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Real-Time Conversion of Haze Into Haze-FreeImages And Videos

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Abstract:

Weather is a major factor in outside photography and computer vision. Fog, sunshine, and smoke obscure images and videos captured by a camera because they obscure the contrast among them. In this study, a new real- time dehazing method is proposed. We can estimate theambient light and extract the clear picture objects from a single input image using approaches like the dark channel prior and the depth map. Our solution outperforms previous methods in terms of both performance and processing time. It is possible to utilize the proposed method to monitor vehicles from the outside and make them smarter.

Keywords: *Dark channel prior, bilateral filter, depth map, dehaze*

I. INTRODUCTION:

When photographing under adverse weather conditions, light is dispersed and absorbed, and this light is also homogenized with light reflected from multiple directions, known as the airlight, which returns to the camera. [1]. As a result of this technique's reduced use of color and sharpness, the final image lacks a realistic quality to it.

Fog, smoke, dust, rain, snow, and other types of precipitation can all generate undesirable visual effects in photos and movies. These abnormalities in event detection may have a significant impact on surveillance from the outside and ADAS technologies (advanced driver aid systems). Hazing artifacts have been found to have a significant impact on the performance of image/video compression, reducing the transmission and storage capacity of digital visual information. As a result, the removal of weather effects (also known as "de-weathering") from images and films has become increasingly important and has attracted considerable interest. Our primary focus in this study is on a single image for haze removal (or dehazing).

In order to construct the MSRL-DehazeNet, a deep learning method for removing background haze from a single image, numerous scales of residual learning were used (MSRL). Aside from the end-to-end mapping of hazy images to their clear counterparts, we re-frame this problem as a restoration of the image's basic component. To map haze-free base components to the haze- freebase components, an image can be dehazed using multiscale deep residual learning and simplified U-Net learning. Another convolution neural network that has been training or education can then be used to enhance the specific component (CNN). For more effective feature extraction, features are transferred to the next layer using CNN architecture and reduced U-Net structure. Consequently, color distortion in the restored image is avoided. Achieved images and movies that are clearer and more detailed because of the haze-removed improved detail component.

II RELATED WORK:

Runde Li utilized images acquired from the same scene with varying polarisation levels in [1]. This filter may be ineffective when the scene is dynamic since it is tied to a camera. It is impossible to use this technique since it is restricted to static situations in [2] Yu Zhang's work because several images are shot in various weather conditions.

When Xiao Sun divides the scene radiance into surface shading and subsequently extracts transmission, he does so where the transmission and surface shading are not connected. Haze images produced by Tengu Yu's factorial Markov random field model are susceptible to color distortion for this. To clear the haze, S. Narasimhan uses photos with improved visibility to restore the image [5]. It's easier to see the findings, but they maybe be skewed by the saturation and hence not be true to reality.

In [6] "Visibility in poor weather," Clear weather is the ideal environment for current vision systems. There is no avoiding "bad" weather in any outside application. A computer vision system must include methods that allow it to work (even if slightly less reliably) in the presence of haze and fog as well as other weather conditions. To begin, we examine how various weather situations seem visually. We use what we currently know about atmospheric optics to do this. Next, we'll look at ways in which terrible weather might benefit us. Visual information coding may be understood in terms of atmosphere modulating how information is sent from a scene point to the viewer. In light of these findings, we create models and strategies for recapturing relevant images.

'Vision and the atmosphere' may be found in [7]. Visual information coding may be understood in terms of atmosphere modulating how information is sent from a scene point to the viewer. We use two fundamental scattering models and create methods for recovering relevant scene attributes, such as three-dimensional structure, from one or two photos obtained in poor weather. Our next step is to simulate and test the chromatic effects of air scattering. These geometric limitationsare derived from this chromatic model, which explains how weather conditions affect the color of a scene. As a result of these restrictions, we've developed algorithms that cancompare these two or more images taken under distinct but unknown weather circumstances to determine the hue of fog or haze, segment depth, and extract three-dimensional structure.

"Vision and rain" occur in [8]. Rain has a variety of visualeffects. Rain causes pictures and videos to shift dramatically in intensity, which can have a negative impact on outdoor vision systems. The visual impact of rain and the different elements that influence it are examined in this research. Based on these findings, we've been able to create very efficient algorithms for dealing with rain in computer vision and portraying rain in computer graphics that are photorealistic. Photometric models characterize the intensity of individual rain streaks while dynamic models capture the Spatio- temporal features of rainfall. We begin by developing these two models. Together, these models depict the whole range ofrain's visual qualities. A simple and effective post-processing technique for the identification and removal of rain from movies is developed using these models. ' In this study, we show that our technique can differentiate between rain and other time-varying textures such as intricate scene object motion. Our investigation is then reinforced by examining the effects of various camera parameters, rain characteristics, and scene brightness on how rain appears. As a result of the rain's small size, fast velocity, and wide dispersion, its visibility maybe seriously impacted by the camera settings. Rain may be reduced during image collection by setting camera parameters with care, using this dependency. Camera settings can also be used to make rain more apparent. This capability may be exploited to create a reduced, portable rain gauge based on a camera that can measure the rate of rain in real-time. It's at this point that we create a rain streak appearance model that takes into consideration the raindrop's quick form distortions (or oscillations). These distortions allow us to accurately describe the complex intensity patterns evident in the case of raindrops that are near to the camera.

As stated in "Video-based automated incident detection for smart roads: the outside environmental issues with false alarms," AID systems are becoming more common in intelligent transportation systems[9]. In contrast, video- based AID’s precision is heavily influenced by environmental factors such as shadows and intensity. The ability to perceive environmental variables such as static shadows, snow, rain, and glare has been studied in the literature. By adapting to the external environment, video- based AID systems will be better at detecting warnings. To close existing detection gaps in outdoor environmental circumstances, this study will draw on the reviewed literature to suggest new research options. It's expected that in the future, video-based AID systems will be more reliable and hence more widely used. New algorithmic methods for recognizing environmental elements that affect the AID system's accuracy are also suggested by this study.

The most common negative of these methods is the lack of speed for videos, which is the most common drawback.

An improved real-time video and picture dehazing algorithm is presented in this paper. The outcomes are better since the processing time is greatly decreased.

III METHODOLOGY:

A) BACKGROUND:

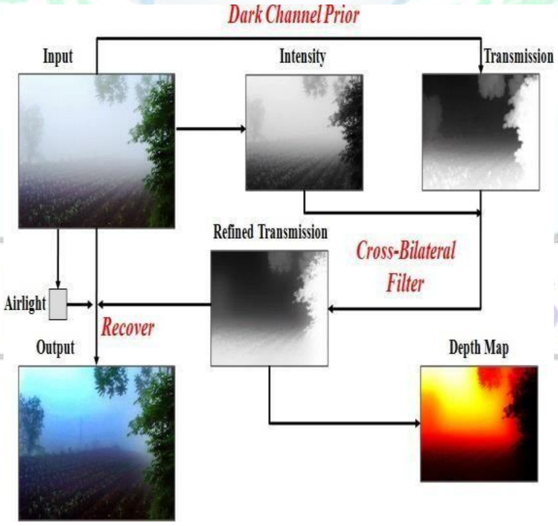
Direct attenuation and light going through the scattering medium and being distributed in various directions are two expressions used to create a hazy image. Attenuation is influenced by two, namely the medium and the depth of field. Air-light is the term used to describe the scattering of light fromother directions. The model may be described using the following equation.

$$A(x) = b(x) * C(x) + (1-b(x)) * D$$

A represents the acquired picture of haze, B represents the image without haze we want to restore, D represents the ambient light, and b represents the transmission medium that characterizes the light that isn't dispersed and gets to the camera. x represents the location of the pixel in this equation. The original haze-free image can be restored using this formula. The scalar value of transmission, which runs from 0 to 1, gives the product the depth information of the objects. Let us suppose that the medium is homogenous, and we can calculate the transmission as follows:

$$b(x)=e\beta^{\,d(x)}$$

where β indicates the scattering coefficient of the mediumwith the depth scene d



B) SINGLE-LAYER IMAGE DEHAZING

Rough transmission analysis, cross-bilateral filter smoothing, and picture recovery are the topics of this chapter.

1) EXTRACTION OF TRANSMISSION BY USINGDARK CHANNEL PRIOR

First, the airlight transmission map should be removed so that the stunned image may be recovered. In this instance, we're intending to use the dark channel that used to be there. For thevast majority of non-sky areas, at least one color channel will have low intensity at some pixel points. It is imperative that the intensity of such a patch be reduced to a minimum. Consider that a pixel in picture C has a dark channel value of [x]

$$\mathrm{A}^{dark}(x) = \min c \in \{r,g,b\} \ (\min y \in \Omega(x) \ (\mathrm{A}^{c} \ (y)))$$

Ac is a color channel of A, as shown. Assume that a dehazed image has a dark channel value of zero because it should be extremely low. Assume that t is the transmission time of a local patch. As a consequence, the hazy imaging model follows as follows.

$$\min c \in \{r,g,b\} \ (\min y \in \Omega(x) \ (\ c(y) / \ ^{c} \ ))$$

$$= \ \tilde{}(x) \min c \in \{r, g,b\} \ (\min y \in \Omega(x) \ (\ c(y) \ \ c \ ))$$

The above equation will handle both sky regions and otherregions.

Searching is divided into rows and columns using the CNNalgorithm. It uses two buffers and three comparisons per pixel to convert it into a pass. Because of this, each pixel comparison requires no and over 8 comparisons in all. Because of this, the dark channel is proportional to the size of the image. We utilize a patch size of 11 X 11 in our implementation

2) REFINEMENT OF THE TRANSMISSION IMAGEUSING BILATERAL-FILTER

The refining process is sped up by using an edge- preserving filter in this procedure.

Dual Filtering is a non-linear filtering method that maintains the strong edges to capture the strong edge and outline a picture's profile while removing any block that affects the original image. cross-border filtering is used to ensure seamless transmission. tr(x) stands for refine transmission and may be calculated:

$$t(x) = 1 \quad (x) \sum y \in \Omega(x) \quad (\|x - y\|) \quad r \ (| \ \ x - \ \ y|)t \ \tilde{}(x)$$

Using Paris and Durand's signal processing method to recast the calculation. Then, trilinear interpolation and division are applied.

3) RECOVERY OF THE HAZE-FREE IMAGE

In order to reassemble the haze-free image C, we willneed to change the transmission map.

$$\mathrm{C}(x) = \mathrm{A}(x) - \mathrm{D} \max(t(x), t0)/+ \mathrm{D}$$

The transmission can only go back to a certain period, t0. As a result, the final free picture C may be found using the following technique.

IV) EXPERIMENTAL RESULTS

i) Subjective Results on Hazy images:

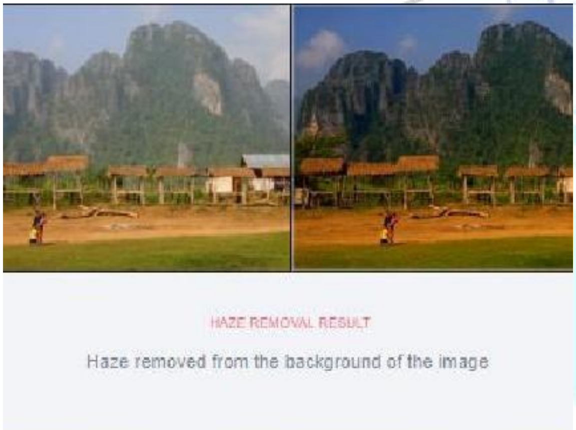
On the basis of these findings, we tested the suggested technique on real-world photos, including some of the most demanding natural photographs. When applied to real-world foggy photos, our technique yields superior dehazed images with improved retention of features and color information.

ii) Hazy Images: Quantitative and Qualitative Results

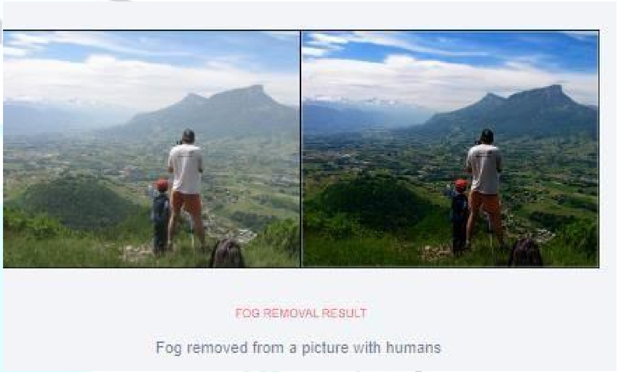
The original dark channel prior-based method, which is also a deep learning-based methodology, is compared to evaluate how well it works in terms of quantitative performance evaluation. Note that we employed three different sets of images for our tests: SOTS, OTS, and the High-Sensitivity Test Set (HSTS) (Synthetic Objective Testing Sets).

iii) Pre-processing and Problem Formulation:

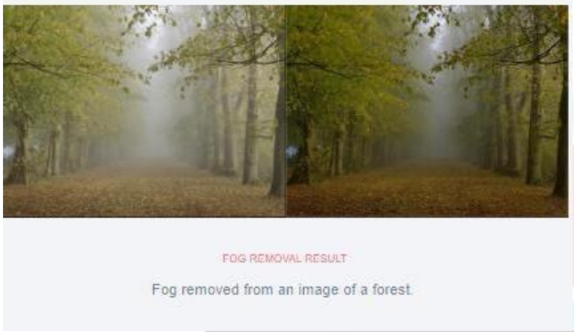
Our earlier image decomposition frameworks were the inspiration for this approach, which uses image filtering to divide an input fuzzy image into two parts: the base component and the detail component. As a result of the dehazing process, delicate details may well be lost.


HAZE REMOVAL RESULT

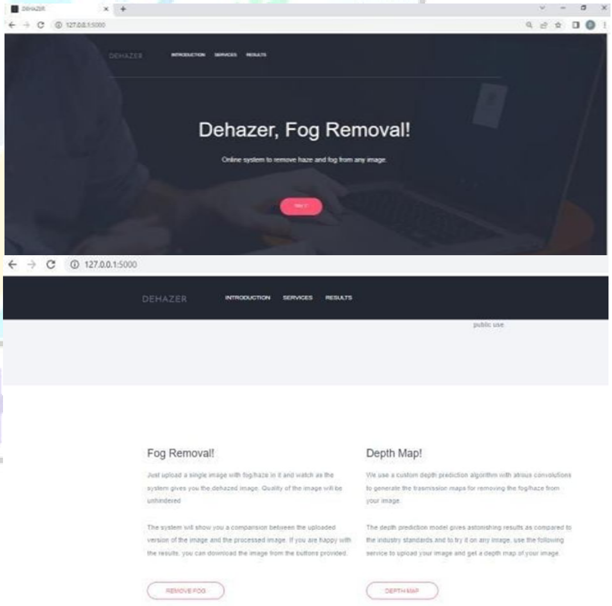
Haze removed from the background of the image


FOG REMOVAL RESULT

Fog removed from a picture with humans


FOG REMOVAL RESULT

Fog removed from an image of a forest



Dehazer, Fog Removal!

Online system to remove haze and fog from any image.

Fog Removal!

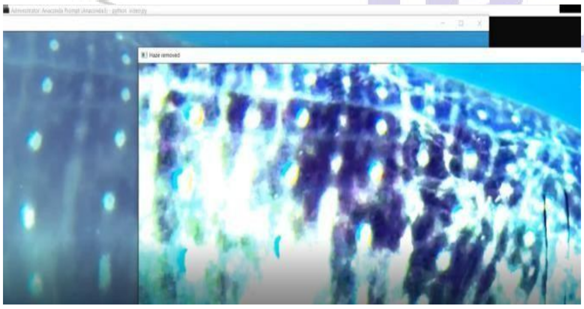
Just upload a single image with fog/haze in it and watch as the system gives you the dehazed image. Quality of the image will be unhindered.

The system will show you a comparison between the uploaded version of the image and the processed image. If you are happy with the results, you can download the image from the buttons provided.

Depth Map!

We use a custom depth prediction algorithm with atrous convolutions to generate the trasmission maps for removing the fog/haze from your image.

The depth prediction model gives astonishing results as compared to the industry standards and to try it on any image, use the following service to upload your image and get a depth map of your image.



IV) CONCLUSION:

In this paper, we have proposed a method to retain the image's color information by extracting the haze-relevant structural and statistical picture properties from the base component.

Nonlinear regression-based picture enhancement preserves the real features of the picture. Data from tests show that single picture dehazing approaches perform similarly in a lightweight network structure can be achieved by first decomposing an image into its most basic and most detailed components and then developing an in-depth model to learn a wide range of haze-related image properties.

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