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ABSTRACT - The images captured during the conditions like sandstorms, hazy or foggy weather conditions suffers poor visibility, which will create a lot of impacts on the outdoor computer vision systems, such as video surveillance, intelligent transportation assistance system, remote sensing space cameras and so on. The quality of the image is degraded by the scattering of atmospheric particles. The traditional methods to estimate haze using visibility restoration becomes inefficient, therefore it do not get our desired output. In order to overcome this problem, we go for edge collapse based dehazing algorithm for visibility restoration which is proposed in this paper. By doing so, a high-quality image with clear visibility and vivid color can be generated to improve the visibility of single input image (with fog or haze), as well as the image's details. Our approach stems from two important statistical observations about haze-free images and the haze itself. The famous dark channel prior, a statistics of the haze-free outdoor images, can be used to estimate the thickness of the haze, and then application of gradient prior law of transmission maps, which is based on dark channel prior. This can improve the quality and visibility of the images. This also keeps the haze estimation details of fog degraded image. Experimental results via qualitative and quantitative evaluations demonstrate that the proposed method can effectively improve images captured during inclement weather conditions and produce our desired results.

INTRODUCTION

Signal processing is a discipline in electrical engineering and in mathematics that deals with analysis and processing of analog and digital signals, and deals with storing, filtering, and other operations on signals. These signals include transmission signals, sound or voice signals, image signals, and other signals etc., Out of all these signals, the field that deals with the type of signals for which the input is an image and the output is also an image is done in image processing. As its name suggests, it deals with the processing on images. Analog image processing is done on analog signals. It includes processing on two dimensional analog

signals. In this type of processing, the images are manipulated by electrical means by varying the electrical signal. The common example include is the television image. Digital image processing has dominated over analog image processing with the passage of time due to its wider range of applications.

BLOCK DIAGRAM:

The block diagram of the dehazing procedure is represented with the help of a block diagram; the simplest one is shown in figure 1.

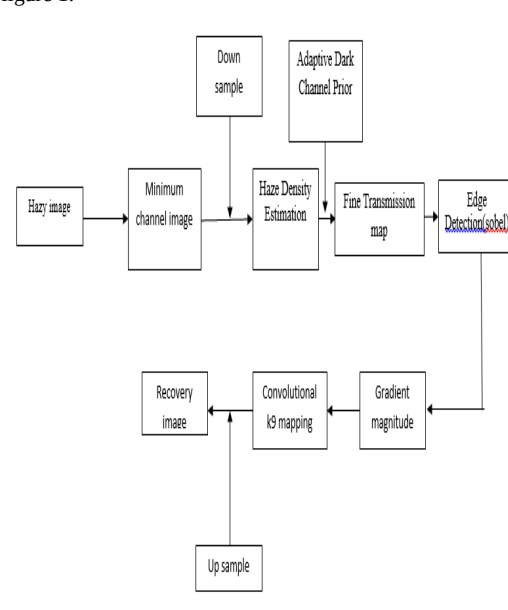


Figure 1: block diagram

Haze is an atmospheric phenomenon that dims the clarity of observed scene due to particles such as fog, smoke and dust. A Hazy scene is characterized by an important attenuation of colour that depends proportionally by distance to the object scenes. The dehazing process is controlled only by some parameters such as atmospheric veil inference, smoothing, restoration and tone mapping. The term atmospheric light will be estimated from dark channel of hazy image. It is the brightest 0.1% of pixels within a dark channel and from these one, the highest intensity pixels are chosen from RGB planes of hazy image as a atmospheric light. The dark channel prior is estimated by minimum filter which applies on input image. It is based on key concept that haze free images have at least one colour

channel with low intensity values. Down sampling is done to increase the values along the Y-axis. Then the haze density is estimated. The Transmission Map is done to recover visibility of an image, transmission map is determined from normalization of hazy image with atmospheric light. Inner min filter is determined minimum value of colour channel at each point and outer min filter finds minimum of local patch centred at each pixel. Transmission map is further utilized to find refined transmission using detailed edge information and it is enhanced by adaptive gamma correction to get better visibility from hazy images. The Sobel operator, also known as Sobel–Feldman operator or Sobel filter, is used in image processing and computer vision, particularly within edge detection algorithms where it creates an image emphasizing edges. The operator uses two 3×3 kernels [matrix] which are convolved with the original image to calculate approximations of the derivatives for horizontal, vertical changes. The gradient of the image is one of the fundamental building blocks in image processing. An image gradient is a directional change [x & y axes] in the intensity or color in an image i.e., direction and magnitude of the image. Koschmieder proposed that visibility is inversely proportional to the extinction coefficient of air, and this model has been widely adopted during the past century. Using radioactive transfer theory, it presents a general relationship for the law of contrast reduction and point out that the Koschmieder model is workable only to situations when a common-size object can be viewed tens of kilometers away. The algorithm above converges only for linearly separable data. If the data set is not linearly separable, we can map the samples into a feature space of higher dimensions. After these up sampling is done in order to increase the values along X-axis and then the image is recovered.

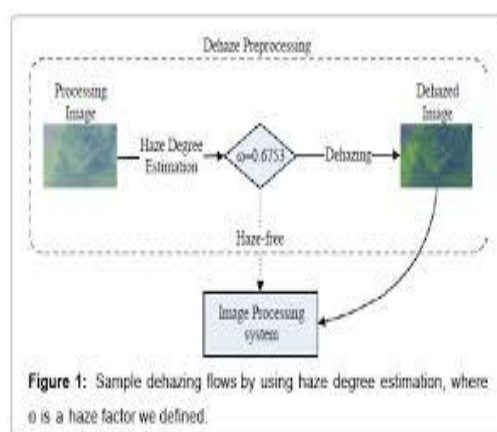


Figure 2: Sample dehazing flow

IMAGE RESTORATION TECHNIQUE

During inclement weather conditions such as fog, sand, and mist, captured images will

exhibit degraded visibility. This is because the suspended particles absorb and scatter specific spectrums of light between the observed objects and the digital camera. Accordingly, these degraded images can directly reduce the performance quality of systems such as object recognition systems, obstacle detection systems, video surveillance systems, intelligent transportation systems, and so on. Numerous visibility restoration approaches have been proposed to restore the visibility of degraded images in order to improve system performance during inclement weather conditions. These visibility restoration approaches can further be divided into additional information approaches, multiple-image approaches and single-image approaches.

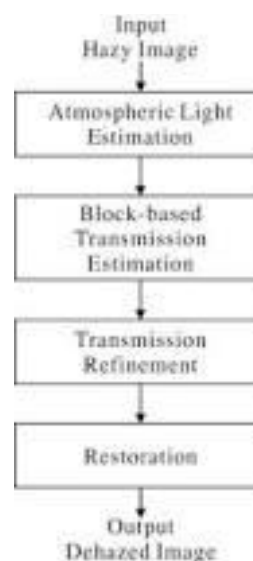


Figure 3: dehazing flow chart

Additional information approaches restore hazy images by using given scene depth information obtained from either an additional operation or user interaction, such as through user operation to control camera positions and via a given approximate 3-D geometrical model. However, these approaches are not well-suited for real-world application due to limitations placed on the acquisition of scene depth information by unknown geography information and additional user operation. Multiple image approaches adopt two or more images of the same scene, which are captured by using specific hardware, e.g., a rotating polarizing filter, to effectively construct the scene depth information and further achieve visibility restoration of incoming hazy images. These approaches are based on either strong assumptions or robust priors, by which haze thickness is estimated by using only a single image. Observing that a haze-free image possesses evident contrasts compared with a hazy image. By using observations of scene contrast changes, the method of Tan restores

different. Further challenges arise from interclass similarity in which instances from different classes can appear very similar. This paper addresses two goals of recognition are image classification and object detection. The task of image classification is to determine if an object class is present in an image, while object detection localizes all instances of that class from an image. Toward these goals, the main contribution in this paper is an approach for object class recognition that employs edge information only. The novelty of our approach is that we represent contours by very simple and generic shape primitives of line segments and ellipses, coupled with a flexible method to learn discriminative primitive combinations. These primitives are complementary in nature, where line segment models straight contour and ellipse models curved contour. We choose an ellipse as it is one of the simplest circular shapes, yet is sufficiently flexible to model curved shapes. These shape primitives possess several attractive properties. First, unlike edge-based descriptors they support abstract and perceptually meaningful reasoning like parallelism and adjacency. Also, unlike contour fragment features storage demands by these primitives are independent of object size and are efficiently represented with four parameters for a line and five parameters for an ellipse.

Additionally, matching between primitives can be efficiently computed (e.g., with geometric properties), unlike contour fragments, which require comparisons between individual edge pixels. Finally, as geometric properties are easily scale normalized, they simplify matching across scales. In contrast, contour fragments are not scale invariant, and one is forced either to rescale fragments, which introduces aliasing effects (e.g., when edge pixels are pulled apart), or to resize an image before extracting fragments, which degrades image resolution. An important feature of our contour-based recognition approach is that it affords us substantial flexibility to incorporate additional image information. Specifically, we extend the contour-based recognition method and propose a new hybrid recognition method which exploits shape tokens and SIFT features as recognition cues. Shape-tokens and SIFT features are largely orthogonal, where the former corresponds to shape boundaries and the latter to sparse salient image patches. Here, each learned combination can comprise features that are either 1) purely shape-tokens, 2) purely SIFT features, or 3) a mixture of shape-tokens and SIFT features. The number and types of features to be combined together are learned automatically from training images, and represent the more discriminative ones based on the training set. Consequently, by imparting these two degrees of variability (in both the number and the types of features) to a combination, we empower it with even greater flexibility and discriminative potential.

A (digital) color image is a digital image that includes color information for each pixel. Each pixel has a particular value which determines its appearing color. This value is qualified by three numbers giving the decomposition of the color in the three primary colors Red, Green and Blue. Any color visible to human eye can be represented this way. The decomposition of a color in the three primary colors is quantified by a number between 0 and 255. For example, white will be coded as $R = 255, G = 255, B = 255$; black will be known as $(R, G, B) = (0, 0, 0)$; and say, bright pink will be $(255, 0, 255)$. In other words, an image is an enormous two-dimensional array of color values, pixels, each of them coded on 3 bytes, representing the three primary colors. This allows the image to contain a total of $256 \times 256 \times 256 = 16.8$ million different colors. This technique is also known as RGB encoding, and is specifically adapted to human vision. Thus performing transmission mapping and filtering to get the hazeless clear image.

CONCLUSION

In our paper, we propose a Laplacian-based visibility restoration approach to effectively solve inadequate haze thickness estimation. By doing this, a high-quality image with clear visibility and vivid color can be produced to improve the visibility of single image (with fog or haze), and the details of the image. The dark channel prior can be used to estimate the thickness of the haze and the gradient prior law of transmission maps, which is based on dark channel prior. The experimental results show that the proposed approach can effectively improve the visibility and keep the details of fog degraded images in the meanwhile. Experimental results via qualitative and quantitative evaluations demonstrate that the proposed method can dramatically improve images captured during inclement weather conditions and produce results superior to those of other state-of-the-art methods.

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