A Review on Image Denoising & Dehazing Algorithm to Improve Dark Channel Prior

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Abstract: *In this Paper, we design a new rapid variation approach to dehaze and denoise simultaneously. The proposed technique first estimates a transmission map the usage of a home windows adaptive method primarily based at the celebrated dark channel prior. This transmission map can drastically lessen the threshold artefact in the resulting photograph and enhance the estimation precision. The transmission map is then transformed to a depth map, with which the new variation version can be constructed to searching for the very last haze- and noise-unfastened image. The existence and specialty of a minimiser of the proposed variation model is similarly mentioned. A numerical procedure primarily based at the Chambolle–Pock algorithm is design, and the convergence of the set of rules is ensured. Sizeable experimental consequences on real scenes display that our approach can repair brilliant and contrastive haze- and noise-loose snap shots efficiently*

Keywords: Dehaze, Denoise, Adapative, Chambolle–Pock algorithm

1. INTRODUCTION

Bad weather conditions together with haziness, mist, foggy and smoky degradation inside the high-quality of the out of doors scene. it is an traumatic trouble to photographers as it changes the shades and decreases the contrast of daily pics, it diminishes the visibility of the scenes and it's miles a hazard to the reliability of many packages like out of doors surveillance, item detection, it also decreases the readability of the satellite tv for pc photos and underwater pics. So putting off haze from images is an imperative and broadly demanded vicinity in photo processing. The massive portions of those suspended debris in environment reason scattering of light before it reaches the camera which corrupts the out of doors photograph first-rate. Haze attenuates the meditated light from the scenes and blends it with additive light in surroundings. Haze removal techniques tend to improve this meditated light (i.e. scene colorations) from blended light. The constancy and electricity of the visible machine can additionally be progressed via the usage of this effective haze removal of picture. there are numerous techniques to be had to eliminate haze from photo like polarization independent aspect analysis, dark channel prior. Due to the presence of the atmosphere, the light reflected from a scenario is always scattered before it reaches the camera lens, and the light collected by any camera lens is usually blended with the airlight This leads to inevitable image degradation such as increasing noise, reduction of intensity contrast, and loss of color fidelity. This kind of degradation is particularly serious when the weather conditions are poor, i.e., when aerosols such as haze, fog, rain, dust, or fumes are present. For instance, as a common weather phenomenon, fog may produce an albedo effect, which leads to ambiguity and noise. These phenomena, to some extent, have adverse effects on comprehension and extraction of contents from the images. Therefore, effective haze removal (or dehazing) and denoising methods are urgently needed in real applications. Indeed, the image dehazing and denoising of natural scene images have attracted much attention in imaging science recently. The advantages of such operations are clear. First, the haze- and noise-free images are visually more vivid and appealing; second, the haze- and noise-free images are more suitable for many important applications such as image segmentation, feature extraction, and image fusion. However, as usually the haze depends strongly on unknown depth information, the image dehazing problem is a very challenging task. The problem will be more ill-posed if the input data is only a single image Image dehazing is an interdisciplinary challenge which involves not only ma-chine vision but meteorology, optics and some aspects of computer graphics.Haze as well as fog are limiting factors for the visual range within the atmosphere and have the effect and potential to heavily and significantly reduce the contrast of the target scenes.

A core objective of image analysis is aimed at the improvement of visibility, the recovery of constituent colors, as well as all constituting image parameters as if the image was captured or acquired under favorable onditions.

The core benefit of image dehazing lies in the manner in which it allows computer vision and human vision systems to capitalize on such improved and refined images for the realization of various applications. Additionally, most computer vision applications, ranging from low-level image analysis schemes to high-level object recognition, usually tend to assume the input image as the ultimate and most reliable source of the scene radiance.

This, therefore, goes to establish that the performance of computer vision algorithms no matter how high level they may have a strong dependence upon the quality and reliability of the input image. Such algorithms will invariably suffer from biased and corrupted input images as a result of haze or fog presence within the target scene.

Research work dedicated towards image dehazing has been ongoing for several decades now. We can loosely group the current state-of-the-art into two main groups. Firstly, we have the image enhancement-based schemes that fail to consider the physical modeling of the image as well as image formation principles. Such schemes only seek to boost image quality in order to please the viewer. Such enhancement based dehazing schemes have included

2. BLOCK DIAGRAM

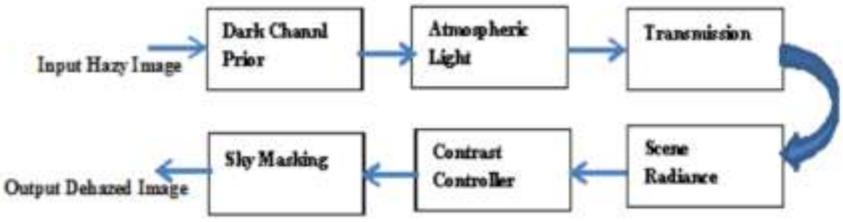

Fig 1 Block diagram of Proposed Haze removal model

The main Objectives will be:

• We present a windows adaptive method to estimate the transmission map;

• We propose a new energy model for dehazing and denoising simultaneously;

• We describe the existence and uniqueness of the minimizer of the proposed energy functional;

• To the best of our knowledge, the framework of the weighted vectorial total variation introduced here is somewhat new and could be applied elsewhere;

This project is comprised of several components and thus has a number of key objectives

• Take as input any user-specified RGB source image that is polluted with haze.

• Accurately determine which areas are polluted with haze.

• Dehaze the image using the dark channel prior.

• Complete all computation in a reasonable amount of time (under 30 seconds for an 800x600 pixel image, if possible)

3. Research Methodology/Planning of Work

The dark channel prior method has become a well-adopted algorithm to improve hazy images, and it has been used as the basis of numerous research projects. For example, the dark channel prior is used in a video application to recognize fog based on traffic scene in hazy weather . There have also been extensions of the dark channel prior to improve film and video quality for under water photography .

There have also been efforts to enhance the current dark channel prior method. For instance, the dark channel prior method was improved through the use of contrast enhancement to enhance color contrast with less color distortion. Still, there has been little effort to improve the computation time of the dark channel prior method. The soft matting function in the dark channel prior algorithm is computationally expensive and causes a bottleneck in the code. For this dehazing method to be a user-friendly application, we believe speed must be improved. We used a series of bilateral filters techniques.

Specifically, we design an optimization algorithm that balances between a system of three bilateral filters and the dark channel prior, so that the time to clean up hazy images is improved. Experimental results show that the proposed method accurately finds areas that have low contrast to the sky region to determine what is hazy and what is not in an image. The produced images have undesirable artifacts; however, our goal was to improve the performance of the dark channel prior method not the quality of the produced image. The results are significantly faster than the conventional dark channel prior method, with speeds now running at about 12 seconds for an 800x600 pixel image.

Lastly, methods before claimed that their methods worked on images that were polluted with smoke, fog, haze etc., but those methods never demonstrated experimental results using images other than hazy images. Our method used images that were taken both of fog/haze as well has images that were polluted with smoke and steam.

To conduct our experiments we enhanced a dark channel prior Matlab code We also used Matlab code from to apply the guided joint filter in the bilateral filtering algorithm. We decided to continue running the code in Matlab because it tends to be a robust application for computational photography. To execute the dehazing method as a whole, and algorithm to complete the three-step bilateral filtering process. The following breaks down the steps with their corresponding functions that were necessary to develop haze free images. The test images we used in our experiments were images we took in the field prior to the project. Images are either polluted with haze, steam, or smoke. The input image used in this section was polluted with smoke; however, the results would be similar for a hazy or steamy image

Haze removal algorithms have become a need for various computer vision based applications. But in already existing approaches, many aspects have been neglected i.e. No technique is accurate in different situation.

Survey has displayed the neglected points in the presented methods like the noise reduction methods.

The problem of uneven and over illumination is also an issue for dehazing methods. So there is a need of modification in the existing methods so that existing methods work in better way. An integrated dark channel prior, CLAHE and bilateral filter combined algorithm can be used to get better results.

4. Design and Implementation of Adaptive Filters

Once the dark channel priories of the image have been successfully computed the algorithm proceeds into the adaptive filtering component. This component plays a major role in enhancing the features of the dark channel priori-based image and aiding in boosting the efficiency of the subsequent components of the algorithm. From a general perspective, a filter is termed adapted when it is capable of changing its filtering parameters (coefficients) over time, in order to allow adaption to image dynamics. In order to satisfy this task, an adaptive filter must self-learn. As the input image arrives at the filter, the adaptive filter coefficients are capable of adjusting themselves in order to achieve an optimum outcome, such as identifying an unknown filter component or canceling out noise in the input image. In designing of an adaptive filter, some filter properties are required to be taken into account in order to realize filters that perform optimally as adaptive filers. These benchmark properties are briefly presented below. Filter Convergence Rate:

The convergence rate determines the rate at which the filter converges to its resultant state. Usually, a faster convergence rate is the desired characteristic of an adaptive system. Convergence rate is not, however, independent of all of the other performance characteristics. There will be a tradeoff, in other performance criteria, for an improved convergence rate and there will be a decreased convergence performance for an increase in other performance. For example, if the convergence rate is increased, the stability characteristics will decrease, making the system more likely to diverge instead of converging to the proper solution.

Likewise, a decrease in convergence rate can cause the system to become more stable. This shows that the convergence rate can only be considered in relation to the other performance metrics, not by itself with no regards to the rest of the system.

5. Minimum Mean Square Error:

The minimum mean square error (MSE) is a metric indicating how well a system can adapt to a given solution. A small minimum MSE is an indication that the adaptive system has accurately modeled, predicted, adapted and/or converged to a solution for the system. A very large MSE usually indicates that the adaptive filter cannot accurately model the given system or the initial state of the adaptive filter is an inadequate starting point to cause the adaptive filter to converge. There are a number of factors which will help to determine the minimum MSE including, but not limited to; quantization noise, the order of the adaptive system, measurement noise, and error of the gradient due to the finite step size.

 Computational Complexity:

Computational complexity is particularly important in real time adaptive filter applications. When a real time system is being implemented, there are hardware limitations that may affect the performance of the system. A highly complex algorithm will require much greater hardware resources than a simplistic algorithm.

 Stability:

Stability is the most important performance measure for the adaptive system.By the nature of the adaptive system, there are very few completely asymptotically stable systems that can be realized. In most cases, the systems that are implemented are marginally stable, with the stability determined by the initial conditions, the transfer function of the step size of the input.

 Robustness:

The robustness of a system is directly related to the stability of a system. Robustness is a measure of how well the system can resist both input and quantization noise.

Filter Length:

The filter length of the adaptive system is inherently tied to many of the other performance measures. The length of the filter specifies how accurately a given system can be modeled by the adaptive filter. In addition, the filter length affects the convergence rate, by increasing or decreasing computation time, it can affect the stability of the system, at certain step sizes, and it affects the minimum MSE. If the filter length of the system is increased, the number of computations will increase, decreasing the maximum convergence rate. Conversely, if the filter length is decreased, the number of computations will decrease, increasing the maximum convergence rate.

For stability, due to an increase in the length of the filter for a given system, you may add additional poles or zeroes that may be smaller than those that already exist. In this case, the maximum step size, or maximum convergence rate, will have to be decreased to maintain stability. Finally, if the system is under specified, meaning there are not enough pole and/or zeroes to model the system, the mean square error will converge to a nonzero constant. If the system is over specified, meaning it has too many poles and/or zeroes for the system model, it will have the potential to converge to zero, but increased calculations will affect the maximum convergence rate possible.

6. 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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