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UNDERWATER IMAGE ENHANCEMENT

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ABSTRACT

Underwater Imaging Enhancement is important for research area and technology in ocean engineering. Underwater haze removal techniques become very important due to the use of no. of vision underwater applications. Within the recent past year, scientists are very keen to explore the mysterious underwater world. Haze in the Image brings trouble to many computer vision/graphics applications as it degrades the visibility of the scene and Image Quality. Haze is formed due to the attenuation and the air light. Attenuation reduces the contrast and air light increases the whiteness in the scene. This paper deals with an approach to enhance underwater images and its quality. The proposed approach gives better result of enhanching clarity of underwater image which is very important for underwater analysis and enhancement

Keywords— underwater imaging, dehazing,dark channe

I.INTRODUCTION

Fog, dust, haze or other types of atmospheric degradations are formed by particles present in the environment are present in outdoor images. An image obtained at the other end is characterized on the basis of reduced contrast and become less clearly visible colors. In an artistic setting, effect may be desirable so degradation removing is needed. Weather condition [1] changes in the types and sizes of the particles that are involved in the atmosphere. For example, most of the computer vision algorithms based on the hypothesis that the input image is perfectly the scene radiance, i.e. there is no effect from haze. When this consideration is failed, error occurs in algorithm and that can be extremely harmful. Consequently, finding effective methods for haze removal is an emerging area of interest in the computer vision fields and image processing.

Underwater Imaging is a very important research area in ocean engineering and computer graphics. Underwater haze removal techniques become very popular due to the use of various vision underwater applications. Underwater images and videos are captured to show the world at underwater. Scientists are keen to explore the mystifying underwater world. Haze is a natural phenomenon which decreases the visibility of underwater images. Haze decreases the scene contrast and result in fading of colors. So, removing the haze is a complex and challenging task. There are various techniques and methods developed to remove the haze from underwater images so image quality is enhanced. Some of the underwater imaging applications are as follows:

(a) National geographic channel

(b) Underwater Surveys

(c) Marine Archaeology

(d)Marine Geology

There are two techniques for addressing image processing: one technique is image restoration or another technique is an image enhancement:

(i) To recover a degraded image using a model of the degradation and of the original image formation; is the main objective of image restoration. These methods require many model parameters which are hardly known in tables and can be extremely variable. Depth estimation of a given object in the scene is also important parameter which is required.

(ii)For producing more visible image the image enhancement technique uses qualitative subjective criteria and for image formation they do not depends on any physical model.

A. Dehazing Methods

There are two categories of Haze Removal methods one is multiple image haze removal and other is single image haze removal methods. Some dehazing methods are discussed below:

1. Single Image Dehazing Method

This method works on single input image. This method relies upon statistical assumptions [14] and the nature of the scene and retrieves the scene information based on the prior information from a single image. The methods come under this category are as follows:

- Contrast Maximization Method
- Independent Component Analysis (ICA)*
- Dark Channel Prior (DCP)
- Anisotropic Diffusion

2. Multiple Image Dehazing Method

In this haze removal, more than one images of the same scene are used. The methods come under this category are as follows:

- Method based on different Weather Condition
- Method based on Polarization
- Depth Map based Method

II. RELATED WORK

Due to haze, there are problems in many computer vision /graphics applications as it degrades the visibility of the scene. Haze is formed due to the two main elements one is air light other is attenuation. In scene whiteness is increased by the air light and attenuation decreases scene contrast. Using Haze removal techniques we can recover the color and contrast of the scene. These techniques are widely used in numbers of applications such as underwater images, object detection, consumer electronics, outdoor surveillance etc.

N. Karpel and Y.Y. Schechner analyzed the visibility degradation effect. It was that the partial polarization of light is related to degradation effect .The authors proposed an algorithm of image recovery which is based on a number of scenes captured at different positions with a polarizer. The authors derived the distance map. It resulted in enhancement of image contrast and color correction and a visibility range of underwater was nearly doubled.

K. Iqbal et al. presented a model for enhancement of underwater image is integrated color model. The approach proposed by the authors is on the basis of slide stretching: First is, RGB algorithm is used to compensate the color contrast in the images. Second is, intensity stretching and saturation of HSI are employed to improve solve the issue of lighting and true color. Image have blue color component is handled by the intensity saturation to make the ranges from pale blue to deep blue. By decreasing or increasing contrast values the contrast ratio is controlled.

H.Y. Yang et al. proposed an underwater image enhancement method which is based on dark channel prior. It is efficient and had poor complexity. In the proposed approach to estimate the depth map of the image instead of the soft matting procedure the median filter had been used. The color correction method is adopted for enhancing color contrast for underwater image. The presented approach required less time, gives enhanced underwater images and was applicable for implementing on the underwater navigation in real time.

A.T. Celebi S. Erturk proposed Empirical Mode Decomposition which is based on underwater image enhancement approach. The enhanced image was constructed by merging the IMF's Intrensic Mode Functions of spectral channels with different weights in order to obtain an enhanced image with increased quality. Genetic algorithm was used to perform the weight estimation automatically. The proposed approach provided visibility, perception and interpretability of objects. The improved images had more quality and better visual details of color and good contrast.

J.Y. Chiang et al. proposed a novel algorithm called Wavelength Compensation and Dehazing to improve underwater images. To correct the attenuation discrepancy along the propagation path and to take the advantage of an artificial light source into assumptions the dehazing algorithm is used. Firstly depth map was generated and then the segmentation of background and foreground in a scene was done. The background and foreground of light intensities were compared to show that during the image capturing process, whether an artificial light source was present or not. After reimbursing the effect of haze, variance and artificial light in wavelength attenuation along the underwater transmission path to camera were corrected.

H. Wen et al. derived a model to describe underwater image formation through an underwater optical model in true physical process and then author proposed algorithm with derived optical model to improve perception of underwater images or video frames is effective enhancement algorithm.

M.S. Hitam et al. presented method to boost underwater images is Adaptive Histogram Equalization method. The enhancement method effectively improves the visibility of underwater images and produces the better MSE and the better PSNR values. CLAHE was applied to the image in RGB and Hue Saturation-Value (HSV) color models separately. Here, the distribution of pixel was set on the basis of Rayleigh distribution for the CLAHE process in both color models. These processes of applying CLAHE in the RGB and HSV color models produced two independent images: called CLAHE-RGB and CLAHE-HSV.

S. Serikawa and H. Lu proposed a Joint Trilateral filter is used for underwater image dehazing. In this paper, the authors presented a novel method for enhancing underwater images by image dehazing. A new underwater model had also been proposed by author to correct the attenuation discrepancy along the propagation path. Theproposed underwater model was suitable in underwater environment. They also proposed a fast joint trilateral filter for underwater image dehazing. The joint trilateral filter removed overly dark fields of underwater images by refining transmission depth map. The proposed joint trilateral filter also acted as edge preserving smoothing operator and near the edges it has better behaviour.

A. Drawback of Existing System

For many computer vision applications there are useful algorithms on fog removal. As per literature survey here we found that many of the existing researchers have not focused on many issues related. Research gaps given below:-

(a) The existing methods have avoided the techniques to reduce the issue of noise is seen in the output images of the existing algorithms of haze removal.

(b) Much effort has not taken the dark channel prior (DCP)

(c) The problem of the unequal brightness is also not considered by the researchers. It decreases the performance of haze removal algorithms

(d) More work is not done on inwater images

B. Proposed Work

Algorithms for haze removal become more useful for number of computer vision applications and computer graphics. The existing researchers have avoided many issues such as no technique is perfect for different kind of issues of haze removal. The survey has shown that the existing methods have ignored the techniques to reduce the noise issue which is presented in the output images of the existing algorithms for haze removal. So it is necessary to modify the existing methods in such a way that it work on underwater videos, removes artificial lighting and maintain image quality by using enhanced WCID algorithm. Due to this we get the haze-free and color corrected underwater image

Architecture of proposed work is shown in figure-1. Input for system is underwater video and from that video hazy frame is selected for further processing. Dehazing procedure is applied on the selected hazy frame. In this procedure Dark channel prior, image matting, segmentation of foreground and background is done. Then checked for artificial lighting and if present then it is removed and then color change approach is applied and hence will get haze-free and color corrected underwater frame as an output.

First we give input as underwater video. From that video frames are captured for further processing i.e. removing haze from frame. Then we select hazy frame from the frames that we have captured already. Then dark channel prior is applied on frame. In Fig 2. Matting is used to do right foreground estimation in frame. In Fig 3. Segmentation is used to partitioning image into multiple segments so it will change the image representation in meaningful and easier way to analyze. In Fig 4. Artificial light is detected which is showed in closed image (b).In fig 5. Luminance of artificial light is distributed in (a) Red (b) Blue (c) Green channel respectively.

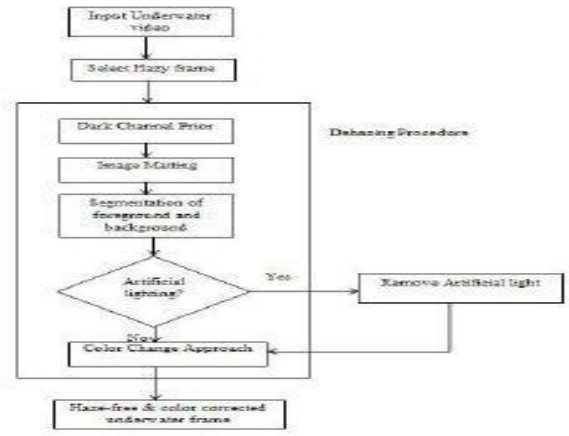

Fig1. System Architecture

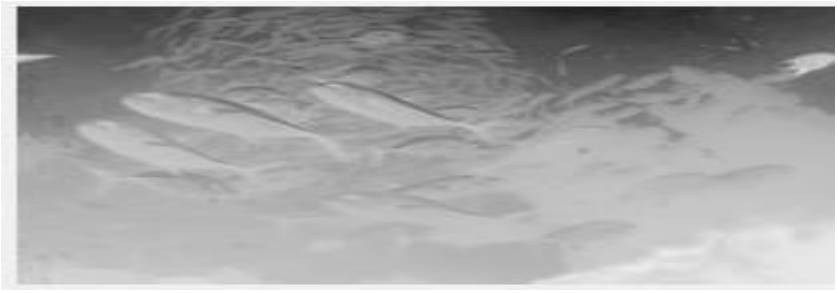

Fig 2. Image matting

Fig 3. Artificial light detection (a) gray scale input (b) detection of light source

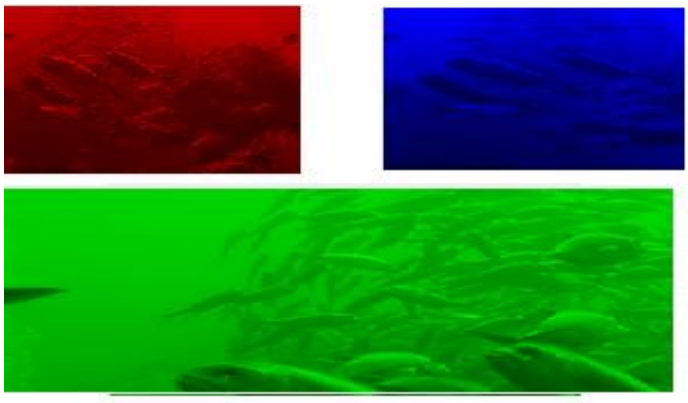

Fig5. Distribution of an artificial light
(a) red (b) blue, and (c) green channel

III. CONCLUSION AND FUTURE WORK

Underwater imaging and enhancement is the area of image processing and it is a dynamic field. For enhancement of underwater images and videos new techniques and methods are reported routinely in new product development. For enhancement of underwater image dehazing here we propose an new algorithm that work on underwater videos and remove artificial lighting and increase image quality.

In future work we will focus to place the dehazed frame in the input underwater video for better quality of underwater video and underwater images.

REFERENCES

[1] Narasimhan Srinivasa G., and Shree K. Nayar. "Contrast restoration of weather degraded images." Pattern Analysis and Machine Intelligence, IEEE Transactions on 25, no. 6 (2003): 713-724

[2] Coleman Dwight F., James B. Newman, and Robert D. Ballard. "Design and implementation of advanced underwater imaging systems for deep sea marine archaeological surveys." *In Oceans 2000 MTS/IEEE Conference and Exhibition*, vol. 1, pp. 661-665. IEEE, 2000

[3] Schechner Yoav Y., and Nir Karpel. "Recovery of underwater visibility and structure by polarization analysis." *Oceanic Engineering, IEEE Journal of 30*, no. 3 (2005): 570-587

[4] Iqbal, Kashif, Rosalina Abdul Salam, Mohd Osman, and Abdullah Zawawi Talib. "Underwater Image Enhancement Using An Integrated Colour Model." *IAENG International Journal of Computer Science* 32, no. 2 (2007): 239-244

[5] Yang Hung-Yu, Pei-Yin Chen, Chien-Chuan Huang, Ya-Zhu Zhuang, and Yeu- Horng Shiau. "Low complexity underwater image enhancement based on “dark channel prior."

[6] In *Innovations in Bio-inspired Computing and Applications (IBICA), 2011 Second International Conference on*, pp. 17-20. IEEE, 2011.

[7] Celebi Aysun Tasyapi, and Sarp Erturk. "Visual enhancement of underwater images using Empirical Mode Decomposition." *Expert Systems with Applications* 39, no. 1 (2012): 800-805.

[8] Chiang John Y., and Ying-Ching Chen. "Underwater image enhancement by wavelength compensation and dehazing." *Image Processing, IEEE Transactions on* 21, no. 4 (2012): 1756-1769.

[9] Wen Haocheng, Yonghong Tian, Tiejun Huang, and Wen Gao. "Single underwater image enhancement with a new optical model." In *Circuits and Systems (ISCAS), 2013 IEEE International Symposium on*, pp. 753-756. IEEE, 2013.

[10] Hitam Muhammad Suzuri, Wan Nural Jawahir Hj Wan Yussof, Ezmahamrul Afreen Awalludin, and Zainuddin Bachok. "Mixture contrast limited adaptive histogram equalization for underwater image enhancement." In *Computer Applications Technology (ICCAT), 2013 International Conference on*, pp. 1-5. IEEE, 2013.

[11] Serikawa Seiichi, and Huimin Lu. "Underwater image dehazing using joint trilateral filter." *Computers Electrical Engineering* 40, no. 1 (2014): 41-50.

[12] Tan Robby T. "Visibility in bad weather from a single image." In *Computer Vision and Pattern Recognition, 2008. CVPR 2008. IEEE Conference on*, pp. 1-8. IEEE, 2008.

[13] Fattal Raanan. "Single image dehazing." In *ACM Transactions on Graphics (TOG)*, vol. 27, no. 3, p. 72. ACM, 2008.

[14] He Kaiming, Jian Sun, and Xiaoou Tang. "Single image haze removal using dark channel prior." *Pattern Analysis and Machine Intelligence, IEEE Transactions on* 33, no. 12 (2011): 2341-2353.

[15] Hautière Nicolas, Jean-Philippe Tarel, and Didier Aubert. "Towards fog-free invehicle vision systems through contrast restoration." In Computer Vision and Pattern Recognition, 2007. CVPR'07. IEEE Conference on, pp. 1-8. IEEE, 2007.

[16] Shwartz Sarit, Einav Namer, and Yoav Y. Schechner. "Blind haze separation." In Computer Vision and Pattern Recognition, 2006 IEEE Computer Society Conference on, vol. 2, pp. 1984-1991. IEEE, 2006.

[17] Schechner Yoav Y., Srinivasa G. Narasimhan, and Shree K. Nayar. "Instant dehazing of images using polarization." In Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on, vol. 1, pp. I-325. IEEE 2001