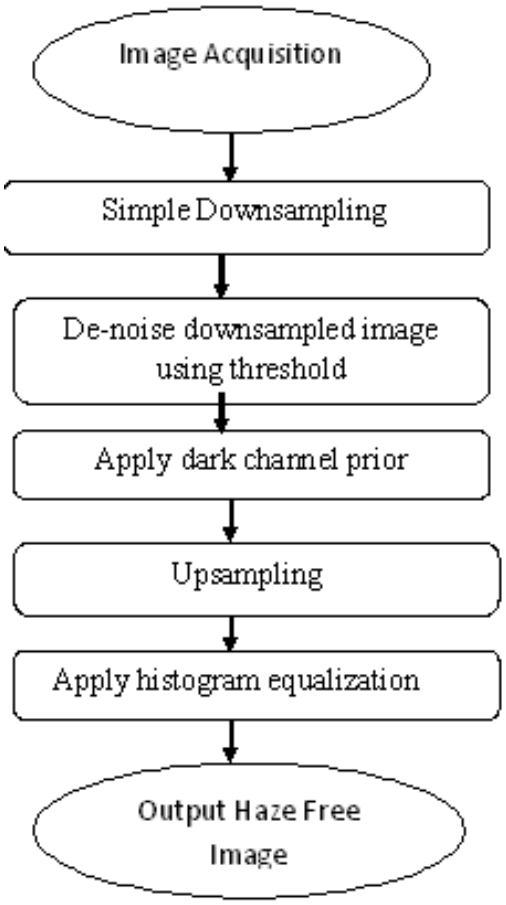

Figure 2 Purposed Dehazing Algorithm

1.4.1 Facts Favouring the Algorithm

Below are the facts which favour aour algorithm which is to be implemented in MATLAB IDE.

1. Downsampling is used to produce low resolution image and the methods like interpolation etc are complex methods and we suggest a simple downsampling method which will help in reducing the computational time.
2. Histogram Equalisation is used in place of histogram scratch, former being effective and simple to use.
3. Soft Matting and Guided filtering is eliminated at the time and if needed simple smoothening filter can be implemented which will further help in improving the time of the algorithm.

V. CONCLUSION

In this paper we analyzed the already existing dehazing algorithms which used Dark Channel Prior technique, a major breakthrough in the field of image dehazing. But using complex post processing mechanisms along with Dark Channel made the whole process of image haze removal a very complex and slow process. This paper brought into light some facts and modifications which are expected to achieve better results in terms of statistical parameters of the digital Image such as Mean, Variance and Entropy etc.

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