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A REVIEW ON UNDERWATER IMAGE ENHANCEMENT TECHNIQUES

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Abstract - *Image enhancement is one of the preprocessing step in various computer vision applications. It is the process of improving the quality of image without any information loss. Usually the images are affected by various facts. Especially in underwater imagery, the haze and hue variations are greatly affected. This paper discusses the issues in underwater images and compares the existing image enhancement techniques for underwater images.*

Key Words: Underwater images, Enhancement, Contrast stretching, Histogram Equilization, Color correction

1. INTRODUCTION

Underwater images are corrupted due to scatters and amalgamation, resulting in low contrast and color distortion. Captured underwater images suffer from poor visibility. It is hard to acquire visible agreeable images at long or short distances due to the absorptive and dispersion nature of sea water. Noises diminish the details that could contain significant information. Thus, super-resolving underwater speckled images are important for ocean observation. These images frequently suffer from color distortion and low contrast due to the propagated light reduction with distance from the camera, mainly resulting from absorption and scattering effects.

Even though there are many image enhancing techniques developed, such as white balance, color correction, histogram equalization, and fusion-based methods [1], they are not based on a physical model underwater, and thus are not applicable for underwater images with different physical properties. It is challenging to restore underwater images because of the deviation of physical properties. Light reduction underwater[2] leads to different degrees of color change, depending on wavelength, dissolved organic compounds, water salinity, and concentration of phytoplankton [3].

2. LITERATURE SURVEY

Various image enhancement techniques are proposed in the literature. Haze in underwater image is reduced by dark channel. Hue variations are minimized by wavelength compensation [4]. Underwater images have low perceivability, small divergence and lessening hues [5]. A new scheme for enhancing ocean optical images whereas light traveling in the water, lights are distorted based on the wavelength [6]. Improve the nature of underwater images that has been debased due to various twists [7]. John Y. Chiang and Ying - Ching Chen.[8] proposed an algorithm that uses WCID which helps in efficiently restoring image color balance and remove haze. Naim and Isa[9] proposed a method called pixel distribution shifting color correction (PDSCC) for digital color image to correct the white reference point and ensure that the white reference point is achromatic.

Rizzi et al.[10] proposed unsupervised digital image color equalization with simultaneous global and local effects. Schechner and Karpel[11,12] analyzed the physical effects of visibility degradation and devised an image recovery algorithm based on several images taken through a polarizer at different orientations. Trucco and Olmos-Antillon[13] proposed a self-tuning image restoration filter that simplifies Jaffe[14] and McGlamery[15]. Shelda Mohan and T.R. Mahesh, 2013[16] has presented Particle Swarm Optimization (PSO) for tuning the enhancement parameter of Contrast Limited Adaptive Histogram Equalization relied on Local Contrast Modification (LCM).

ICM[17] and UCM[18] are the popular techniques that use the histogram modification technique to increase the quality of underwater image. ICM and UCM methods give

a better result of underwater image in terms of contrast. Objects in the image are recognized from the original image efficiently. The main disadvantage is that it does not drastically improve the image contrast as more blue-green illumination retains in the output image. Unsupervised Colour Correction Method (UCM), which can powerfully remove bluish colour cast, increase the low red and low illumination problem in order to achieve high quality images for scientific purpose. There are three stages : equalize the RGB, contrast correction of RGB and then contrast correction of HSI. These three stages are applied to every pixel of the image to produce the correct value for the pixel.

Garcia et al. 2002[19] gave an analysis and comparision of various techniques for dealing with the problems of underwater images which are deal with nonuniform illumination, lowcontrast in underwater images.

Bazeille et al. [20, 21] propose an algorithm to pre-process underwater images. It reduces underwater perturbations and improves image quality. It is composed of several successive independent processing steps which correct non uniform illumination (homorphic filtering), suppress noise (wavelet denoising), enhance edges (anisotropic filtering) and adjust colors (equalizing RGB channels to suppress predominant color). The algorithm is automatic and requires no parameter adjustment.

3. IMAGE EHNACEMENT TECHNIQUES FOR UNDERWATER IMAGE

Image intensification is a process of improving the quality of image by improving its features. There are three methods for image intensification for underwater images : Contrast stretching, Histogram equalization and Contrast limited adaptive histogram equalization. A number of contrast measures were proposed for complex images as underwater images.

Contrast stretching is a straightforward image enhancement method that is used to improve, enhance the image contrast by `stretching' the series of intensity values. A measure of image's dynamic range or the "broaden" of image's histogram is the contrast of an image. Whole range of intensity values present within the image, or in a easier way, the minimum pixel value subtracted from the maximum pixel value is called dynamic range of image. It differs from the more complicated histogram equalization in a way that it can only concern a linear scaling function to the image pixel values.

There are many applications, there is a need for flat histogram. This cannot be achieved by histogram stretching. so Histogram Equalization can be used here. A perfect image has equal number of pixels in all its grey levels. Hence to get a perfect image, the objective is not only to spread the dynamic range , but also to have has equal number of pixels in all its grey levels .This technique is known as Histogram Equalization (HE). Histogram equalization maps grey levels r of an image into grey levels s of an image in such a way that grey levels s are uniform.

This expands the range of grey levels (contrast) that are near the histogram maxima, and compresses the range of grey levels that are near the histogram minima. For most images, the contrast is usually expanded for most pixels, improving many image features

Contrast Limited Adaptive Histogram Equilization (CLAHE) was originally developed for medical imaging and has proven to be successful for enhancement of low-contrast images such as portal films.The CLAHE algorithm partitions the images into contextual regions and applies the histogram equalization to each one. This evens out the distribution of used grey values and thus makes hidden features of the image more visible.The full grey spectrum is used to express the image.

4. CONCLUSION

This review paper discus the image enhancement techniques for underwater images and issues in it. Obtaining visibility of objects at long or short distance in underwater scenes is very difficult and is challenging task. The atmospheric light is a

major difficulty to process underwater images comes from the poor visibility conditions under the water, scattering of light and light attenuation due to all the reasons the underwater images suffers a lot and affect their visibility and the contrast which they contain actually. The enhanced images provide more interpretability, visibility and are better in terms of color and clarity. Further improvement a color correction quality is employed to enhance the color contrast of the object in underwater and remove different noise particles .The presented strategies have ignored the methods to lessen the noise issue, which is available in the resultant pictures of the current image improvement procedures. This is the further directions of the research.

REFERENCES

[1] C. Ancuti, C. O. Ancuti, T. Haber, and P. Bekaert. "Enhancing underwater images and videos by fusion," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR) , pages 81-88, June 2012.

[2] S. Q Duntley "Light in the sea." J. Opt. Soc. Amer. , vol. 53, no. 2, pp. 214233, 1963

[3] Yan-Tsung Peng, and Pamela C. Cosman, "Underwater Image Restoration based on Image Blurriness and Light Absorption", in IEEE Transactions on Image Processing, 2017.

[4] R. Sathya and M. Bharathi," Enhancement of Underwater Images Using Wavelength Compensation Method", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 3, March 2015, pp: 1829 – 1835

[5] Sonali Talwarand Rajesh Kochher," Evaluation of Underwater Image Dehazing Techniques", International Journal for Science and Emerging Technologies with Latest Trends" 21(1): 11 - 13(2015).

[6] Huimin Lu, Yujie Li, Jianru Li, Xin Li, Yohei Kashio and Seiichi Serikawa," Image Contrast Enhancement for Deep - sea Observation Systems", The 3rd International Conference on Industrial Application Engineering 2015, pp: 619-624.

[7] Martin Roser, Matthew Dunbabin and Andreas Geiger," Simultaneous Underwater Visibility Assessment, Enhancement and Improved Stereo", 2014 IEEE International Conference on Robotics & Automation (ICRA)Hong Kong Convention and Exhibition Center May 31 - June 7, 2014. Hong Kong, China, pp: 3840 -3847.

[8] John Y. Chiang and Ying – Ching Chen . " Underwater Image Enhancement by Wavelength Compensation and Dehazing" , 1756 IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 4, APRIL 2012.

[9] Naim MJNM, Mat Isa NA. Pixel distribution shifting color correction for digital color images. Applied Soft Computing. 2012;12(Issue 9):2948–2962. doi: 10.1016/j.asoc.2012.04.028.

[10] Rizzi A, Gatta C, Marini D. A new algorithm for unsupervised global and local color correction. Pattern Recogn Lett. 2003;24:No. 11:1663–1677. doi: 10.1016/S0167-8655(02)00323-9.

[11] Schechner YY, Karpel N. Clear underwater vision. Proceeding of the IEEE Conference on Computer Vision and Pattern Recognition. 2004;1:536–543

[12] Schechner YY, Karpel N. Recovery of underwater visibility and structure by polarization analysis. IEEE J Ocean Eng. 2005;30:No. 3:570–587. doi: 10.1109/JOE.2005.850871.

[13] Trucco E, Olmos-Antillon AT. Self-tuning underwater image restoration. IEEE J Ocean Eng. 2006;31:No. 2:511–519. doi: 10.1109/JOE.2004.836395.

[14] Jaffe JS. Computer modeling and the design of optimal underwater imaging systems. IEEE J Ocean Eng. 1990;15(2):101–111. doi: 10.1109/48.50695.

[15] McGlamery BL. A computer model for underwater camera systems. Proc. SPIE. 1979;208:221–231. doi: 10.1117/12.958279

[16] Shelda Mohan and T. R. Mahesh. "Particle Swarm Optimization based Contrast Limited enhancement for mammogram images." IEEE, 2013.

[17] Iqbal K, Salam RA, Osman A, Talib AZ. Underwater image enhancement using integrated color model. IAENG Int J Comput Sci. 2007;34:2 IJCS 34-2-12.

[18] Iqbal K, Odetayo M, James A, Salam RA, Talib AZ. Enhancing the low quality images using unsupervised color correction method. Istanbul: International conference on system man and cybernatics (SMC); 2010. pp. 1703–1709.

[19] Rafael Garcia, Tudor Nicosevici and Xevi Cufí. "On the Way to Solve Lighting Problems in Underwater Imaging"IEEE, 2002.

[20] *Bazeille S, Quidu I, Jaulin L, Malkasse JP: Automatic underwater image pre-processing. Proceedings of the Caracterisation du Milieu Marin (CMM '06), 2006*

[21] *Bazeille S: Vision sous-marine monoculaire pour la reconnaissance d'objets, Ph.D. thesis. Université de Bretagne Occidentale; 2008.*

BIOGRAPHIES

The author has 12 years of teaching experience and has interest in the area of image processing and networks.