© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 06 Issue: 03 | July-September 2015

Underwater Image Quality Enhancement Using Adaptive Gamma Correction Weighting Distribution

Er. Charanjeet Kaur
M.tech Scholar Deptt. of CSE
Guru Kashi University
Talwandi Sabo
grewal.charanjeet@yahoo.in

Er. Rachna Rajput
Assistant Professor Deptt. of CSE
Guru Kashi University
Talwandi Sabo
rachna12cse@gmail.com

Abstract

In the technique known as Adaptive gamma correction using weighting distribution (AGCWD) was presented that modify histograms and enhance contrast in digital images. The AGC method increases low intensity and avoids significant decrement of high intensity. The nature of underwater picture is poor because of the properties of water and its contaminations. The properties of water reason lessening of light goes through the water medium, bringing about low complexity, obscure, inhomogeneous lighting, and shading decreasing of the underwater pictures. New proposed a system for improving the nature of underwater picture. Common histogram leveling uses the same change got from the picture histogram to change all pixels. This functions admirably when the conveyance of pixel qualities is comparable all through the picture. When the picture contains areas that are altogether lighter or darker than the majority of the picture, the complexity in those districts won't be adequately upgraded. The goal is to improve the underwater pictures differentiation while safeguarding picture brilliance and gives better visual quality and PSNR esteem. We getting a better result using PSNR, MSE, AMBE parameters. In future work, we will also apply CLAHE on L*A*B color space and compare the results on different color spaces. we would also like to test our method for underwater videos.

Keyword: Image enhancement, HE, BBHE, PSNR, Adaptive Gamma Correction etc.

I. INTRODUCTION

Image enhancement is a technique of improving the quality of image by improving its features , stretching the contrast of RGB , stretching the saturation and intensity of HSI to solve the problem of lighting. Underwater image enhancement process is a challenging field because of physical objects of such an environment. Underwater image enhancement techniques provide a way to improving the property or object identification in underwater environment. There is lot of research started

for improving the quality of underwater images, but limited work has been done in the area of underwater images. The quality of underwater images get blurred due to poor visibility and effects like absorption or reflection or bending , scattering of light. There are the important reasons which causes the degradation of underwater images. This paper describes the review of development work on the techniques and methods of underwater image enhancement.

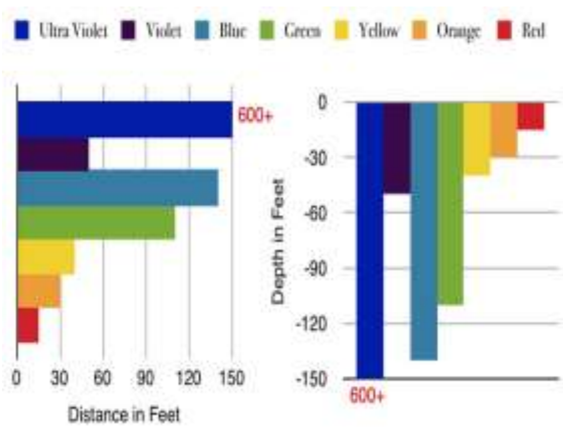


Fig. : Illustration of underwater color diminishing

II. ENHANCEMENT TECHNIQUES

(a) Histogram Equalization

It is a popular technique for improving the appearance of a poor image. It's a function is similar to that of a histogram stretch but often provides more visually pleasing results a cross a wide range of images. Histogram equalization is a technique where the histogram of the resultant image is as flat as possible (with histogram stretching the overall shape of the histogram remains the same). The results in a histogram with a mountain grouped closely together to "spreading or flatting histogram makes the dark pixels appear darker and the light pixels appear lighter (the key word is "appear" the dark pixels in a photograph can not by any darker. If, however, the pixels that are only slightly lighter become much lighter, then the dark pixels will appear darker. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In particular, the method can lead to better views of bone structure in x-ray images, and to better detail in photographs that are over or under-exposed. A key advantage of the method is that it is a fairly straightforward technique and an invertible operator. So in theory, if the histogram equalization function is known, then the original histogram can be recovered. The calculation is not computationally intensive. A disadvantage of the method is that it is indiscriminate. It may increase the contrast of background noise, while decreasing the usable signal. In scientific imaging where spatial correlation is more important than intensity of signal (such as separating DNA fragments of quantized length), the small signal to noise ratio usually hampers visual detection. Histogram equalization often produces unrealistic effects in photographs.

Fig : Image enhancement before and after HE

(b) Adaptive Histogram Equalization

Adaptive histogram equalization (AHE) is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast .However, AHE has a tendency to over amplify noise in relatively homogeneous regions of an image. A variant of adaptive histogram equalization called contrast limited adaptive histogram equalization (CLAHE) prevents this by limiting the amplification.

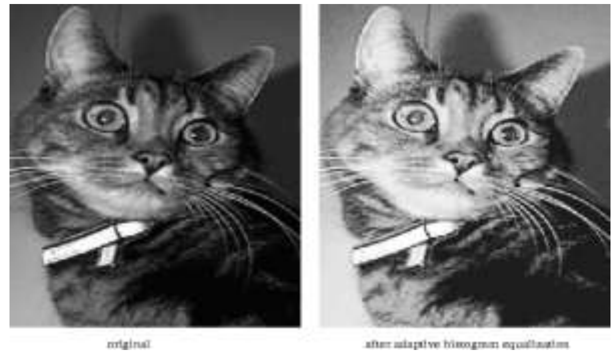


Fig : Image enhancement before and after AHE

(c) Adaptive Gamma Correction

Many devices used for capturing, printing or displaying the images generally apply a transformation, called power-law, on each pixel of the image that has a nonlinear effect on luminance:

$$g(u) = u^{\gamma}$$

In the above equation u ϵ [0, 1] denotes the image pixel intensity, γ is a positive constant introducing the gamma value. By this assumption, the value of γ typically can be determined experimentally, by passing a calibration target with a full range of known luminance values through the imaging device. When the value of γ is known, inverting this process is trivial:

$$g^{-1}(u) = u^{1/\gamma}$$

Often such calibration is not available or direct access to the imaging device is not possible. Hence an algorithm is needed to enhance an image for its gamma values without any knowledge about the imaging device . In addition to this problem, in practice, these nonlinear effects aren't consistent across all regions of the image. In other words, the value of gamma may change from one region to another. For instance, it is possible that a scene contains a large dynamic illumination range that an imaging device is not able to adequately capture. Thus, especially in very dark or bright regions of the image, some details may become clustered together within a small intensity range. Hence a local enhancement process is needed to adjust the image quality in different regions in a way that the human viewers grasp these details.

Recently, a number of algorithms have been developed to determine image gamma values. In a global blind inverse gamma correction technique was developed exploiting the fact that gamma correction introduces specific higher-order correlations in the frequency domain. In this approach the gamma values from 0.1 to 3 are applied to image pixels in 128×128 windows so that the best gamma value for each value is the one that minimizes those higher order correlations. This method is time consuming and has limited success. Another global gamma correction based on texture analysis has been introduced. Although this method is not time consuming, but because of global gamma correction this method may not be succeed to enhance some images that need local gamma correction. A mapping function is considered to correlate gamma values with pixel values. In fact, the algorithm is a nonlinear transformation that makes pixels with low values brighter, whereas pixels with high values become darker. This transformation leaves mid tons with less correction or even no correction. This approach is a pixel wise operation that may be successful on reducing the illumination on the scene. Since local information of the pixels is not used, image distortion may occur in natural scene images. A new local gamma correction method based on nearest neighbor algorithm and two feature vectors: pixel intensity histograms and dispersion-versus-location distributions is presented. Although this method produces satisfying results, but its computational complexity is high and it only works on grayscale images.

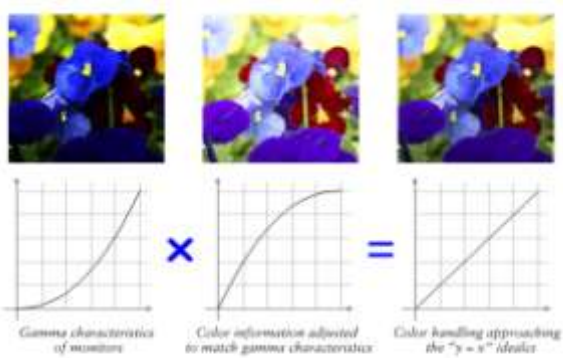


Fig : Gamma Correction

(d) Brightness Preserving Bi-Histogram Equalization (BBHE):

In this technique, the input image is decomposed and two sub images are formed on the bases of mean value. One Sub image contains the set of samples that are less than or equal to mean whereas the other sub image is the set of samples greater than mean. Then the method equalizes both sub images independently according to their respective histograms with a constraint that samples in the first sub image are mapped in the range from minimum gray level to input mean and samples in second sub image are mapped in the range from mean to maximum gray level. That means one sub image is equalized over the range up to mean and other sub image is equalized over the range from mean based on the respective histograms. The resultant equalized sub images are bounded by each other around input mean, which has an effect of preserving the mean brightness .BBHE has an advantage that it preserves mean brightness of the image while enhancing the contrast and, thus, provides much natural enhancement that can be utilized in consumer electronic products.

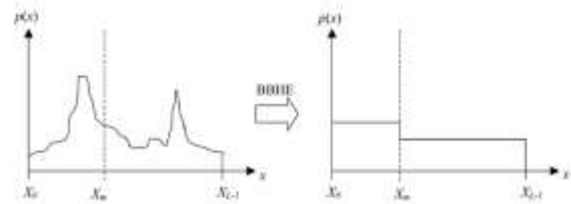


Figure 1: Histogram before and after BBHE

III. PROBLEM FORMULATION

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. For example, you can remove noise, improves sharpen, or brighten an image, making it easier to identify key features. There are some drawbacks of different image enhancement techniques. Image enhancement technique that is Adaptive histogram produces blurred and washed out images especially at the edges. Whereas alpha rooting produces over-graying enhanced images so to overcome all these drawbacks. One drawback of the histogram equalization can be found on the fact that the brightness of an image can be changed after the histogram equalization, which is mainly due to the flattening property of the histogram equalization. In underwater situations, clarity of images are degraded by light absorption and scattering. This causes one color to dominate the image. In order to improve the perception of underwater images, we proposed an approach based on slide stretching. Proposed method is gamma correction for underwater image enhancement. The term gamma correction means doing graphics color math accounting for the distortion that the color will eventually go through when displayed on a monitor. Gamma is useful because Gamma encoded images store tones more efficiently. Our eyes do not perceive light the way cameras do. we perceive twice the light as being only a fraction brighter and increasingly so for higher light intensities (a "nonlinear" relationship).

IV. OBJECTIVE

Light scattering and color change are two major sources of distortion for underwater photography. Light scattering is caused by light incident on objects reflected and deflected multiple times by particles present in the water before reaching the camera. This in turn lowers the visibility and contrast of the image captured. This can be achieved by using the Adaptive Gamma Correction as they enhance the contrast using intensities.

Our Objectives are as follows:

➢ The objective is to enhance the underwater images contrast while preserving image brightness.

➢ To apply histogram equalization to enhance the different properties.

➢ To apply BBHE, RESWHE with Gamma Correction techniques.

V. METHODOLOGY

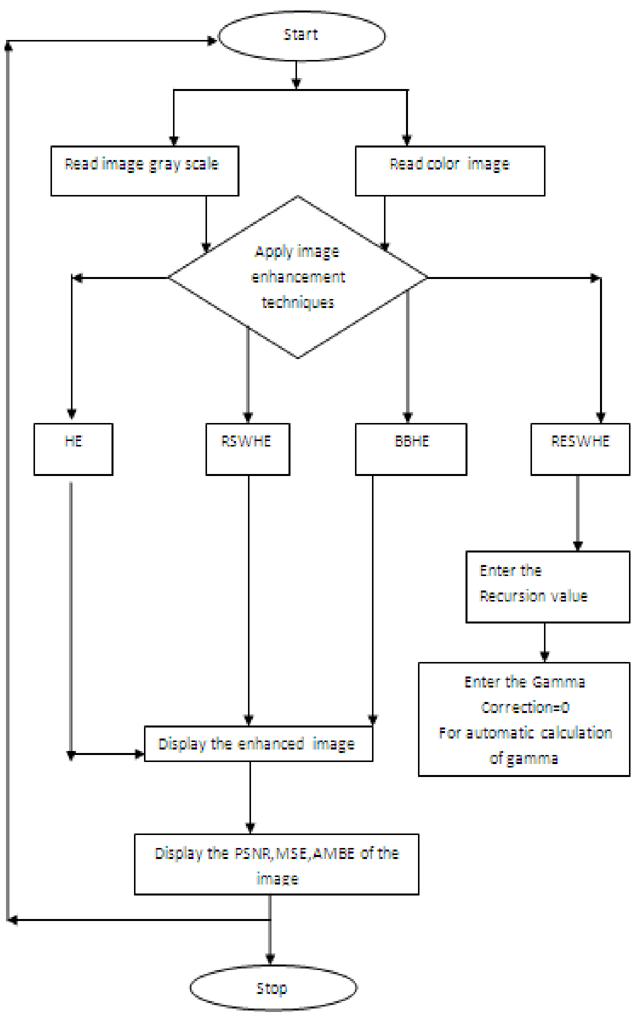


Fig : Flowchart of the proposed method implementation

VI. PROPOSED TECHNIQUE

- Image quality enhancement using Gamma Correction
- Recursive Sub weighting histogram equalization with gamma correction

VII. RESULTS

Table 1 : For Entropy for Colored image

Image	**HE**	**BBHE**	**RSWHE r=2**	**Proposed method r=2**
Small fish	5.607	6.253	5.759	5.759
Colored	5.228	7.222	6.974	6.974
Yellow	5.992	7.790	7.465	7.465
Blue sea	5.892	7.569	7.366	7.366
Orange sea	5.994	7.881	7.580	7.580
Wale	5.790	7.385	7.134	7.134

Table 2 : For Peak Signal to Noise Ratio (PSNR)

Image	**HE**	**BBHE**	**RSWHE r=2**	**Proposed method r=2**
Small fish	55	64	74	74
Colored	61	72	70	73
Yellow	64	73	72	77
Blue sea	63	68	71	74
Orange sea	67	74	71	75
Wale	63	69	74	75

Table 3 : For Mean Brightness Error (AMBE)

Image	**HE**	**BBHE**	**RSWHE r=2**	**Proposed method r=2**
Small fish	100.18	27.18	4.87	6.10
Colored	49.58	6.25	11.77	7.31
Yellow	35.63	10.72	12.56	7.23
Blue sea	38.62	13.53	16.10	9.75
Orange sea	28.80	8.84	16.18	10.22
Wale	48.13	7.16	12.91	9.45

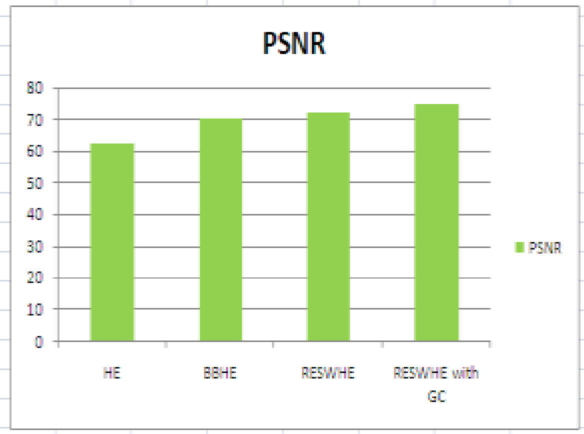
Table 4 : For Mean Square Error (MSE)

Image	HE	BBHE	RSWHE r=2	Proposed method r=2
Small fish	0.197	0.038	0.006	0.007
Colored	0.052	0.005	0.006	0.004
Yellow	0.024	0.005	0.004	0.002
Blue sea	0.039	0.010	0.007	0.003
Orange sea	0.022	0.004	0.006	0.003
Wale	0.073	0.009	0.005	0.003

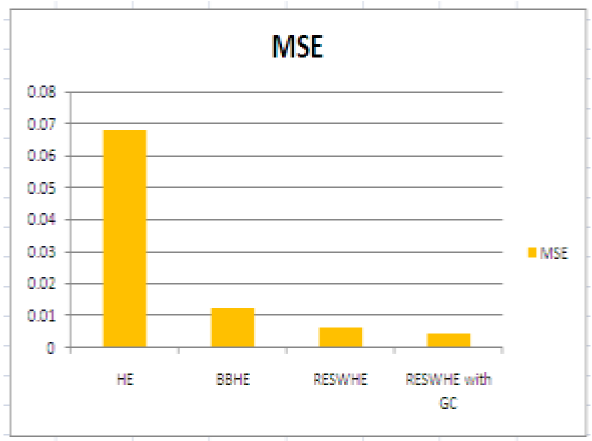
Table 5 : For Average values of entropy , MSE , PSNR , and proposed method for underwater images.

Method	Entropy	PSNR	MSE	AMBE
HE	5.75	62.17	0.068	50.16
BBHE	7.35	70	0.012	12.28
RESWHE	7.046	72	0.006	12.4
Proposed method	**7.05**	**74.67**	**0.004**	**8.34**

Note : Te values in bold typeface represent the best results obtained from the comparison.

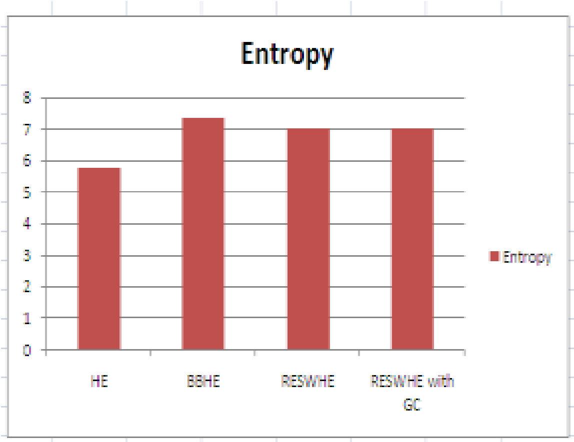


Graph 2: For Peak Signal to Noise Ratio

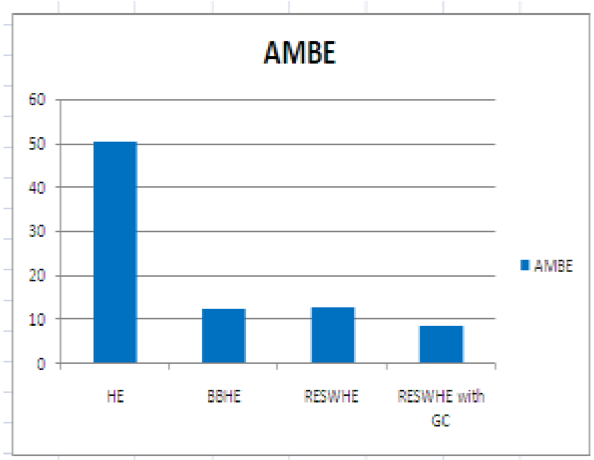


Graph 3: For Mean Square Error

RESULTANT GRAPH IMAGES



Graph 1: For Entropy



Graph 4: For Mean Brightness Error

VII. RESULTANT IMAGES

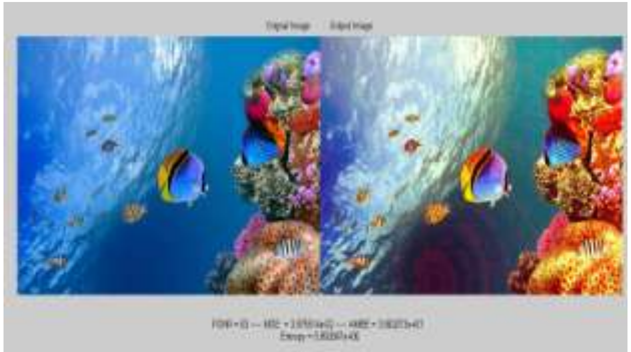


Fig.1 : Image of blue sea. Left image is original image and right image processed using Histogram Equalization Method.

Fig.2 : Image of blue sea. Left image is original image and right image processed using Brightness Preserving Bi-Histogram Equalization Method

Fig.3 : Image of blue sea. Left image is original image and right image processed using Recursively Separated and Weighted Histogram Equalization Method

Fig.4 : Image of blue sea. Left image is original image and right image processed using proposed Method

VIII. CONCLUSION

Underwater picture improvement strategies give an approach to enhancing the property or article recognizable proof in underwater environment. There is parcel of exploration began for enhancing the nature of underwater pictures, yet constrained work has been done in the region of underwater pictures. There are a few disadvantages of diverse picture upgrade strategies. Picture upgrade system Versatile histogram produces obscured and washed out pictures particularly at the edges. Though alpha establishing delivers over-turning gray improved pictures so to defeat every one of these downsides. One disadvantage of the histogram evening out can be found on the way that the brilliance of a picture can be changed after the histogram leveling, which is mostly because of the smoothing property of the histogram balance. The diverse surveys are mulled over from the distinctive papers. Later on work the diverse procedures like BBHE, RESWHE with Gamma Amendment connected to upgrade the pictures.

REFERENCES

REFERENCES

[1]. Ahmad Shahrizan Abdul Ghani , Nor Ashidi Mat Isa (Sept. 2014) "Underwater image quality enhancement through integrated color model with Rayleigh distribution" Applied Soft Computing

[2]. Dr. D. Deepa, V.L.Sangameshwari (Sept. 2014) " A comparative study of underwater image enhancement techniques" International journal of advance research in computer science and management studies, volume 2 issue 9.

[3]. Er. Shefali Gupta, Er. Yadwinder Kaur (July 2014) **"**Review of Different Histogram Equalization Based Contrast Enhancement Techniques" International Journal

of Advanced Research in Computer and Communication Engineering ,Vol. 3, Issue 7, ISSN: 2319-5940.

[4]. Varinderjit kaur, Arpinder Singh et al (July 2014)" A Review on Underwater image enhancement"International Journal of Advanced Research in Computer and Communication EngineeringVol. 3, Issue 7, ISSN: 2319-5940.

[5]. Pranjal Shukla . Varun Prashar (May 2014)," Analysis of Improvement in Image using Gamma Correction Algorithm" , International Journal of Advance Research in Electronics, Electrical & Computer Science Applications of Engineering & Technology, Volume 2, Issue 2, PP 351-355

[6]. Sowmyashree M S, Sukrita K Bekal, Sneha R, Priyanka N (May 2014),"A Survay on the various underwater image enhancement techniques",International Journal of Engineering Science Invention ,Volume 3, Issue 5 , pp:40-45.

[7]. Shivam S. Thakare , Amit Sahu (April 2014)" Comparative Analysis of Various Underwater Image Enhancement Techniques", International Journal of Computer Science and Mobile Computing (IJCSMC), Vol. 3, Issue. 4, pp : 33-38

[8]. Pooja Sahu , Neelesh Gupta, Neetu Sharma (Feb. 2014) , "A Survay on underwater image enhancement techniques" Vol. 87- No.13, PP: 19-23

[9]. Diwakar Shrivastava, Dr. Vineet Richhariya (Feb2014), "Adaptive Contrast Image Enhancement Based on Fuzzy Set Theory "International Journal of Advanced Research in Computer Science and Software Engineering ",Volume 4, Issue 2, February 2014 ISSN: 2277 128X .

[10]. Vinod Kumar, Rahul Raj Choudhary (May 2012)," A Comparative Analysis of Image Contrast Enhancement Techniques based on Histogram Equalization for Gray Scale Static Images ",International Journal of Computer Applications (0975 – 8887) Volume 45– No.21.

[11]. Kashif Iqbal , Rosalina Abdul Salam et al (Nov. 2007)," Underwater image enhancement using an Integrated Color Model", IAENG International Journal of Computer Science (IJCS), _34_2_12.

[12]. K. Somasundaram and P. Kalavathi " Medical Image Contrast Enhancement based on Gamma Correction"

[13]. Jonathan Cepeda-Negrete and Raul E. Sanchez-Yanez, "Combining Color Constancy and Gamma Correction for Image Enhancement"

[14]. Cosmin Ancuti, Codruta Orniana Ancuti et al ," Enhancing Underwater Images and Videos by Fusion."