ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

A Single Image Haze Removal Algorithm Using Color Attenuation Prior

Y. Nirmala Devi
M.Tech Student,
Dr K. V. Subba Reddy Institute of Technology.

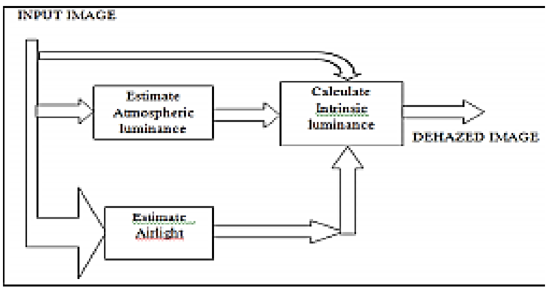
S. Feroz Shah Ahmed, M.Tech
Assistant Professor,
Dr K. V. Subba Reddy Institute of Technology.

ABSTRACT:
This paper compares the Fast Single Image Haze Removal (FSIHR) using Color Attenuation Prior (CAP) and MultiScale Fusion (MSF) methods. Single image haze removal has been a challenging problem due to its ill-posed environment. FSIHR works as simple but powerful color attenuation earlier, for removal of haze from a single input hazy image. MSF method is a fusion-based approach that results from two original hazy image inputs by applying a white balance and a contrast enhancing process. To merge the information of the derived inputs successfully, to maintain the regions with good visibility, it filters their important features by computing three measures (weight maps): luminance (Y), chromaticity (C), and saliency (S). The other FSIHR using CAP creates a linear model for modeling the picture depth of the hazy image with a supervised learning method; the depth information can be well recovered. With the depth map of the hazy image, the transmission and the scene radiance restoration via the atmospheric scattering model, and thus efficiently remove the haze from a single image. While the MSF method is faster than existing single image dehazing strategies and yields precise results.
Keywords dehazing, image defogging, image restoration, depth estimation.

INTRODUCTION:
Outdoor scene of image quality is degraded due to the poor weather condition such as haze, fog, mist and smoke, due to the presence of haze when the image taken from outdoor using digital camera means light gets scattered before reaching the camera due to the noise present in the atmosphere. So haze removal is critical problem. In poor weather conditions de haze the image is very critical issue in applications such as aerial photography, image recognition, driving assistance and visual surveillance .So dehazing the image using our method to improve contrasts of the foggy images and restores the visibility of the scene.. Hence removal of fog requires the estimation of air light map or depth map. Image enhancement and image restoration are the two techniques used in the haze removal Image.

Enhancement doesn't include the cause of fog fades image value. The haze image leads to loss of information instant of using the enhancement techniques. Image refurbishes the study of the physical process of imaging in fog. Enhancement is usually used in the following three cases: noise decreases from image, contrast enhancement of the really dull and bright image, and show up the boundaries of the substance in a blurring image. Noise decrease is the Method of reducing noise forms a signal or an image. In general, images occupied with both digital camera and conventional film cameras will choose noisefrom a multiple of sources. It is main to removed noise for many uses of these images. Contrast enhancement is capturing clear image from side to side intensity.

TOWARDS HAZE FREE VISION:



During bad weather conditions the atmosphere contains the fog and smoke particles. Due to this, it can significantly reduce the color and contrast of the images. In this phenomenon the amount of degradation increases with the distance from the camera to the object. The removal of fog from the captured foggy images is required to estimate the depth of the fog. The initial works for the fog removal uses multiple input images of the same scene that has been taken during different bad weather condition and the recent fog removal method requires only single input image for the estimation of the depth. Schechner and et al [1] method is based on the fact that airlight scattered by the atmospheric particles is always partially polarized. In this approach, the polarization filter alone cannot remove the fog effects from images. Here image formation is mainly occurs due to the polarization effect of atmospheric scattering and then inverting this process is required to obtain fog free image. In this method, input image is basically composed of mainly two unknown components. The first one is the scene radiance in the absence of the fog and the other one is air light. In order to recover these two unknowns, we need two independent images. It can easily be obtained, because the airlight is usually partially polarized. This method that doesn't need the weather conditions to change and it can be applied at any time. Tan [2] method is based on single image dehazing .This method based on the optical model. The optical model consists of two terms. The first term is the direct attenuation and the second term is the airlight. He then expressed it in terms of light chromaticity and as color vector components. This proposed approach is based on the assumption that the clear day images has high contrast as compared to the images those are affected by the bad weather. Relying upon this assumption, Tan removed the haze by maximizing the local contrast of the restored image It is not easy to remove haze because it depends on the information of scene depth. Fog effect is the function of distance between camera and object. Hence fog removal method needs the estimation of depth map. The fog removal method can be described into two ways: imageenhancement and image restoration. Image enhancement does not consist of the reasons of fog degrading image quality. This method can improve the haze image but by this Information regarding image losses. Image restoration firstly studies the physical process of image imaging in foggy weather. After observing that degradation model of fog image will be established. At last, the degradation process is inverted to generate the fog free image without the degradation. So, the quality of degraded image could be better.

IMAGE ENHANCEMENT:

A process of enhancing the visual quality of images due to no ideal image acquisition process (e.g., poor illumination, coarse quantization etc.)The principal objective of image enhancement is to process a given image so that the result is more suitable than the original image for a specific application. It accentuates or sharpens image features such as edges, boundaries, or contrast to make a graphic display more helpful for display and analysis. The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily The greatest difficulty in image enhancement is quantifying the criterion for enhancement and, therefore, a large number of image enhancement techniques are empirical and require interactive procedures to obtain satisfactory results. Enhancement methods can be based on either spatial or frequency domain techniques.

PREVIOUS WORKS:

The haze free image is mentioned commonly used for robotics application because of viewing the environment is outside the control of observer. In this [1]they used Distance metric learning based object classification algorithm To obtain more reliable solution given the limited side information and optimization tends to be faster,and it Only classifying the physical object not classifying the haze particle. KaimingHe,JianSun,andXiaoouTang,Fellow,[2] in this Dark channel prior algorithm which is used to convert some pixels of very low intensities of one color channel into high quality of haze free images.it have

ISSN No: 2348-4845
International Journal & Magazine of Engineering,
Technology, Management and Research
A Peer Reviewed Open Access International Journal

limitation is suffer from gradient reversal artifacts dark channel prior is based on the prior assumption. They have observed that in most of the local regions which do not cover the sky, some pixels have very low intensity in at least one color (RGB) channel and these pixels are known as the dark pixels. In hazy images the intensity of the dark pixels in that color channel is basically contributed by the air light and these dark pixels are used to estimate the haze transmission. After estimation of the transmission map for each pixel, combining with the haze imaging model and soft matting technique to recover a high quality haze free image. The dark channel prior does not work efficiently when the surface object is similar to the atmospheric light.

Tarel and Hautière (2009), Tan (2008) and Ancuti et al. (2014) have employed contrast based single image dehazing. In [3] Robby T. Tan has introduced an automated method that only requires a single input image. Two observations are made based on this method, first, clear day images have more contrast than images afflicted by bad weather; and second, airlight whose variant mostly depends on the distance of objects to the observer tends to be smooth. Tan develops a cost function in the framework of Markov random fields based on these two observations. The results have larger saturation values and may contain halos at depth discontinuities. As increasing demand for enhancing remote sensing images, presented histogram-based contrast enhancement methods notable to conserve edge details and demonstrate saturation artifacts in low and high intensity regions. If do not consider spatially varying intensity distributions, in the same way contrast-enhanced images may have intensity distortion and lose image details in some regions[3]. For overcoming these problems, decompose the input image into four different layers of single dominant brightness levels. K. B. Gibson, D. T. Vo and T. Q. Nguyen[4] are proposed that they using single-image dehazing using median operation to achieve better dehazing performance with fewer artifacts and better coding efficiency .in these they compare with there image thresholding and produce result but it have some drawback as Compression is must before dehazing the image .

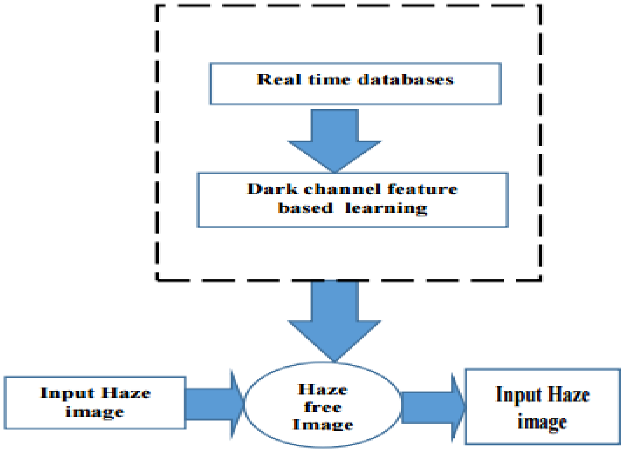


Fig: existing work block diagram

Andrew Adams [6] proposed that algorithm of Highdimensional Gaussian filter to obtain Our algorithm is first implemented of a high –dimensional Gaussian filter in both linear input size and polynomial in dimensionality it also have drawback Suffer from irregularity and require heavy parameter. Zhou Wang, Alan C. Bovik,Hamid R. Sheikh, and Eero P. Simoncelli [7], in this they used Bit assessment algorithm. This method has used for human visual perception for extracting structural information.it can occur the Issues is HVS is complex for non linear system and its error sensitive.Srinivasa G. Narasimhan and Shree K. Nayar[8],Weather removal algorithm is used . It restore scene contrast and produce effective image under wide range of weather condition. it can occur the Issues is Bad weather increase exponentially this method is failed to use. He et al. [9] discover the dark channel prior (DCP) that, in most of the non-sky patches, at least one color channel has some pixels whose intensities are very low and close to zero. With this prior, they estimate the thickness of haze, and restore the haze-free image by the atmospheric scattering model. The DCP approach is simple and effective in most cases. However, it cannot well handle the sky images and is computationally intensive. Dark channel prior is a statistics of outdoor image haze removal. It is based on the fact that the local patches in

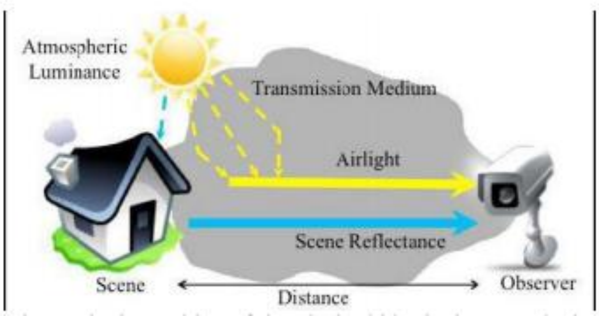
ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

the haze free images whose intensity is very low in at least one color channel. This information is used by dark channel prior method to improve the quality of image. From these pixels whose intensity is low the thickness of the haze can be estimated and the high quality haze free image can be recovered. High quality depth map of the image can also be obtained. Due to the air light; a foggy image is brighter than its fog-free version in where the transmission t is low. So the dark channel of the foggy image will have higher intensity in regions with denser fog. Thickness of the fog is a rough estimate of the intensity of the dark channel.

PROPOSED WORK:

In this paper, we propose a novel color attenuation prior for single image dehazing. This simple and powerful prior can help to create a linear model for the scene depth of the hazy image. By learning the parameters of the linear model with a supervised learning method, the bridge between the hazy image and its corresponding depth map is built effectively. With the recovered depth information, we can easily remove the haze from a single hazy image. An overview of the proposed dehazing . The efficiency of this dehazing method is dramatically high and the dehazing effectiveness is also superior to that of prevailing dehazing algorithms.

ATMOSPHEREIC SCATTERING MODEL



where x is the position of the pixel within the image, I is the hazy image, J is the scene radiance representing the haze-free image, A is the atmospheric light, t is the medium transmission, is the scattering coefficient of the atmosphere and d is the depth of scene. I, J and A are all threedimensional vectors in RGB space. Since I is known, the goal of dehazing is to estimate A and t, then restore J .It is worth noting that the depth of the scene d is the most important information. Since the scattering coefficient β can be regarded as a constant in homogeneous atmosphere condition , the medium transmission t can be estimated easily according to Equation if the depth of the scene is given. Moreover, in the ideal case, the range of d(x) is $[0, +\infty)$ as the scenery objects that appear in the image.

COLOR ATTENUATION PRIOR:

To detect or remove the haze from a single image is a challenging task in computer vision, because little information about the scene structure is available. In spite of this, the human brain can quickly identify the hazy area from the natural scenery without any additional information. This inspired us to conduct a large number of experiments on various hazy images to find the statistics and seek a new prior for single image dehazing. Interestingly, we find that the brightness and the saturation of pixels in a hazy image vary sharply along with the change of the haze concentration. A natural scene to show how the brightness and the saturation of pixels vary within a hazy image. In a haze-free region, the saturation of the scene is pretty high, the brightness is moderate and the difference between the brightness and the saturation is close to zero. But it is observed the saturation of the patch decreases sharply while the color of the scene fades under the influence of the haze, and the brightness increases at the same time producing the high value of the difference in a dense-haze region, it is more difficult for us to recognize the inherent color of the scene, and the difference is even higher. It seems that the three properties (the brightness, the saturation and the difference) are prone to vary regularly in a single hazy image .

As reported in previous work, the atmospheric luminance considered to be constant in an single image and relatively high intensity in intrinsic luminance.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

$$I(x) = J(x)t(x) + A(1 - t(x))$$

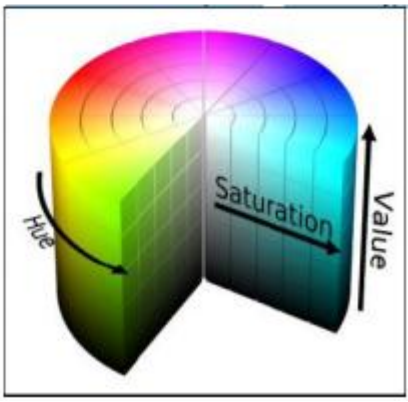
$$t(x) = e^{-\beta d(x)}$$

SCENE DEPTH RESTORATION:

The Linear Model Definition As the difference between the brightness and the saturation can approximately represent the concentration of the haze, we can create a linear model, i.e., a more accurate expression, as follows:

$$d(x) = \theta_0 + \theta_1 v(x) + \theta_2 s(x) + \epsilon(x)$$

where x is the position within the image, d is the scene depth, v is the brightness component of the hazy image, s is the saturation component, θ0, θ1, θ2 are the unknown linear coefficients, ε(x) is a random variable representing the random error of the model, and ε can be regarded as a random image.



Sobel image ▽d =θ1▽v+θ2▽s+▽ε, where θ1 is simply set to 1.0, θ2 is set to -1.0, and ε is a random image.

TRAINING DATA COLLECTION In order to learn the coefficients θ0, θ1 and θ2 accurately, the training data are necessary. In our case, a training sample consists of a hazy image and its corresponding ground truth depth map. Unfortunately, the depth map is very difficult to obtain due to the fact that there is no reliable means to measure the depths in outdoor scenes. Current depth cameras such as Kinect are not able to acquire the accurate depth information. for each haze-free image, we generate a random depth map with the same size. The values of the pixels within the synthetic depth map are drawn from the standard uniform distribution on the open interval (0, 1). Secondly, we generate the random atmospheric light A (k, k, k) where the value of k is between 0.85 and 1.0. Finally, we generate the hazy image I with the random depth map d and the random atmospheric light A.

ESTIMATION OF THE DEPTH INFORMATION:

Fig a1. depth information

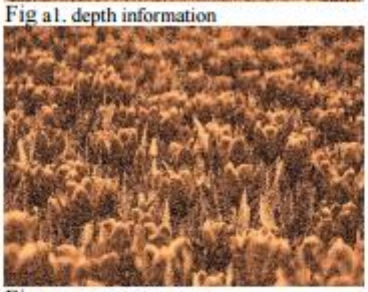


Fig b1.depth information

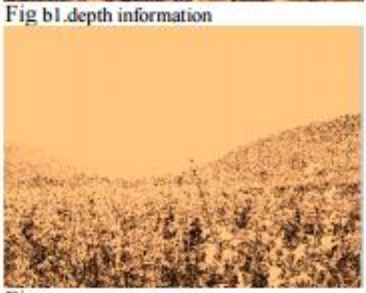


Fig c1.depth information

As the relationship among the scene depth d, the brightness v and the saturation s has been established and the coefficients have been estimated, we can restore the depth map of a given input hazy image . However, this model may fail to work in some particular situations. For instance, the white objects in an image are usually with high values of the brightness and low values of the saturation. Therefore, the proposed model tends to consider the scene objects with white color as being distant. Unfortunately, this misclassification will result in inaccurate estimation of the depth in some cases

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

QUANTITATIVE COMPARISON:

In order to quantitatively assess and rate the algorithms, we calculate the mean squares error (MSE) and the structural similarity (SSIM) of the result The MSE of each result can be calculated by the following equation:

$$e = \sqrt{(1/3N\epsilon_{c\epsilon(r,g,h)} MJ^{C} - GC||^{2})}$$

where J is the dehazed image, G is the ground truth image, Jc represents a color channel of J, Gc represents a color channel of G, N is the number of pixels within the image G, and e is the MSE measuring the difference between the dehazed image J and the ground truth image G. Note that J and G have the same size since they are corresponding with the hazy image I. Given J and G, a low MSE represents that the dehazed result is satisfying while a high MSE means that the dehazing effect is not acceptable. We further show the MSEs of the results produced by different algorithms .S As can be seen, Nishino et al.'s results produce the highest MSEs overall.

CONCLUSION AND DISCUSSION:

Fig b1.Input haze image Fig b2.haze free image

Fig c1.input haze image Figc2 .haze free image

In this paper, we have proposed a novel linear color attenuation prior, based on the difference between the brightness and the saturation of the pixels within the hazy image. By creating a linear model for the scene depth of the hazy image with this simple but powerful prior and learning the parameters of the model using a supervised learning method, the depth information can be well recovered. By means of the depth map obtained by the proposed method, the scene radiance of the hazy image can be recovered easily. Experimental results show that the proposed approachachieves dramatically high efficiency and outstanding dehazing effects as well. Although we have found a way to model the scene depth with the brightness and the saturation of the hazy image, there is still a common problem to be solved. That is, the scattering coefficient β in the atmospheric scattering model cannot be regarded as a constant in inhomogeneous atmosphere conditions .For example, a region which is kilometers away from the observer.

Therefore, the dehazing algorithms which are based on the atmospheric scattering model are prone to underestimating the transmission in some cases. As almost all the existing single image dehazing algorithms are based on the constant assumption, a more flexible model is highly desired. To overcome this challenge, some more advanced physical models can be taken into account. We leave this problem for our future research.

REFERENCES:

[1] Qingsong Zhu , Jiaming Mai and Ling Shao "A fast single image Haze Removal algorithm using color attenuation prior", IEEE Trans. On Image Proc., Vol. 24 ,pp- 3522-3533, Jan 2015.

[2] Y. Luo, T. Liu, D. Tao, and C. Xu, "Decomposition based Transfer Distance Metric Learning for Image Classification", IEEE Transactions on Image Processing, vol. 23, no. 9, pp. 3789-3801, September 2014.

[3] Kaiming He, Member, IEEE, Jian Sun, Member,IEEE,andXiaoouTang,Fellow,IEEE "Guided image filtering", IEEE Trans. Pattern Analysis and Machine Intelligence vol.35, 2013

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

[4] K.b. Gibson,D.T.Vo and T. Q. Nguyen, ―An investigation of dehazing effects on image and video coding‖, IEEE Trans. Image Processing (TIP), vol. 12, no. 2, 2012.

[5] K. B. Gibson, D. T. Vo and T. Q. Nguyen, "An investigation of dehazing effectss on image and video coding", IEEE Trans. Image Processing (TIP), vol. 12, no. 2, 2012.

[6] K. He, J. Sun, and X. Tang, "Single image haze removal using dark channel prior," IEEE Trans. Pattern Analysis and Machine Intelligence (TPAMI), vol. 33, no. 12, pp. 2341-2353, 2011

[7] Andrew Adams,Jongmin Back, Myers Abraham Davis.Fast.," High –Dimensional Filtering using the permutohedral lattice‖ Journal compilation .,vol 29(2010)

[8] Anatlevin,Danilischinski and Yairweiss.,"A closed –form solution to natural image matting" IEEE Transactions on pattern analysis and machine intelligence ,vol 30,no 2,februrary 2008