

# ANALYSIS OF UNDERWATER IMAGE VISIBILITY USING WHITE BALANCE ALGORITHM

Sahaya Sujithra S<sup>1</sup>& Mrs. Rekha C<sup>2</sup>& Mrs. Agnes Ramena T<sup>3</sup>

<sup>1</sup>2nd YEAR PG, PET ENGINEERING COLLEGE

<sup>2</sup>ASSISTANT PROFESSOR, PET ENGINEERING COLLEGE

<sup>3</sup>ASSISTANT PROFESSOR, PET ENGINEERING COLLEGE

\*\*\*

**Abstract** —This paper deals with a technique to improve the degraded images which were captured underwater as well as degraded due to scattering and absorption. From the original degraded image, color compensated images and white balanced version image were to be derived for image reconstruction. White balancing aims at improving the image aspect, primarily by removing the undesired color castings. These two images and their weight maps are useful for enhancing the color contrast in the output image. Multiscale fusion strategy was adapted for avoiding the short weight maps transition which creates artifacts in the low frequency components of the reconstructed image. This algorithm shows that the reconstructed image are independent of hardware features. This technique to measure the metrics such as PCQI, UCIQE, UIQM and to compare the measured values with various algorithm like gray edge, max RGB, shades of gray.

**Key Words:** Underwater, image fusion, white-balancing.

## 1. INTRODUCTION

According to the Beer-Lambert law, transmission  $t$  is exponentially decreasing with respect to the distance. For the case of haze in the atmosphere, the transmission of an object in the scene depends both on the composition  $n$  of the portion of air that the light beam has traversed to reach it, the red channel still keeps some intensity, so its reciprocal  $1/JR$  is low, and the prior is still true. However, as distance increases, red intensity rapidly decays, and its weight in the Red Channel image decreases. A pixel that lies at the maximum depth with respect to the camera. The pixel does not need to be the brightest pixel in the Red Channel [1]. The general idea of image fusion is that the processed result, combines several input images by preserving only the most significant features of them. It is obtained by a fusion-based approach fulfills the depiction expectation. The image restoration is tightly correlated with the color appearance, and as a result the measurable values such as salient features, local and global contrast or exposedness are difficult to integrate by naive per pixel blending, without risking to introduce artifacts[2]. Color constancy algorithms are based on simplifying assumptions such as restricted gamuts (limited number of

image colors which can be observed under a specific illuminant), the distribution of colors that are present in an image (e.g., white patch, gray-world, etc.), and the set of possible light sources[3]. The formulation consists of a single observation, the foggy image, and two layers of latent variables. We associate one hidden layer with the albedo term  $C$  and the other with the depth  $D$ . These two latent layers can be considered statistically independent, since surface color and its geometric structure are not statistically tied to each other. The estimation of the albedo  $\rho(x)$  and depth  $d(x)$  corresponds to maximizing the posterior probability. A general method for factorizing a single foggy image into its scene albedo and depth by leveraging natural constraints imposed on the latent layers[4]. The vehicle is modeled as a rigid body acted on by a hydrodynamic force vector, a control force vector, a hydrodynamic moment vector, and a control moment vector. The fluid and the vehicle are coupled by the hydrodynamic force vector and the hydrodynamic moment vector [5]. Cable has been detected in the image, its location and orientation in the next one are predicted by means of a Kalman filter. The number of pixels to be processed can be reduced to a small Region of Interest in the image. This fact lowers the probability that the system errs. The fact that the clusters appear more or less separated depends not only on the image and the level of noise, but also on the gradient operator. The direction of scanning is important as the lower part of the image tends to be clearer than the upper part when the camera is not oriented towards the seabed, due to the properties of light propagation [6].



## 2. METHODOLOGIES

Underwater images typically exhibit color distortion and low contrast as a result of the exponential decay that light suffers as it travels. Moreover, colors associated to different wavelengths have different attenuation rates, being the red wavelength the one that attenuates the fastest. Where colors associated to short wavelengths are recovered, as expected for underwater images, leading to a recovery of the lost contrast. The Red Channel method can be interpreted as a variant of the Dark Channel method used for images degraded by the atmosphere when exposed to haze. Experimental results show that our technique handles gracefully artificially illuminated areas, and achieves a natural color correction and superior or equivalent visibility improvement when compared to other state-of-the-art methods.



**Fig-1:** Results on the Ship image With the Red Channel algorithm.

The visual results of restoring these images with the algorithms

This paper describes a novel strategy to enhance underwater videos and images. Built on the fusion principles, our strategy derives the inputs and the weight measures only from the degraded version of the image. In order to overcome the limitations of the underwater medium we define two inputs that represent color corrected and contrast enhanced versions of the original underwater image/frame, but also four weight maps that aim to increase the visibility of the distant objects degraded due to the medium scattering and absorption. Our strategy is a single image approach that does not require specialized hardware or knowledge about the underwater conditions or scene structure. Our fusion framework also supports temporal coherence between adjacent frames by performing an effective edge preserving noise reduction strategy. The enhanced images and videos are characterized by reduced noise level, better exposedness of the dark regions, improved global contrast while the

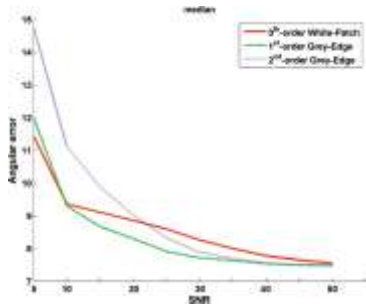
finest details and edges are enhanced significantly. In addition, the utility of our enhancing technique is proved for several challenging applications.



**Fig-2:** Single image dehazing

The underwater light propagation is more complex and the image dehazing could have sub-class of the underwater image restoration problem. It is able to dehaze images comparable to and even more accurate than the specialized single dehazing techniques.

Existing color constancy methods are all based on specific assumptions such as the spatial and spectral characteristics of images. As a consequence, no algorithm can be considered as universal. However, with the large variety of available methods, the question is how to select the method that performs best for a specific image. To achieve selection and combining of color constancy algorithms, in this paper natural image statistics are used to identify the most important characteristics of color images. Then, based on these image characteristics, the proper color constancy algorithm (or best combination of algorithms) is selected for a specific image. To capture the image characteristics, the Weibull parameterization (e.g., grain size and contrast) is used. It is shown that the Weibull parameterization is related to the image attributes to which the used color constancy methods are sensitive. An MoG-classifier is used to learn the correlation and weighting between the Weibull-parameters and the image attributes (number of edges, amount of texture, and SNR). The output of the classifier is the selection of the best performing color constancy method for a certain image. Experimental results show a large improvement over state-of-the-art single algorithms. On a data set consisting of more than 11,000 images, an increase in color constancy performance up to 20 percent (median angular error) can be obtained compared to the best-performing single algorithm. Further, it is shown that for certain scene categories, one specific color constancy algorithm can be used instead of the classifier considering several algorithms.



**Fig-3:** The sensitivity of the different color constancy.

This figure shows the better SNR. Further, first-order and second-order Gray Edges have a higher error than the zeroth-order method for low signal-to-noise ratios, but a lower error for higher signal- to-noise ratios.

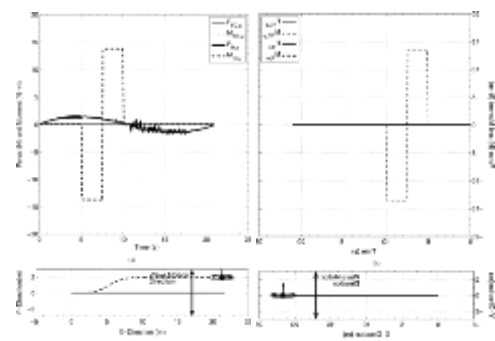
Atmospheric conditions induced by suspended particles, such as fog and haze, severely degrade image quality. Restoring the true scene colors (clear day image) from a single image of a weather-degraded scene remains a challenging task due to the inherent ambiguity between scene albedo and depth. In this paper, we introduce a novel probabilistic method that fully leverages natural statistics of both the albedo and depth of the scene to resolve this ambiguity. Our key idea is to model the image with a factorial Markov random field in which the scene albedo and depth are two statistically independent latent layers. We show that we may exploit natural image and depth statistics as priors on these hidden layers and factorize a single foggy image via a canonical Expectation Maximization algorithm with alternating minimization. Experimental results show that the proposed method achieves more accurate restoration compared to state-of-the-art methods that focus on only recovering scene albedo or depth individually.



**Fig-4:** A foggy street scene

This method achieves much greater consistency in the colors of the recovered albedo layer when compared with the original image. A greater consistency in the recovered colors when compared to the original image.

In this paper, a general formulation of the problem of control of underwater vehicles in full unsteady flow is presented. First, a reduced-order model of the coupled fluid vehicle (CFV) system is developed. The inability to observe fluid motion motivates a fluid compensation control (FCC) approach that compensates for the hydrodynamic loads synthesized from surface measurements. The FCC consists of a tracker, a regulator, and a fluid compensator. A condition is provided that guarantees vehicle stability. The tradeoff between regulation and fluid compensation is also examined. A numerical example of an elliptically shaped vehicle illustrates the results.

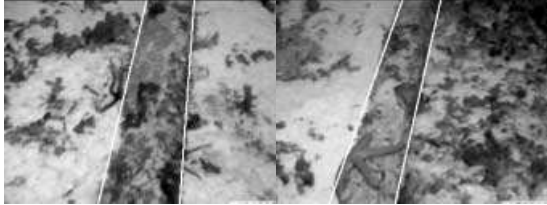


**Fig-5:** Straight run through a canyon with fluid compensation.

The fluid compensation force is approximately zero because the vehicle does not undergo an undesirable yaw. The vehicle follows the desired path perfectly.

Nowadays, the surveillance and inspection of underwater installations, such as power and telecommunication cables and pipelines, is carried out by operators that, being on the surface, drive a remotely operated vehicle (ROV) with cameras mounted over it. This is a tedious and high time-consuming task, easily prone to errors mainly because of loss of attention or fatigue of the human operator. Besides, the complexity of the task is increased by the lack of quality of typical seabed images, which are mainly characterised by blurring, non-uniform illumination, lack of contrast and instability in the vehicle motion. In this study, the development of a vision system guiding an autonomous underwater vehicle (AUV) able to detect and track automatically an underwater power cable laid on the seabed is the main concern. The vision system that is proposed tracks the cable with an average success rate above 90%. The system has been tested using sequences coming from a video tape obtained in several tracking sessions of various real cables with a ROV driven from the surface. These cables were installed several years ago, so that the images do not present highly contrasted cables over a sandy seabed; on the contrary, these cables are

partially covered in algae or sand, and are surrounded by other algae and rocks, thus making the sequences highly realistic.



**Fig-6:** Final results for two images of high complexity. Both pictures show the detected sides of the cable.

This image shows, Belong to the high complexity end (i.e. cables over rocks and algae, and/or a high degree of cable occlusion).

## RESULT AND DISCUSSION

In this paper, we have discussed many techniques. In Red channel method the value of PSNR is very low. This method is adapted in automatic red channel underwater image restoration and also PSNR value were comparatively less in Enhancing the underwater images and videos by fusion. From the detailed study our approach generally results in good perceptual quality, with significant enhancement of the global contrast, the color, and the image structure details. The main limitations are related to the fact that: (i) color can not always be fully restored, and (ii) some haze is maintained, especially in the scene regions that are far from the camera. Those limitations are however limited, especially when compared to previous works. The good performance.

## CONCLUSION

In this survey paper, various methods were analyzed. From the observation it was found white balancing algorithm produced to enhance a wide range of underwater images (e.g. different cameras, depths, light conditions) with high accuracy, being able to recover important faded features and edges.

## REFERENCES

- [1] A. Galdran, D. Pardo, A. Picón, and A. Alvarez-Gila, "Automatic red-channel underwater image restoration," *J. Vis. Commun. Image Represent.*, vol. 26, pp. 132–145, Jan. 2015
- [2] C. Ancuti, C. O. Ancuti, T. Haber, and P. Bekaert, "Enhancing under- water images and videos by fusion," in *Proc. IEEE CVPR*, Jun. 2012, pp. 81–88.
- [3] A. Gijssenij and T. Gevers, "Color constancy using natural image statistics and scene semantics," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 33, no. 4, pp. 687–698, Apr. 2011.
- [4] L. Kratz and K. Nishino, "Factorizing scene albedo and depth from a single foggy image," in *Proc. IEEE ICCV*, Sep. 2009, pp. 1701–1708.
- [5] B. A. Levedahl and L. Silverberg, "Control of underwater vehicles in full unsteady flow," *IEEE J. Ocean. Eng.*, vol. 34, no. 4, pp. 656–668, Oct. 2009.
- [6] A. Ortiz, M. Simó, and G. Oliver, "A vision system for an underwater cable tracker," *Mach. Vis. Appl.*, vol. 13, pp. 129–140, Jul. 2002.