

# Enhancement of low exposure images underwater: A review

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**Abstract:** Image enhancement is an important image processing technique that processes images suitably for a specific application e.g. image editing. The light attenuation that travels through the water medium tends to destroy the image quality and gives image with low exposure. This therefore subjects to the problem of differentiating the image from the background. Many methods have been proposed to enhance the underwater images using threshold, histogram equalization, global and local contrast correction etc. This paper provides overview of such methods.

**Keyword:** Image Enhancement, image exposure, low exposure images.

## 1. INTRODUCTION

Image enhancement plays an important role in vision and image processing. Enhancement under the water medium refers to accentuation or sharpening of image features such as edges, boundaries, exposure or contrast to make a graphic display more useful for display and analysis and to differentiate it from the background. The enhancement process does not inherent information content in the data but increases the dynamic range of the chosen features so that they can be detected easily. The main objective of enhancement is to process an image so that the result is more suitable than the original image. For this, various underwater imaging techniques have been introduced into underwater image processing field. This paper gives an overview of the defined techniques.

## 2. PROBLEMS IN UNDERWATER IMAGING

Underwater images are subjected to many problems such as light absorption, reflection and inherent sea structure. The light travelling from air medium to water medium is partly reflected back from the water surface and partly enters the water. But this light disappears as we go deeply into the water. Thus, giving as a dark and low exposure image. It is only the blue colour that has longer wavelength and thus travels deeper into the water. This makes the water look blue in colour. In addition to it, the blur image underwater has low brightness and low contrast. The light travelling through the water medium tends to lower the exposure and quality of the image, thus giving as a blur image since exposure determines the darkness or brightness of each element of the image.



**Figure 1:** colour appearance underwater

### 3. OVERVIEW OF VARIOUS DEFINED UNDERWATER IMAGING TECHNIQUES.

#### A. Recursive exposure based sub-image histogram equalization:

It is the extension of exposure based sub image histogram equalization method which is used for enhancement of low exposure images. The method first divides the histogram into two sub histograms based on medium intensity. The two histograms are further divided into sub histograms based on mean intensity. The sub histograms are equalized individually. Images with darker grey level are low exposed images and the images with brighter part possess higher exposure. Both the under and over exposed images are iterated until the exposure value is less than the threshold value. The two images are then concatenated to obtain an enhanced image.

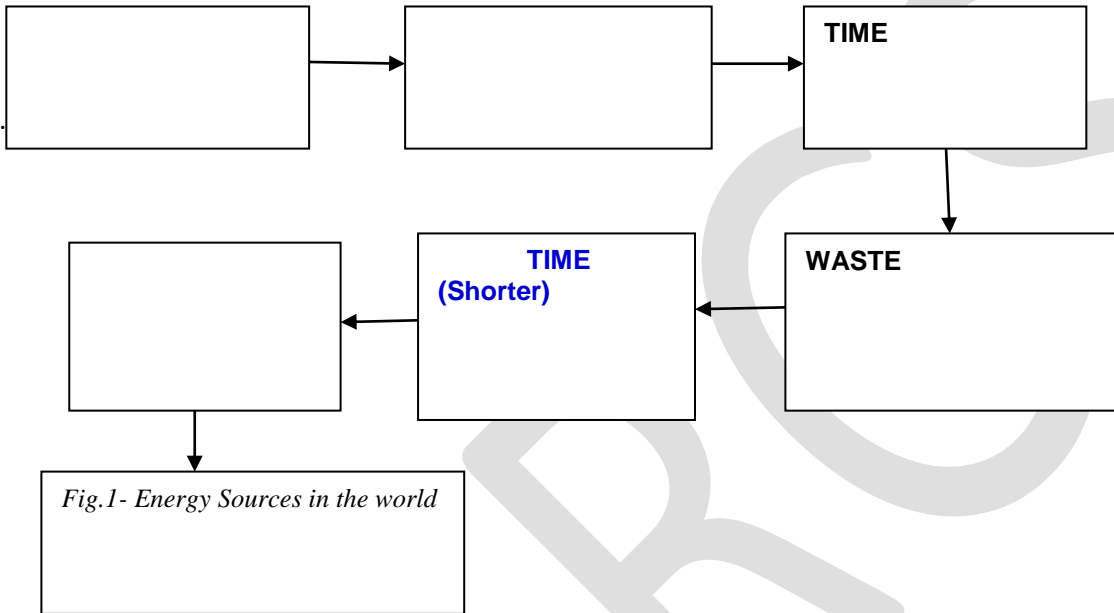


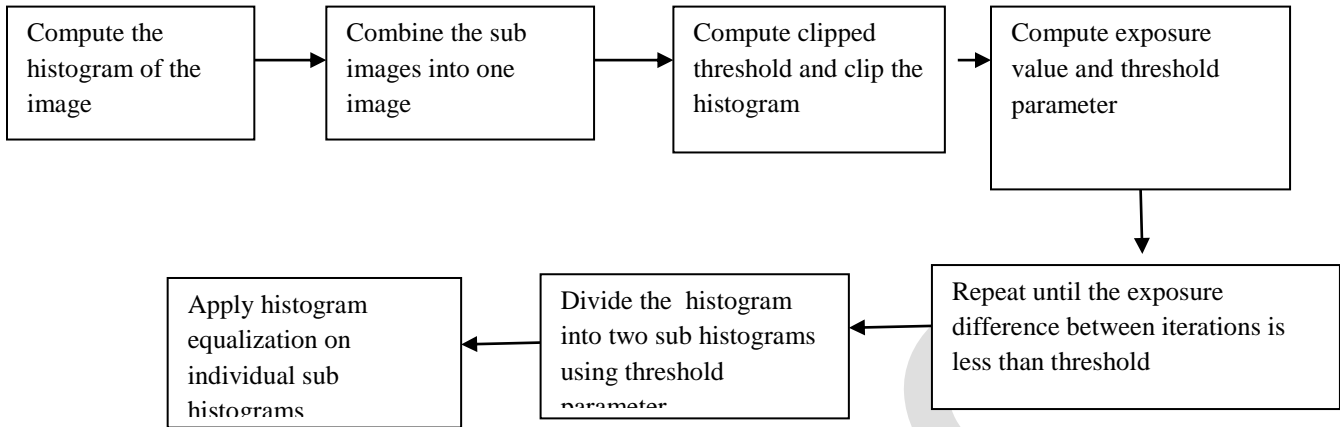
Figure2. Original underwater image



Figure3. enhanced Image

#### B. Recursively separated exposure based sub image histogram equalization

It is recursive version of exposure based sub image histogram equalization. Unlike recursive exposure based method, it performs recursive divisions of histogram based on exposure threshold of individual sub histogram up to a defined recursion level which are further equalized individually.



**Figure4. original image**



**Figure5.enhanced red plane**

Compute clipping threshold and clip histogram

#### 4. LITERATURE SURVEY

References	Paper	Technique	Parameters
[1]	Saliency guided naturalness enhancement in colour images	Combine the concept of popular Retinex and the histogram equalization (HE) and propose an efficient image naturalness enhancement algorithm for both non-uniform and low light images.	Difference Mean Opinion Score(DMOS) Lightness-Order-Error Execution time
[2]	Enhancement of low exposure images via recursive histogram equalization algorithm	This paper proposes exposure based recursive histogram equalization methods for image enhancement. The proposed methods are very effective for images acquired in low light condition like under water sequences or night vision images.	Entropy
[3]	Enhancement of low quality Underwater images through integrated global and local contrast correction	dual-image Rayleigh-stretched contrast-limited adaptive histogram Specification, which integrates global and local contrast correction.	Entropy MSE PSNR Sobel Count MSSIM EMEE NIQE
[4]	Intensity and edge based adaptive un-sharp masking filter for color image enhancement	An adaptive gain adjustment method is proposed here aiming at minimizing the number of over-range pixels while maximizing the image sharpness and information content.	Entropy Neighbourhood Pixel Gradient Standard Deviation

[5]	Multi-level image fusion and enhancement for target detection	A novel infrared-to-visible image fusion algorithm for enhancing contrast and visibility is proposed	standard deviation, average gradient, spatial frequency, and information entropy
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## 5. Conclusion

This paper gives an overview of enhancement of underwater imaging by enhancing low exposure images and quality of the images. It gives an overview of pre defined underwater imaging techniques such as recursive exposure based and recursive separately exposure based sub image histogram equalization technique. Both the techniques are suitable for bringing out the information contents of the image and provide efficient results for images acquired in dim light conditions.

## REFERENCES:

- [1] Yuecheng Li, Hong Zhang, Wenyan Jia, Ding Yuan, Feiyang Cheng, Ruiming Jia, Lu Li, and Mingui Sun, "Saliency guided naturalness enhancement in color images", Optik Journals, pp. 1326-1334, July 2015.
- [2] Kuldeep Singh, Rajeev Kapoor, and Sanjeev Kr. Sinha, "Enhancement of low exposure images via recursive histogram equalization algorithm", Optik Journals, pp. 2619-2625, June 2015.
- [3] Ahmad Shahrizan Abdul Ghani, Nor Ashidi Mat Isa, "Enhancement of low quality underwater images through integrated global and local contrast correction", Applied Soft Computing Journal, pp. 332-344, August 2015.
- [4] S.C.F. Lin, C.Y. Wong, G. Jiang, M.A. Rahman, T.R. Ren, Ngaiming Kwok, Haiyan Shi, Ying-Hao Yu, and Tonghai Wu "Intensity and edge based adaptive un-sharp masking filter for color image enhancement", Optik Journals, pp. 407-414, August 2015.
- [5] Weiji He, Weiyi Feng, Yiyue Peng, Qian Chen, Guohua Gu, and Zhuang Miao, "Multi-level image fusion and enhancement for target detection", Optik Journal, pp. 1203-1208, February 2015.