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A Review on Underwater Image Enhancement

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ABSTRACT

While capturing underwater image there are lot of imposed due to low light, light variation, poor visibility. Photography is about light, but since water has an a lot more prominent density than air — around 800 times more noteworthy not all wavelengths of light travel similarly well inside it. This implies as we go down into deep water, we lose the shades of the range one by one. This is the reason submerged photographs lose all the red and orange hues even at a genuinely shallow profundity and appear to be increasingly more blue as we go deep in water, henceforth captured image need enhancement. It's a vital research area, in this paper we will review different techniques of underwater image enhancement.

Keywords : CLAHE, Gamma, Histogram, RGB

I. INTRODUCTION

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. Image enhancement can be easily described in fig.1 block diagram.

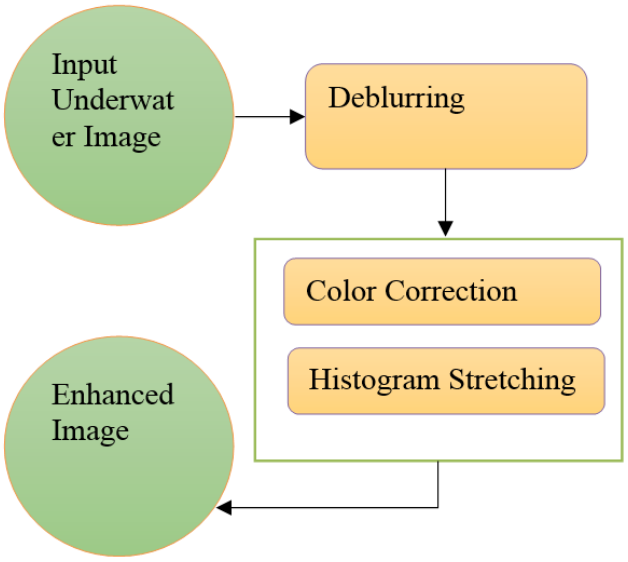


Fig.1 Image Enhancement Steps

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. Two methods of cultivating image quality is by image restoration and image enhancement.

Image restoration: It deals with filtering the input under water image to minimize the effect of dreadful conditions. The efficiency of image restoration be determined by on the degree and the accuracy of the knowledge of dreadful conditions process. Image restoration varies from image enhancement. Image restoration is centered on further extraction of input image features. The image restoration intentions to recover a tainted image using a model of the degradation. These methods require many model parameters like attenuation and diffusion coefficients that characterize the water turbidity.

Image enhancement: Image enhancement recovers the visibility of one aspect or component of an image. It mentions to improving of image features such as

boundaries, or contrast to make a graphic display. This is mostly valuable for display & examination. This procedure will not upsurge the intrinsic information content in the data. This comprises gray level & contrast influence, noise lessening, sharpening, filtering, interpolation and magnification, pseudo coloring etc.. Image enhancement uses qualitative subjective approach to produce a additional visually pleasing image. It do not trust on any physical model for the image development. These methods are typically pretentious and quicker than deconvolution methods. The prevailing research shows that underwater images increase new fangled challenges and enact significant problems due to light captivation and trickle effects of the light and inherent structureless environment. Travel around, accepting and examining underwater activities of images are acquisition of importance for the last few years. Scientists are keen to explore the mysterious underwater world. However, this area is still lacking in image processing analysis techniques and methods that could be used Researchers have tried to employ various different enhancement techniques.

Color correction is the most essential step for image enhancement as depth increases in water colors snoozes one by one contingent on their wavelength Firstly, red color vanishes at the depth of 3m roughly. At the depth of 5m, the orange color is vanished. Most of the yellow goes off at the depth of 10m and finally the green and purple disappear at further depth. The blue color travels the longest in the water due to its shortest wavelength. The underwater images are therefore dominated by blue-green color. Also the light source variations will affect the color perception. As a consequence, a strong and non-uniform color cast will characterize the typical underwater images. In this paper we will discuss different methods of image enhancement.

In the next section of the paper we will elaborate some literature, in section III we will discuss how we motivated towards this research and problem in image enhancement, in section IV we give experimental evaluation of different existing image enhancement techniques, at last we will conclude our study.

II. LITERATURE SURVEY

Md Jahidul Islam et. al. presented a conditional generative adversarial network-based model for underwater image enhancement in real-time. In order to supervise the adversarial training, we formulate an objective function that evaluates the perceptual image quality based on its global content, color, and local style information. In addition, author presented EUVP, a large-scale dataset of a paired and an unpaired collection of underwater images (of poor and good quality) that are captured using seven different cameras over various visibility conditions during oceanic explorations and human-robot collaborative experiments.Author concluded that proposed model can be used to improve real-time perception performances of visually-guided underwater robots [1].

Codruta O. Ancuti et. al. introduces an effective technique to enhance the images captured underwater and degraded due to the medium scattering and absorption. Our method is a single image approach that does not require specialized hardware or knowledge about the underwater conditions or scene structure. It builds on the blending of two images that are directly derived from a colorcompensated and white-balanced version of the original degraded image. The two images to fusion, as well as their associated weight maps, are defined to promote the transfer of edges and color contrast to the output image. To avoid that the sharp weight map transitions create artifacts in the low frequency components of the reconstructed image, we also adapt a multiscale fusion strategy[2].

Donna M. Kocak et. al. discussed advances in the field of underwater optical imaging . A synopsis of research and technical innovations is presented. Several recent

applications of novel systems are shown as examples, and trends in emerging underwater imaging research and development are briefly summarized by author [3].

Marino Mangeruga et. al. said that images obtained in an underwater environment are often affected by colour casting and suffer from poor visibility and lack of contrast. In the literature, there are many enhancement algorithms that improve different aspects of the underwater imagery. Each paper, when presenting a new algorithm or method, usually compares the proposed technique with some alternatives present in the current state of the art. There are no studies on the reliability of benchmarking methods, as the comparisons are based on various subjective and objective metrics. Author has evaluated enhanced images by means of three different approaches: objective metrics often adopted in the related literature, a panel of experts in the underwater field, and an evaluation based on the results of 3D reconstructions [4].

László Neumann et. al. said that Underwater image processing has to face the problem of loss of color and contrast that occurs when images are acquired at a certain depth and range. The longer wavelengths of sunlight such as red or orange are rapidly absorbed by the water body, while the shorter ones have a higher scattering. Thereby, at larger distance, the scene colors appear bluish-greenish, as well as blurry. The loss of color increases not only vertically through the water column, but also horizontally, so that the subjects further away from the camera appear colorless and indistinguishable, suffering from lack of visible details. Author presents a fast enhancement method for color correction of underwater images. The method is based on the gray-world assumption applied in the Ruderman-opponent color space and is able to cope with non-uniformly illuminated scenes. Integral images are exploited by the proposed method to perform fast color correction, taking into account locally changing luminance and chrominance. Due to the low-complexity cost this method is suitable for real-time applications ensuring realistic colors of the objects, more visible details and enhanced visual quality [5].

Rafał Protasiuk et. al. proposed approach combines both local and global information through a simple yet powerful affine transform model. Local and global information are carried through local color mapping and color covariance mapping between an input and some reference source, respectively. Several experiments on degraded underwater images demonstrate that the proposed method performs favourably to all other methods including ones that are tailored to correcting underwater images by explicit noise modelling [6].

S. No.	Author/Title/ Publication Year	Approach Used	Description
1.	Md Jahidul Islam et. al. / Fast Underwater Image Enhancement for Improved Visual Perception / arXiv 2019	Conditional generative adversarial network-based model	Proposed model can be used as an image processing pipeline by visually-guided underwater robots in real-time applications
2.	Rafał Protasiuk et. al. / Local Color Mapping Combined with Color Transfer for Underwater Image Enhancement / IEEE 2019	Local color mapping and color covariance mapping	Proposed method performs favourably to all other methods including ones that are tailored to correcting underwater images by explicit noise modelling.

3.	Codruta O. Ancuti et. al./ Color Balance and Fusion for Underwater Image Enhancement/2018 IEEE	Combining white balancing and image fusion	Blending of two images that are directly derived from a colorcompensated and white-balanced version of the original degraded image.
4.	László Neumann et. al./ Fast Underwater Color Correction Using Integral IMAGES / arXiv 2017	Ruderman-opponent color space	Presents a fast enhancement method for color correction of underwater images. The method is based on the gray-world assumption applied in the Ruderman-opponent color space

III. MOTIVATION AND PROBLEM IDENTIFICATION

There are some problem in underwater image processing:

1. The exhibited methodologies have overlooked the techniques to diminish the noise issue, which is accessible in the resultant photos of the present picture improvement strategies.
2. Sharpening of image not done.

IV. EXPERIMENTAL EVALUATION

For discussing different methods of image enhancement, we have implemented different techniques using Matlab. We have taken different underwater images.

Fig.2 shows the different underwater images as input

(I) Contrast-limited adaptive histogram equalization (CLAHE):

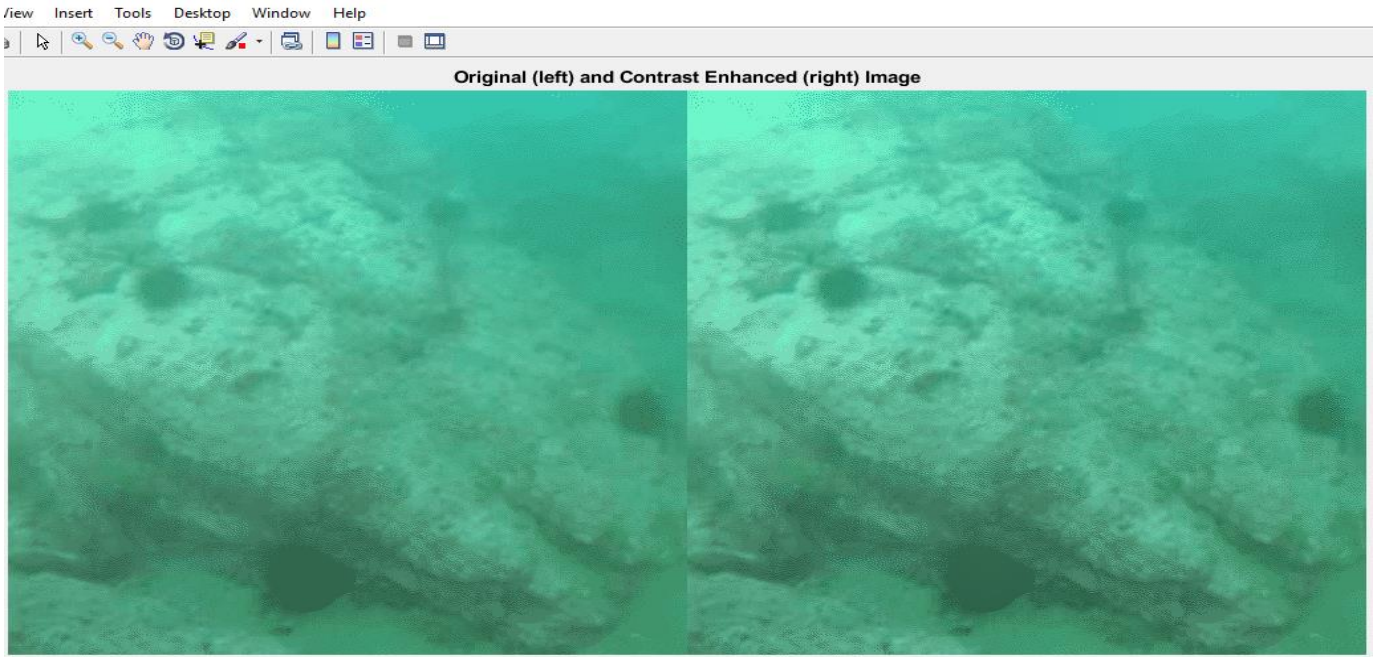


Fig.3 Original image vs Enhanced Image (CLAHE)

(II) Image enhancement by adjusting image intensity value or color space. Fig.4 depicts the same. It saturates the bottom 1% and the top 1% of all pixel values. This operation increases the contrast of the output image

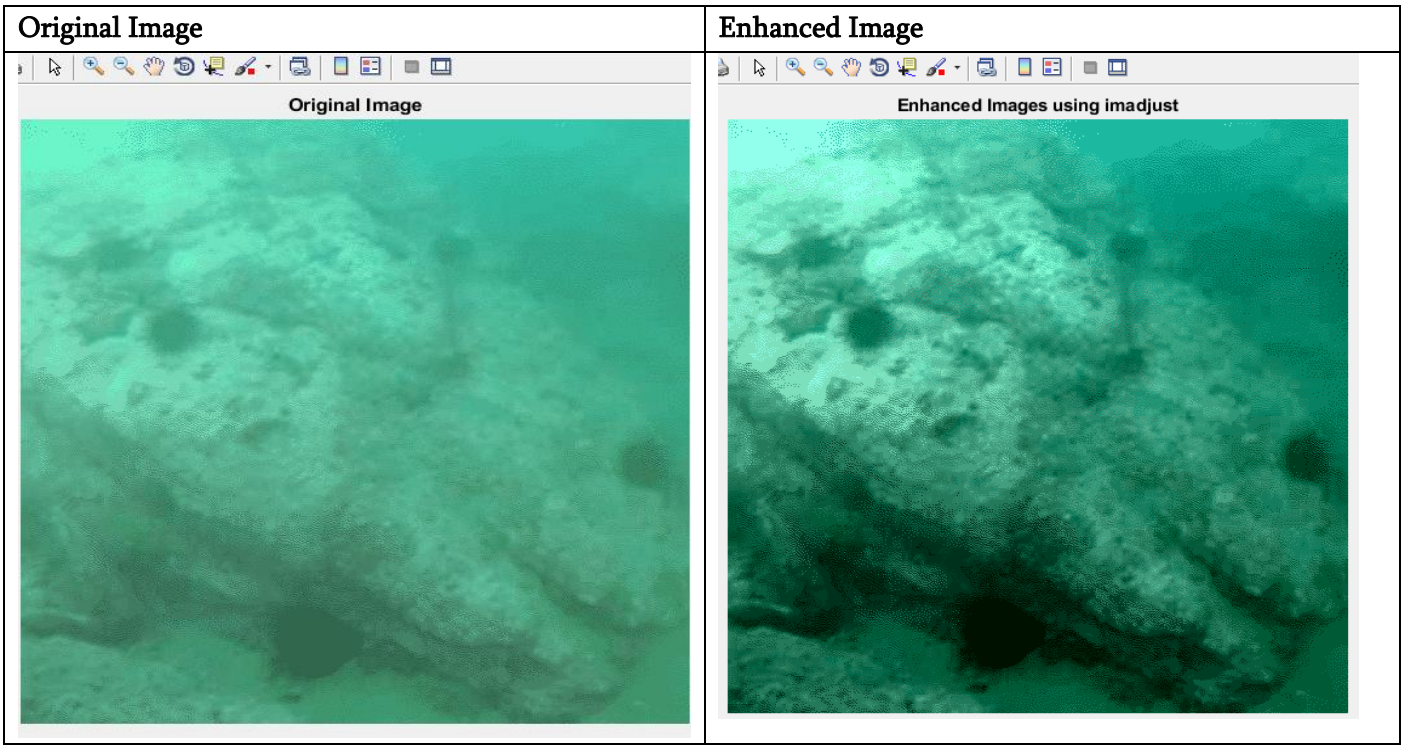


Fig.4 Original image vs Enhanced Image w.r.t. (II)

(III) Image Enhance by enhancing contrast using histogram equalization fig.5 depicts the same.

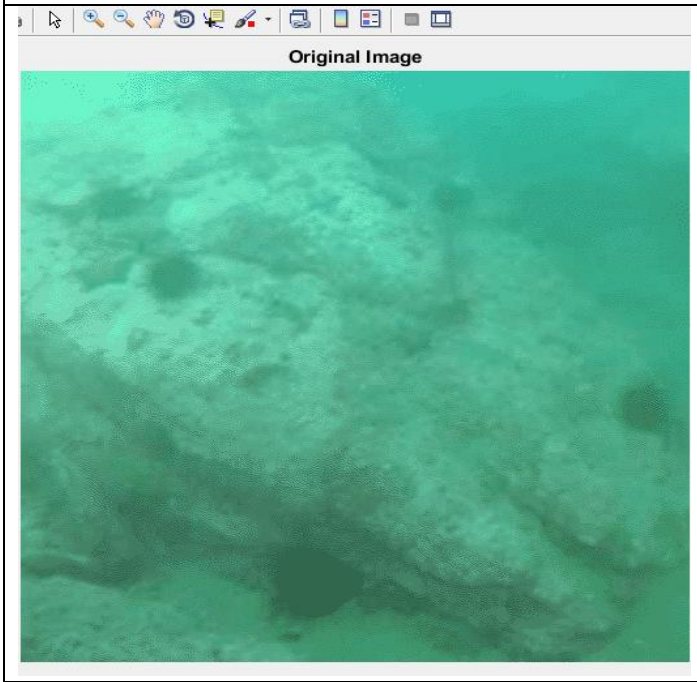
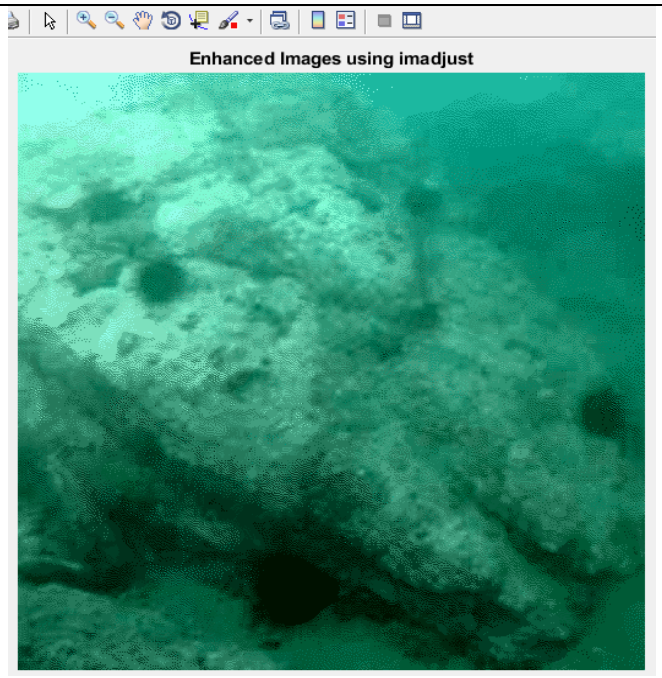
Original Image	Enhanced Image
	

Fig.5 Original image vs Enhanced Image w.r.t. (III)

(IV) Gamma Correction: By changing intensity value fig.6 depicts the comparison of original image vs image with gamma value 1,2,3

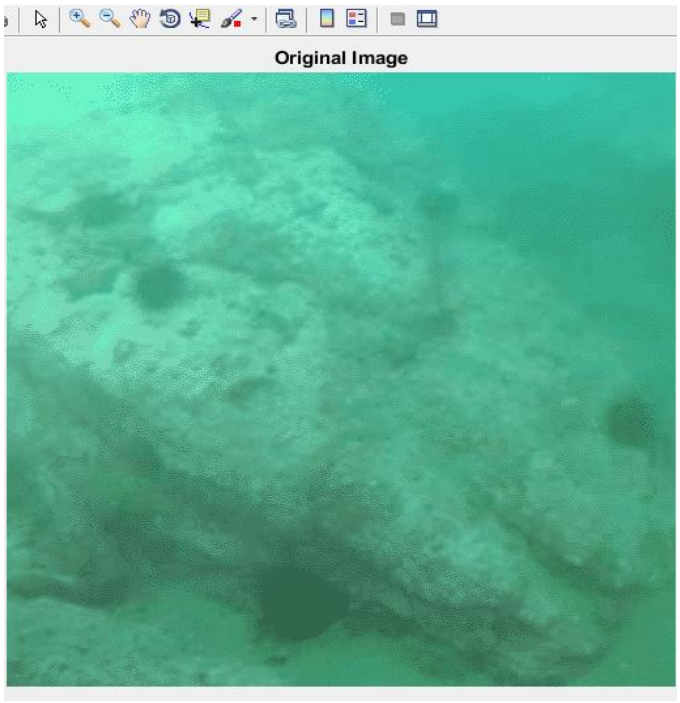
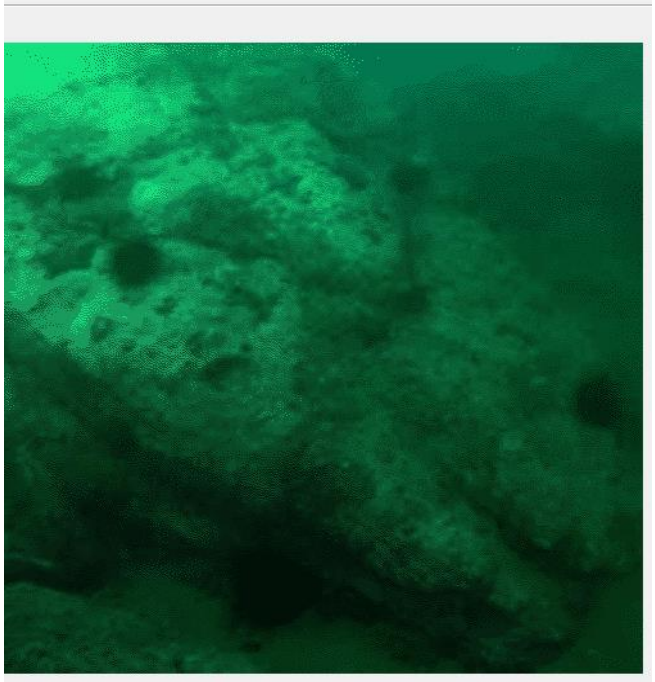
Original Image	Gamma value=1
	
Gamma value=2	**Gamma value=3**
	

Fig.6 Original image vs Enhanced Image w.r.t. (IV)

V. CONCLUSION

Image enhancement recovers the visibility of one aspect or component of an image.Current camera systems often fail as a result of deprived visibility underwater rising from light scattering, light refraction, absorption, and uncontrolled particles in underwater. As well the correct conception of components and their arrangement, henceforth vital to create a sophisticated image enhancement and processing. For the use of camera systems in the underwater area. Eventually we can conclude that denoising is required for under water image enhancement which will significantly improve the value of PSNR.

VI. REFERENCES

[1]. Md Jahidul Islam, Youya Xia And Junaed Sattar, Fast Underwater Image Enhancement For Improved Visual Perception, Arxiv:1903.09766v1 [Cs.CV] 23 Mar 2019.

[2]. Codruta O. Ancuti , Cosmin Ancuti, Christophe De Vleeschouwer , And Philippe Bekaert, Color Balance And Fusion For Underwater Image Enhancement, IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 27, NO. 1, JANUARY 2018

[3]. Donna M. Kocak, Fraser R. Dalgleish, Frank M. Caimi, Yoav Y. Schechner, A Focus On Recent Developments And Trends In Underwater Imaging, Fraser Dalgleish On 06 May 2014.

[4]. Marino Mangeruga 1,2 , Fabio Bruno 1,2,* , Marco Cozza 2, Panagiotis Agrafiotis 3 And Dimitrios Skarlatos, Guidelines For Underwater Image Enhancement Based On Benchmarking Of Different Methods, Remote Sens. 2018, 10, 1652; Doi:10.3390/Rs10101652.

[5]. László Neumann, Rafael Garcia, Józsefjánosik, Nuno Gracias, Fast Underwater Color Correction Using Integral Images,Arxiv 2017.

[6]. Rafałprotasiukm, Adel Bibi, Local Color Mapping Combined With Color Transfer For Underwater Image Enhancement, 978-1-7281-1975-5/19/$31.00 ©2019 IEEE DOI 10.1109/WACV.2019.00157.

[7]. Kashif Iqbal, Rosalina Abdul Salam, Azam Osman And Abdullah Zawawi Talib, "Underwater Image Enhancement Using An Integrated Colour Model" , IAENG International Journal Of Computer Science.

[8]. Prabhakar C.J.1*, Praveen Kumar P.U , " An Image Based Technique For Enhancement Of Underwater Mages ", December 09, 2011

[9]. Wan Nuraljawahirhj Wan Yussof, Muhammad Suzurihitam, Ezmahamrul Afreen Awalludin, And Zainuddin Bachok, " Performing Contrast Limited Adaptive Histogram Equalization Technique On Combined Color Models For Underwater Image Enhancement", International Journal Of Interactive Digital Media.

[10]. Raimondo Schettini And Silvia Corchs, "Underwater Image Processing: State Of The Art Of Restoration And Image Enhancement Methods", EURASIP Journal On Advances In Signal Processing,2010.

[11]. Pulungnurtantioandono, I Ketut Eddy Purnama,Mochamadhariadi, "Underwater Image Enhancement Using Adaptive Filtering For Enhanced Sift-Based Image Matching", Journal Of Theoretical And Applied Information Technology, June 2013.

[12]. Dinesh Sonker, M P Parsai, "Comparison Of Histogram Equalization Techniques For Image Enhancement Of Grayscale Images Of Dawn And Dusk", International Journal Of Modern Engineering Research(IJMER), July 2013.

[13]. M. S. A. C. Marcos, M. N. Soriano And C. A. Saloma,Classification Of Coral Reef Images From Underwater Video Using Neural Network, Optical Society Of America, Vol. 13, No. 22, Pp. 8766–8771, 2005.

[14]. T. C. Aysun And E. Sarp,Visual Enhancement Of Underwater Images Using Empirical Mode

Decomposition,Expert Systems With Applications, Vol. 39(1),Pp. 800-805.

[15]. L. Abril, T. Mendez And G. Dudek, Color Correction Of Underwater Images For Aquatic Robot Inspection, LNCS,3757, Pp. 60-73, 2005.

[16]. R. Garg, B. Mittal And S. Garg, Histogram Equalization Techniques For Image Enhancement, International Journal Of Electronics And Communi-Cation Technology, Vol. 2,Pp. 107–111, 2011.

[17]. S. M. Pizer And E. P. Amburn And J. D. Austin And R.Cromartie And A. Geselowitz And T. Greer And B. T. H.Romeny And J. B. Zimmerman And K. Zuiderveld,Adaptive Histogram Equalization And Its Variations,Computer Vision, Graphics, And Image Processing, 39,Pp. 355–368, 1987.

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