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Image Haze Removal using Dark Channel Prior Technique

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Abstract—**Haze is a full of atmosphere occurrence that significantly degrades the visibility of out of door scene. This is frequently mainly because of the atmosphere element that soak up and separate the sunlight. This paper introduces a unique single image move toward that enhances the visibility of such corrupted pictures. during this work, a single edge-preserving decomposition-based method is introduced to estimation transmission map for a haze image consequently on style one image haze removal algorithmic rule from the Koschmiedars law while not utilization any previous. An alternate fast variation approach to dehaze and denoise at the same time. The designed technique initial estimates a transmission map using a windows adaptive technique support the renowned dark channel previous. Restitution of smog images is important for the de-weathering matter in computer visualization. In this propose a new method for estimating the optical transmission in hazy scenes given a single input image. Based on this estimation, the spread light is eliminating to raise scene visibility and recover haze-free scene contrast.**

Keywords— **Edge Detection, Laplacian distribution, Retinex theory, visibility restoration.**

I. INTRODUCTION

One of the main fundamental kinds of pollution - haze - is that the major motive after reduced visibility in several global cities and scenic areas. Haze is causing once daytime encounter small substance within the air that reduces the clearness and color of what we tend to see, and extensively throughout wet conditions. Several outside laptop vision applications like video police work, object detection, seeing, tracking; intelligent vehicles and remote sensing systems etc. assume that the input pictures have clear visibility. Unhappily, this can be not constantly true in numerous things, especially, haze and smog weather happening a lot of and further of times. External pictures or videos are at times corrupted by light-weight dispersion and interesting from the aerosols, like dirt, smog and smoke within the atmosphere, here considered haze. The captured scenes suffer from poor visibility, contrast, brightness, brightness and distorted color. With the assistance of atmospherically optics theories, one will justify the effects that haze has on the visibility of a scene and eventually of a picture taken of that scene. Moreover, with the event of special effects technology, it's attainable to boost the visibility in terms of vary, color and have separation in digital pictures. in this the term “dehazing” means that to provide a picture of a picture that doesn't contain hazes effects though the supply of that image originally comprised haze.

A most important idea in dehaze investigation is enhancement of visibility and recuperation of colours, as if imaging is done in clear environment. Then pc vision and human vision will method on such improved pictures for numerous applications, like long vary police work. The necessity for image enhancement stem from the real fact that the atmosphere is infrequently free from particle. Even basically clean air, the visibility has been found to be between 277km [1] to 348km [2], [3], not in view of the curve of the earth’s face. However, real visual ranges are a lot of not up to this theoretical worth. The international visibility codes for meteoro logic vary rates visibilities between beneath 50m up to over 50km for exceptionally clear air. These codes are found to reflect a convenient scale for visual ranges within the daily work of meteorologists. Recently, haze removal through single image attracted a lot of interest and created important progresses because of its broad applications. Several single image haze removal algorithms were planned. Supported a surveillance that a haze-free image has higher difference than its haze image, a stimulating single image haze removal algorithmic rule was planned in [5] by increasing the native distinction of the fixed up image. Experimental results show that the planned algorithmic rule is applicable to haze pictures, underwater pictures and traditional pictures while not haze. It ought to be detected that the planned algorithmic rule may be a new framework for signal image haze removal that is from the Koschmiedars law while not victimization any previous**.**

Many outdoor computer vision applications like video surveillance, object detection, object recognition, tracking, intelligent vehicles and remote sensing systems etc. assume that the input images have clear visibility. Unfortunately, this is not always true in many situations, in particular, haze and fog weather occurring more and more frequently. Outdoor images or videos are usually degraded by light scattering and absorbing from the aerosols, such as dust, mist, and fumes in the atmosphere, here regarded as haze. The captured scenes suffer from poor visibility, contrast, brightness, luminance and distorted color. With the help of Atmospheric optics theories, one can explain the effects that haze has on the visibility of a scene and eventually of an image taken of that scene. Moreover, with the development of computer graphics technology, it is possible to improve the visibility in terms of range, color verisimilitude and feature separation in digital images. Herein the term “dehazing” means to produce an image of a scene that does not contain haze effects although the source of that image originally comprised haze.

II. THEORY

II.1. Digital Image Basics

We have multiple ways that to accumulate digital pictures from the important world: digital cameras, scanners, computerized tomography, and magnetic resonance imaging to name a couple of. In each case what humans see are pictures. However, once transforming this to our digital devices what we tend to record are numerical values for every of the points of the image. The widespread availability of relatively low-priced personal computers has heralded a revolution in digital image process activities among scientists and also the shopper population normally.

Digital pictures are composed of pixels (short for image elements). Every pixel represents the colour (or gray level for black and white photos) at one purpose within the image, thus a pixel is sort of a small dot of a specific color. By measurement the colour of a picture at an oversized range of points, we will produce a digital approximation of the image from that a copy of the first will be reconstructed. Pixels are a little like grain particle in a very standard graphic image, however prepared during a regular pattern of rows and columns and store data somewhat differently. A digital image may be a rectangular array of pixels generally called a bitmap.

II.2. Types of Digital Images

For photographic functions, there are 2 necessary varieties of digital images—color and black and white. Color pictures are created from colored pixels whereas black and white pictures are made from pixels in numerous shades of gray.

- Black and White Images

  A black and white image is created from pixels every of that holds one range similar to the gray level of the image at a selected location. These gray levels span the total vary from black to white during a} series of very fine steps, usually 256 totally different grays. Since the attention will barely distinguish concerning 200 totally different gray levels.

- Color Images

  A color image is created of pixels every of that holds 3 numbers similar to the red, green, and blue levels of the image at a selected location. Red, green, and blue (sometimes mentioned as RGB) are the first colours for mix light—these supposed additive primary colours are completely different from the subtractive primary colours used for mix paints (cyan, magenta, and yellow). Any color may be created by mix the proper amounts of red, green, and blue light-weight. Forward 256 levels for every primary, every color component may be kept in 3 bytes (24 bits) of memory. This corresponds to roughly 16.7 million completely different potential colours. Note that for pictures of constant size, a black and white version can use 3 times less memory than a color version.

- Binary or Bi-level Images

  Binary pictures use only one bit to represent every element. Since a little will only exist in 2 states—on or off, each element in a very binary image should be one in every of 2 colours, typically black or white. This incapacity to correspond to midway shades of gray is what limits their quality in handling photographic pictures.

- Indexed Color Images

  Some color pictures are created using a limited palette of colours, generally 256 completely different colours. These pictures are mentioned as indexed color pictures as a result of the information for every element consists of a palette index indicating that of the colours within the palette applies to it element. There are many issues with using indexed color to represent photographic pictures. First, if the image contains a lot of completely different colours than are within the palette, techniques like video digitizing should be applied to represent the missing colours and this degrades the image. Second, combining 2 indexed color pictures that use completely different palettes or maybe retouching a part of one indexed color image creates issues due to the restricted variety of obtainable colours.

III. METHOD

III.1. Dark Channel Prior

The success of recently developed techniques such as [Fattal, 2008], [Kopf et al., 2008] and [Tan, 2008] compared to earlier dehazing methods lies in using stronger assumptions. A very promising new single image technology, developed in 2010 called the Dark Channel Prior comes from He, Sun and Tang.

The main prior in this method is, as the name let's assume, the dark channel prior, which is a statistical based assumption of haze-free outdoor images. The prior says, that in most of the local regions that aren't sky, very often some pixels have a very low intensity in at least one of its colour channels (RGB). In the hazy image then, these dark pixels can be used to determine the true air light, since the air light is apparent on a dark object (as stated in the preceding chapter). The dark channel Jdark of J(the haze-free image) is defined as

$$J^{dark}(x) = \min_{c\in\{r,g,b\}}\left(\min_{y\in\Omega(x)}(J^{C}(y))\right) \quad (1)$$

where Jc is a color channel of J and (x) is a local patch centered at x. This statistical observation is called the dark channel prior. These low intensities come from natural phenomena such as shadows or just really dark or colorful surfaces. Since Jdark tends to be zero and as Ac, the corresponding channel of the atmospheric light is always positive, it may be written:

$$J^{dark}(x) = \min_{c\in\{r,g,b\}}\left(\min_{y\in\Omega(x)}\frac{J^{C}(y)}{A^{C}}\right) = 0 \quad (2)$$

This can be used to estimate the transmission for that patch (x) by putting 2 into the image formation model 2, however now in combination with the min operator:

$$\min_{c}\left(\min_{y\in\Omega(x)} I^{C}(y)\right)=\tilde{t}(x)\min\left(\min_{y\in\Omega(x)} J^{C}(y)\right)+(1-\tilde{t}(x))\cdot A^{C}$$
(3)

With et(x) denoting the transmission in a local patch, then putting 2 into 3 leads to:

$$\tilde{t}(x)=1-\min_{c}\left(\min_{y\in\Omega(x)}\frac{I^{C}(y)}{A^{C}}\right) \quad (4)$$

However, since the direct attenuation term J(x)t(x) can be very close to zero, the transmission is restricted to a lower bound t0 for example t0 = 0.1, since the scene radiance is typically not as bright as the atmospheric light A. The final scene radiance J(x) may then be recovered by:

$$J(x)=\frac{I(x)-A}{\max(t(x),t_0)}+A \quad (5)$$

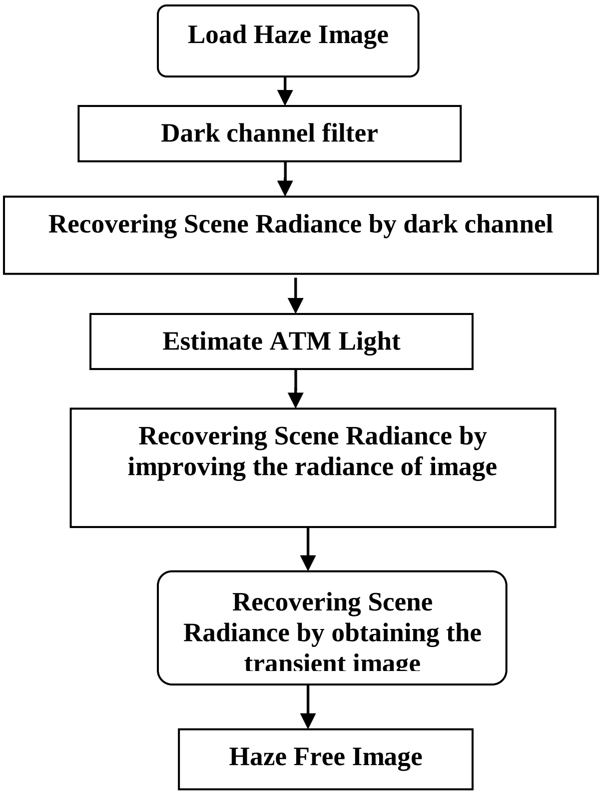

Figure 1 flow diagram of proposed system

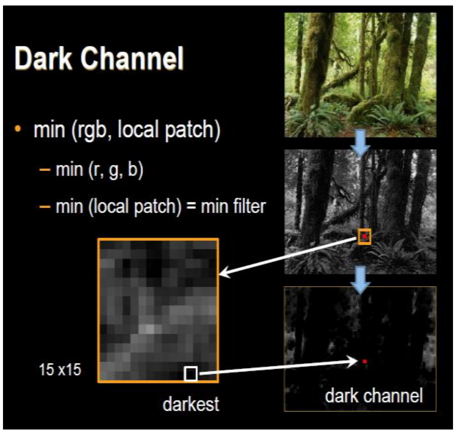

Figure 2 dark channel prior

IV. Result

The images with the haze are analyzed and the following are the results. The performance of proposed technique has been examined in this chapter. The result analysis of the images using proposed system with the dark channel prior algorithm for haze removal and image quality enhancement has been done. The images with the haze are analyzed according to the proposed method and give the following results.

Figure 3 Input images with Haze

As show in above figure 3 is input image. In the above figure we can see the hazy image after taking input haze image we proposed the haze removal. In above input object apply dark channel estimation algorithm as show on equation 1 and 2 and find dark region and light intensity of object. After the collecting dark information in object we mark it as show in figure 4.

The first output is a dark form of image after haze removal. After dark channel estimation the atmospheric estimation and transient estimation algorithms are applied to calculate variations as shown in figure 5.

The estimate of pixel value in dark region and the atmospheric variation estimate is the estimation of transmission obtained as the transient image fig.6.

Figure 4 Dark image after haze removal

Fig.5 is the radiant or dehazed image of the object obtained after further optimization by smoothening the transient image fig.6.

Figure 5 Radiant images after haze removal

The final output is a transient image after haze removal.

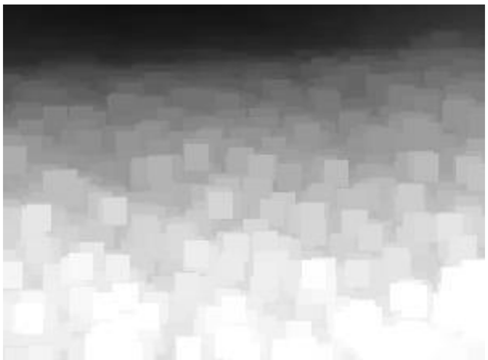

Figure 6transient images after haze removal

Table 1 Result Analysis

S.No.	Parameter	Base Paper	Proposed
1.	Time Complexity	5.25 sec.	2.1 sec.
2.	Quality Factor	35.89dB	38dB
3.	Memory Factor	Core I3 Processor, 2GB	I7 Processor, 8GB RAM

Table 1 shows the comparative results obtained by the technique used in previous paper compared to the proposed technique. The comparison of results can be further seen as the in terms of running times, PSNR. It can be observed that the consumption time or running time taken to process the dehazed image by the proposed technique is less than the technique used in previous technique.

V. CONCLUSION

Single image haze removal formula has been planned throughout this project by introducing an edge-preserving decomposition technique to estimate the transmission map for a haze image, and another author work IVR formula is applicable to haze photos, underwater photos, and traditional photos whereas not haze. The combination of edge-preserving decomposition and IVR for quality output (better restoration rates, MSE, PSNR) is planned. The intended algorithmic rule may possibly be a novel structure for single image haze elimination that is as of the Koschmiedars law while not using any previous. It in addition initiates a brand new reason for accessible edge-preserving smoothing method. With the results obtain in the category of running times, Quality (PSNR) it will be discovered that once a hazy image is taken because the input to the planned technique, the time taken to method the dehazed image will be found with the period of time and also the quality of the image will be measured by the PSNR worth. Hence, with the planned methodology a high quality image with a good PSNR index has been obtained.

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