Using Discrete Wavelet Transformation To Enhance Underwater Image

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Abstract

The underwater image suffers from two main problems. The first is light absorption and the second is the losing colors. These two problems cause losing the basic features of images. A new active approach is presented in this paper to solve the mentioned problems, which depends *Discrete Wavelet Transform* (DWT), *Hue saturation value* color space (HSV), and Slide Stretching. Firstly the underwater image is transformed to the HSV color space, then DWT is applied on the layer H of this image which divides this layer to the four parts according to the importance of the data. Secondly, the part which has much data (called *Low-Low* (LL)) is used with the slide stretching to increase the clarity of color (lost color compensation), on the other hand it provides a suitable solution for the light absorption. The proposed approach has accomplished high processing performance time through focusing on the important part of image by using the DWT. Besides, we did an enhancement in the image that had lost its data and at the same time there are no sources of the image to compare with it. Along with, we noted that the amount of compensation up to its highest level. We gained high ratio of the image enhancement which succeeds up to 98.08%. In addition, the performance time decreases and the compensation ratio of the enhanced image is increases.

Keywords: *DWT, HSV, Underwater Image, Enhancement.*

1. Introduction

The attention of image processing is directed into two fundamental fields: change for the better in figurative information for human visual system as connotation; and manipulating of digital image for storage in outsource such as cloud computing environment, transmission via network, and representation as automatically manner in computers. Image enhancement is a big-name and inevitable grade in several uses of digital image-processing, it has many applications and techniques which are used to get better detail of processed an image. We know that water is denser than air. In fact, it is about 800 times denser merely when the light enters the water. It interacts with the molecules of the water. The atoms await to cause a decrease of light, waste of contrast, changes in color, prevalence, and others negative impacts. The effect of this operation causes losing the light, idling of contrast, changes in color, diffusion and other water impacts. These major problems are light absorption and idling of colors. Absorption impacts several conditions such as the position on the map of the Earth, daily timing, and any season of the year; clarity, and hollowness of the water to acquire the image. The amount of the light reflects upside depending on the height of the sun's light, strictly and even more, under normal circumstances of the sea. In the case of a stormy sea, a lot of light will be distracted. Here the sea can do as of mirror to reflect a lot of light. Depths play a major role in influencing the lighting. Scientific base proves that the loss of light is increased to half whenever we went to the rear more. (In other words, in 10% there will be 50%.,.. , and 12,5% As in a lot of light 30 m , etc). [1, 2] The other dilemma is the dispersion of light. Water molecules react with light by overlapping certain wavelengths. Proportionally, the absorption of light with the wavelength is inversely proportionate. Whereas the short wavelength is moved in the water as long form of colors which are transmitted in batches. The first batches are the red and orange colors, and then it starts with the following colors: yellow, green, and purple, to emerge. The final color is blue. The color that is quickly missing is red, where it falls down at 50 meters. The ratio of loss is

90% in the level of 5 meters. The main scale of idling the color is the distance. Therefore, there are various ratios of them. Fig.1 views the losing of colors [2]. Underwater image grapples with finite range, non uniform lighting, decreasing contrast and hidden color because of specific conversion properties of light in the sea. A significant factor that must be processed is the light alleviating. Light alleviating detects the clarity distance to about 20 meters in visible water. As for the stained water, it is located about 5 meters or less [3, 4]. The problem of lack of lighting is caused by absorption and dissipation. In addition to that, it obtains excitement whenever we move deep in the sea. Absorption deletes the light's energy whereas the scattering inflects the steering of the light's path. Absorption and Scattering infections are suitable to the sea water itself and to other elements such as small observable floating molecules. Another issue in the underwater milieu is the little color differences [4, 5, 6]. This issue causes the color falling to rely on the length of wave of the colors [6, 7]. Enhancement of true images addresses a more complex process not only because of the embedded dimension of the data. However, it refers to the inserted hardness of color impression. Furthermore, underwater image enhancement may need refinement of color counterpoise, color contrast, color brightness in a truth image. The scientific area is witnessing a significant wide development especially in the field of informatics. The underwater image is miserable because of major ordeals such as light absorption and lacking of color when it is acquired at detected depths. As a result of the tremendous scientific advances in the field of information processing, the digital processing of the image was a large shared of it. The digital image processing field is one of the most developing fields of the computer world. The anxiety of most researchers in this field has been to enhance the quality of the images or to calculate some information that intends to obtain lost information throughout complicated provisos such as sight. Image processing in some implementations need an enhancement operation to vivid the image. Image enhancement is considered a significant assignment in the image processing domain. It develops the quality of the images for the human visual system [8, 9]. Removing blurriness, noise, scaling up contrast, and uncovering details are examples of enhancement processes. In other words, it compensates the wastage of the image's information. The admission of information is due to accidental circumstances through image acquiring. The noble goal of the proposed work is to process any picture to manufacture a well image better than the original. The complicity of the image enhancement relies on the ambiance of the image. One of the most complication is the natural of water [10, 11]. Additionally, the source of difficulty in this type of processing is not finding any destination image for compare with it. Therefore, we depended on histogram scale to know enhanced ratio in brightness and contrast in images. Additionally, we used correlation measure to access real value of all components of image. This paper received the gains through the implementation of wavelet transformation for analyzing and de-noising the image and then getting rid of underwater image challenges. In our proposed scheme, repaired color, increase intensity and brightness of underwater image enhancement based on DWT. The mechanism work of our approach, hue is repaired in order to restore color distortion. The reconstructed color is achieved by applying DWT on hue layer. The adaptive luminance enhancement is used to increase the true color and offer solution of light problem, this process is performed via the saturation and intensity stretching of HSV. Our paper is detailed underwater image enhancement and we have used the scale approaches for explaining mechanism of loses color and absorption light. The varieties of approaches can degrade an underwater image into components, which can be applied to know quality of improve contrast; brightness and substitution of lose formation in the image. We are depend on image histogram and correlation as scales to present work, due to it does not find any source image such as previous works. Therefore, Any person can notes amount ratio of enhancement these scales. The underwater image enhancement by using wavelet is quite method to solve problems in this type of digital image.

The organization of this paper includes a series of sections that display the following form . The section 2 addresses and views a summary of the related work. In Section 3, we introduce the primitives and requirements of our work. Section 4 contains the mechanism proposed in this paper. Experimental Results and Analysis have limited in the section 5. The conclusion is referred in the section 6.

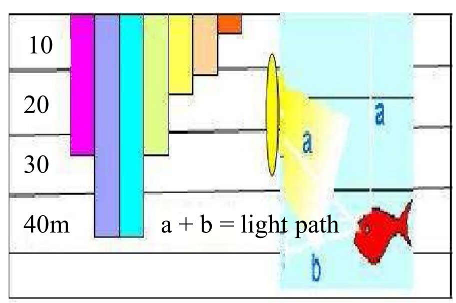

Fig. 1 Loss of Colors

2. Related Works

Often, the data of the image captured is exposed to extreme difficulties. We must, at the outset, address a prior preliminary step. In addition to that, we need to analyze it. In effect, the problems attached of the images underwater is caused by the overlapping of light with the region of absorption. Eventually, the light will disperse. It is activated through the bottom the contrast, thinning luminosity, and limited visibility. There is a need for processing image enhancement impacts. During damping, due to redress of light and restoring, a better balance between the color's components of the color image occurs. Some ways to improve the image retroactive are discovered and are based on responsive phenomenon light impairment [12]. Tristan et al., has suggested a new approach based on the promotion of the video frame sequence to detect different types of fish in the nature of underwater. They applied the equation of the histogram to duplicate the contrast so it can be clearer At the same time, it is used for the median filter to remove the noise. We present a method promoted by slide stretching with DWT. Our proposed scheme does not require median filter because it obtained enhancement ratio is better. The edge detection algorithm was used to disclose Sobel background [13]. Stephane et al., proposed an automated algorithm to reprocess underwater images. The turmoil has decreased under the water, and increased in picture quality. It consists of many sequential phases of processing, which corrects the illumination autonomous non-uniform, lowers noise, increase contrast, and improves color. They used the wavelet transformation to analyze the image. Also, they extended the contrasting for the variation in color and graphed the equation to correct the colors [5]. Our work does not like as above methods, our method based on HSV color system and we selected important layer data (LL) to represent in slide stretching which increase accuracy and performance. Jyoti et al., provided a means of image processing to improve diversity in slow motion underwater, earth, and space images. They proposed, having polished noise that extends on the conversely, they can change the level of brightness for better contrast by using the Histogram Equation (HE) [12]. Our suggested method does not need this service, due to having the privilege gains ability to detail with all types diversity of brightness. Kashif et al., proposed a new approach which depends mainly on slide stretching. This method is a double. First, they use contrast stretching from the RGB method to neutralize color contrast in the image. In addition to that, they applied the stretching of the HSI into the other layers which are intensity and saturation. This increases the true color and presents a solution to the issue of lighting [6]. Liu Chao et al., offered to affect the murky water that can be disabled to detect the clarity of the original vision of the image [14]. Our proposed uses all layers of HSV in easy manner during merge DWT with slide stretching. At last, we got good results in time processing and accuracy of enhancement. The DWT is very quite method to reduce time series. Gang Song et al. suggested an adaptive truth image enhancement depend on human visual features in HSV color system. The truth images enhanced by their algorithm have many features such as richer color, more visible details, and better visual impact. This algorithm is relied on mathematical mean and variance computation. We know the mathematic mean filter leads to miss significant image details like edges and sharpness [15]. The proposal approach enjoys splendid performance in color compensation, regular contrast, brightness balancing and computational cost. G. Padmavathi et al. submitted a set of techniques for the nomination of the image which are deployed in earlier works as a preprocessing of the image. They have been using natural filters to improve the quality of the image, suppression the noise, preserve edges in the image, and increase the smoothness of the image. They compared the experimental results of the current method with three more popular filters: the homomorphic filter, the filter of spread of anisotropic, and the removing noise wavelet by an applied average filter. It is used for underwater image as prior processing [16]. Lastly, Stephane Bazeille et al., reduces confusion under the water, and increases in the quality of the image. This manner contains many of the successive phases of independent processing, nonstandard illumination valid to remove noise, enhance contract and settings to stretch the colors. The evaluating of the performance nomination will be used in the severity of the edge detection standard [5]. The subsequent paper proposes a great way to resolve the difficulties in underwater image. It uses the HSV color system instead of the RGB color system. The HSV is partitioned into three regions: hue, saturation, and value. Equally important, everyone of them, is in a separate stratum. This method allows you to process each of the strata alone by using the discreet wavelet transformation. We concentrate on the sensitive data of image during the use of the transformation of the wavelet and the stratum of hue, respectively. Consensually, the proposed manner offers processing with parts of the image, not as a whole. This is a very important factor in fast, performance and accuracy (See fig.9).

3. Primitives and Requirements

In general, the digital image is a two dimensional matrix. It contains a set of rows and columns. Each of the elements is called a pixel. There are three main types of images: color or true image, gray level image , and monochrome. Color image can be modeled into three main layers. It depends on the basic colors red, green and blue so each layer is different from the other in terms of contract and light intensity [17, 18]. The underwater image enhancing field has addressed enormous interesting within the last years, viewing significant achievements. Now, an increasing attend in naval research has instigated scholar or researchers from different specialties to ship in the deep of underwater world. The underwater image has the same features of the normal images but the most different which is made the underwater image differs from the other images is its environment where, it depends on the stability or agitation of the sea or ocean as well as the reflecting of the sun light effective these issues cause the capturing of image is more difficult as well as the mentioned problems above.

2.1. Underwater image enhancement based on Color System

The underwater image enhancement can be assorted into two classes depending on the color system:

1) **The RGB Color System:** The RGB color system is the most popular systems. It is used to encode the colors. An effective feature is quantization of similar values per element in an image. The output underwater image enhancement in RGB color system not always has improved optimally; Moreover, it has impairment in assimilating rapid brightness impacting. For this reason, we consider transforming an underwater image from RGB color system to HSV color system. Fig.2 shows different types of images.

(a) Binary image (b) Gray-scale (c) Color image

Fig. 2 Views different types of images

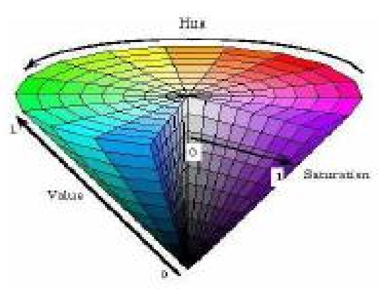

Fig. 3 HSV color system

2) **The HSV Color System:** HSV color system has the ability distinguished between color and severity and it can rebuild images better than is use with the RGB color system. We notice from Fig.3, that the system of HSV is a conical form. The hue stratum ranges from 0 to 1.0 so that it is dedicated to an angle for each color of the same band. The colors here are a closed loop. It starts with red and then tags the following chain of colors: yellow, green, cyan, blue, and magenta [18]. The saturation layer is expressed as the distance which starts from the center of the circle. We notice that the high percentage of saturated colors is on the borders of the cone, while small portions of gray tones are located in the center of the cone. Elements of this layer's are restricted in scope from 0 to 1. Moreover, all components are limited in the range [0,1] in the value layer, the layer that is specialized with brightness. Hence, it produces a more brilliant color. Fig.3 displays the HSV color system [19]. We illustrate this method by the following equations:-

$$r = \frac{R}{R+G+B},\ g = \frac{G}{R+G+B},\ b = \frac{B}{R+G+B} \quad (1)$$

Each normalized H,S and V elements are then obtained by

$$h = \cos^{-1}\left(\frac{05\ (r-g)+(r-b)}{((r-g)\ 2+(r-b)+(g-b))^{\frac{1}{2}}}\right),\ h \in [0,\pi] \quad \text{for} \quad b \le g \quad (2)$$

$$h = 2\pi - \cos^{-1}\left(\frac{05\ (r-g)+(r-b)}{((r-g)\ 2+(r-b)+(g-b))^{\frac{1}{2}}}\right),\ \text{h} \in [0,\pi] \text{ for b} > g \quad (3)$$

$$s = 1 - 3\text{Min}(\text{r, g, b})\ ;\ s \in [0,1] \quad (4)$$

$$\text{v} = \frac{(R+G+B)}{32\ 55};\quad \text{v} \in [0,1] \quad (5)$$

From Fig.3 and Eq.(2) and (3), we note that the calculation of the values of the most important layer (H) , in this system by creating the linear transformation which starts from top to bottom. When you want to make a comparison between the original image and the image of H, the highest values are associated with a shadow of deep blue. The values in the opposite side are connected with a shadow of deep red [19, 20]. The degree of purity is related to a layer of color saturation. Color values in the saturation layer's are very high. Whereas a large degree of convergence is connected to the white shadow. We are noting blending colors like blue, red, and yellow, which resides in the kernel layer saturation. In addition to those intermingled colors, there is a shade of gray. The value stratum is a quasi synonym for brightness. The close link between the original image and the layer value is that the values match the original bright image with counter parts in the layer V [8, 19, 20].

2.2. Discrete Wavelet Transform

The discrete wavelet transformation is used to analyze the two dimensions image where it has the ability to divide the image into four main areas. The distributed data depends on the degree of the important data. The data area is called the low-low (LL) sub band. Occasionally, it is named as an approximation area.

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The rest of the regions are known as the detail. The present sub bands are as follow: high-low (HL), low-high (LH) and the high-high (HH). In brief, they are indicated as (DWT) [14, 16]. The wavelet analysis is permitted in using the long periods of time where the ambition is to get more accurate information from low frequency, and high frequency from the shorter zones [9, 21, 22]. The important data reside in the low frequency because it gives you the opportunity to get a signal of an identity. When you go to the high frequency content, it is characterized by high accuracy. It can be observed by the wavelet analysis for Lena's image (see Fig.5). The following figure, which is figure (4), displays the first level of the DWT [21, 22]. The tactical followed by the separation of the different characteristics of the signal relies on the method of gathering the energy of a few elements. This is called mechanism sub band coding. This class of DWT refers to the place of analysis via the approximation area at level j in four zones. Specifically, level j + 1 consists of approximation and the details. The details are distributed in three zones: horizontal, vertical, and diagonal [17, 19 , 23].

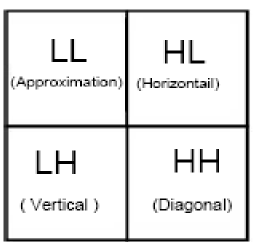


Fig. 4 The first level of the DWT

Fig. 5 The original image and 1-level wavelet decomposition of Lena's image

4. Our Proposed Scheme

Our proposed scheme focuses on providing an appropriate solution to the main problems of the underwater images. We had referred it in the previous parts of this paper. This technique deals with each layer of the HSV system separately. It chooses the most effective class (H), by Eq.(7) to be processed in the DWT. And then it determines the data area (LL) that emerged from the previous processing. The operation of compensation for the lost data are by Eq.(6). The remaining two layers are treated to restore balance in the intensity and illuminate the image contrast by Eq.(6). It will then be returned to enhance the stratum (LL) to the spatial transform. Then it will integrate again with its peers to step out into a new image in the area of HSV. Lastly, the outcome image is converted to space (RGB) which represents the image improved. The stretching function is used to scale the linear function that is applied to the values of pixels in the digital image. Each pixel is processed depending on the following equations:

$$P_i = \begin{cases} s, v + 01 & if \quad P_i \in [\, s, v \,] \\ DWT(h\,) & if \quad P_i \in H \end{cases} \tag{6}$$

$$P_0 = \frac{(P_i - Low) \times (MAx - Low)}{(High - Low)} + \text{Min} \tag{7}$$

Where:
Each h, s, and v rely on Eq. (3-7).
Po :is the enhanced pixel value[18].
Pi :is the pixel value which is applied to Eq.(6).
Min: is minimum value of the scope required.
Max: is the maximum value of scope required.
Low: is the low value of the pixels existing in the image.
High: is the highest value of the pixels which exist in the image.
DWT : discreet wavelet transformation.

We can divide the proposed work into four stages as follow:-The first stage is exerted to overhaul splits of the images. Individual part of the genuine data is enhanced for different color images, resulting in an eminent reduction in enhancement time. This approach implements the DWT. Primarily; it moves the true image from the pattern of the RGB color system into the HSV color system, because the HSV Color system also leads to offer best solutions to the absorption light by using brightness and intensity parameters. The second stage, it performs the DWT on the layer that is most influential which is termed hue in the HSV image. DWT fragments the image data into four data parts. One part of these data are a very heavyweight information. The other parts are for the detailed information. The part of important data will be functioned in the enhancement process. It is stretched to substitute the debiting of colors and rebalance of contrast. We can describe the above stages in more detailed manner. In this approach, the hue layer is represented as image to enter in wavelet domain. DWT are used to partially enhance underwater images. The fundamental idea behind DWT using is very convenient: when acquiring at underwater images and their wavelet domain will generates distributions of frequencies, it seems to contain the most energy (important information) and it locates in the lower frequency bands. One can profit this by splitting an underwater image into twofold: a low-frequency (L) and a high frequency (H) applying convenient filters which called low-pass and high-pass. We know an underwater image which is represented a two-dimensional array, this splitting has to be achieved in both trends leading in 4 subbands; they are named LL, HL, LH, and HH. The important information is distributed in the LL-subband; it fills a small scale edition of the underwater original image. The edge information is offered in other subbands. After the conversion of the image into wavelet domain the LL part will be enhanced. In current process, only important part of image is enhanced whereas the other parts are transmitted without enhanced. To prove the performance of this approach, Fig. (9) explains performance of this approach. The two layers, saturation and value, are also stretched to solve color problem and it contribute to increase intensity and brightness. The arithmetical model for saturation and value components enhancement is obtained by Eq. (6, 7). Where S and V are represent original saturation and value components respectively. As result, P_i is the enhanced saturation and value layers consecutively. The 0.1 is the addition stretch coefficient which detects the adaptive degree of saturation and value enhancement. The value of addition stretch coefficient was arrived at a value of 0.1 after conducting several experiments. This is happen in stage three. Lastly, the four parts are unified back again to gain the image in the wavelet phase. In the spatial pattern, the image will be generated by utilizing the inverse discrete wavelet transform. And then return from HSV color system to RGB. The proposed approach, It dealt with important data area by applying the wavelet transformation and the HSV color system. The stretching was a deep impact that we expressed in Eq.(6) and (7). The stretching operation was performed to rebalance the brightness and the contrast of the image. This is done by applying it on the layers S and V consecutively. Fig. 6 shows how the proposed scheme a worked.

5. Experimental Results and Analysis

In this part, we will address to view the experimental results that took place on a set of images. Our results show the effectiveness of the proposed method. Good results are evident through the seeing experiments on a set of images as can be seen, a histogram of the original image and the resulting image. So, it can reflect the compensation of the lost data during the acquired operation of the image. The evaluation process for the enhanced images will depend on two scales. The reason is due to the strength of the work that we have presented here. The first factor depends on the conviction of specialists in this field to retrieval of lost data through what we observe from the histogram. The second is the calculated amount of error and the amount of compensation to the input images during correlation scale [18,19].

5.1. Histogram

A histogram image is the mathematical standard of the digital image. Furthermore, it helps to understand the distribution of the graphic image. The histogram image means the process of distribution density of brightness and the contrast in the gray-level image [17, 22, 23]. This method is applied in our approach as measure, any person can note enhanced ratio during this scale. Fig.7 refers to the image of the histogram method.

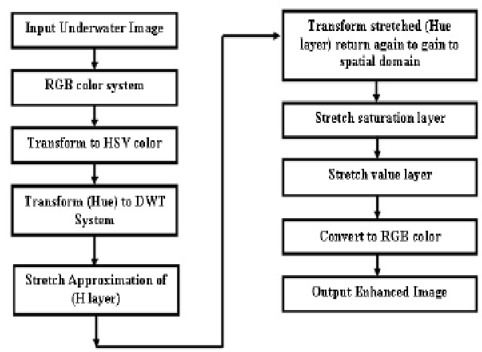
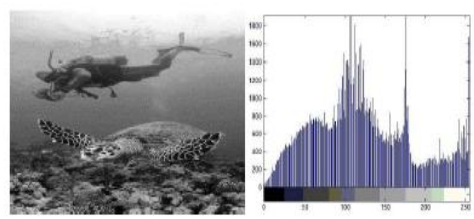


Fig. 6 Demonstration our proposed scheme



(a) Gray-scale image (b) The distributed levels of brightness and contrast

Fig. 7 Histogram of image

5.2. Correlation

Correlation (Crr) is a measure of sameness between the image before and after processing. The exemplary outcomes are near the one which can be identified the following equation [18, 19]:

$$C_{rr}=\frac{\sum_{r=1}^{N}\sum_{c=1}^{M}\left(I_n(r,c)-\overline{I_n}\right)\left(I_0(r,c)-\overline{I_{n0}}\right)}{\sqrt{\left[\sum_{r=1}^{N}\sum_{c=1}^{M}\left(I_n(r,c)-\overline{I_n}\right)^2\right]\left[\sum_{r=1}^{N}\sum_{c=1}^{M}\left(I_n(r,c)-\overline{I_n}\right)^2\right]}} \quad (8)$$

Where:

$I_n(r,c)$: The digital value of the pixel in the (r, c) of image before processing.

I_n : It is referring of the image before processing that

$$\overline{I_n}=\frac{1}{M\times N}\sum_{r=1}^{N}\sum_{c=1}^{M}\left(\overline{I_n}(r,c)\right) \quad (9)$$

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$I_0(r,c)$: The digital value of the pixel in the (r, c) of image before processing.

$$\overline{I_0} = \frac{1}{M \times N} \sum_{r=1}^{N} \sum_{c=1}^{M} (\ \overline{I_0} \ (r,c)) \qquad (10)$$

M: height of the image. N: width of the image. r and c: row and column numbers. The average of these three correlation's are used to generate the Crr of the recreate color image in RGB system. The color correlation equation is as follows:

$$Crr_{RGB} = \frac{Crr_{Red} + Crr_{Green} + Crr_{Blue}}{3} \qquad (11)$$

are closeness for each color layer and Crr_{Red} and Crr_{Green}, Crr_{Blue} where Crr computed by Eq.(10). We can computing the substituting ratio by the following equation:

$$Sub_{RGB} = Crr_{RGB} - (1 - Crr_{RGB}) \qquad (12)$$

The proposal scheme offers mechanism for achieved good balance for main components of the image such as color, brightness and contrast. we use R layer to substitute color loss, while we use both of s and V layers for control the diversity contrast ratio and balancing luminance in images, addition to that, the mechanism work of DWT function as an orthonormal transformation is to decrease the high-dimensional time series into a much more integrate data consideration, with full information saved within its operands. Also we observed that the proposed method has provided balanced solutions for all the contents of the image. The empirical findings view that color underwater images enhanced by the presented approach are pronounced, more visible and more brilliant than original image. The performance of the presented approach is obtained by running color enhancement performance, brightness enhancement performance, contrast brightness enhancement performance, histogram, correlation ratio, and substituting ratio. Fig.8 (a, e, i) show the source underwater images of size 512*512 pixels. Fig.8 (b, f, j) view the histogram of source images . Fig.8 (c, g, k) shows the underwater image enhanced based on our scheme. Fig.8 (b, f, j) views the histogram of target images, where, we can be distinguished into two categories according to proposed approach. Table(1) shows experimental results of underwater images in Fig.(8). In our scheme, it is also proposed to improve the level of performance by performing DWT in H layer which explained in Fig. (9) for images in Fig. (8). The Fig. (9) measures the time per amount of image data processed which explains robustness of the proposed technique which we obtained on a high level of performance. The proposed technique achieved a fantastic balanced mechanism between the image enhancement and processing time. This seems evident in Table (1) and Fig. (9) which is inferred from a set of images that we have chosen in this paper that in which we tested a wide variety of.

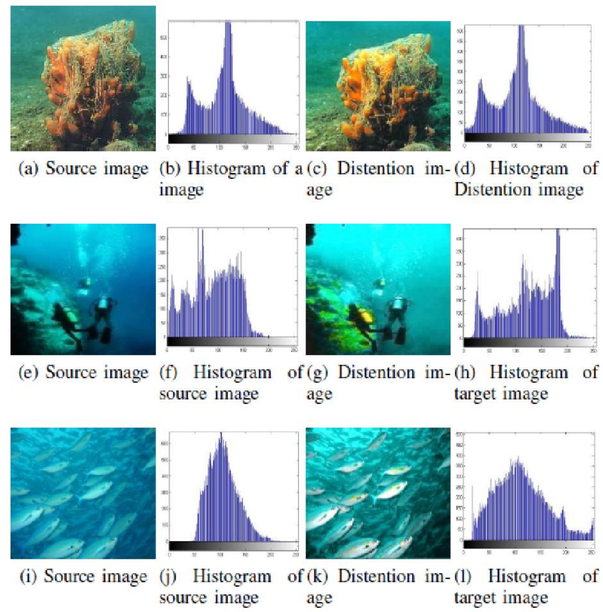


Fig. 8: Results of underwater image enhancement by using our proposed scheme. Source images (a, e and i). Images (c, g, and k) represented the resulting images.

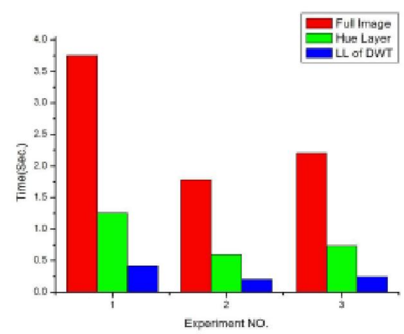


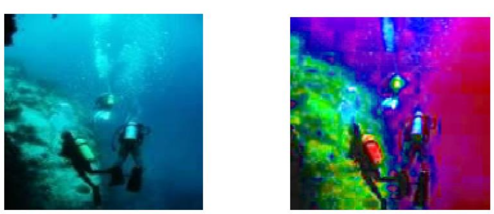
Fig. 9: Time versus enhancement method for source images (a, e, and i) in Fig.8

Table 1: shows the amount of error images and amount of compensation the after processing

source images	Error	Correlation	Min	Max	substituting
a	0.0260	0.9740	0	1	0.9480
e	0.0097	0.9903	0.3	1	0.9806
i	0.0252	0.9748	0.2	1	0.9496

5. Conclusions

There is no doubt that the image processing is a source of the most important sources of scientific impact in many sciences terms. Therefore we see it has been entered strongly in all areas. In this paper we address an important gap, all professionals in the field of marine science and image enhancement can benefit from this. Our proposed scheme aims to achieve a good balance among the missing elements of the underwater image. During that time, we focused on three important components in the images, as reflecting in important data, lighting intensity, and contrast. This is so the tasks can be distributed on this basis. The process of compensating the missing data is the task of the DWT. The balance of brightness and the contrast is due to the stretched process. We used the wavelet transform with the HSV color space to focus on the major areas in the image of precision and processing speed. On the other hand, if we raise the discrete wavelet transform of photos to be addressed, we realize its impact on improving the image as in Fig.10. Out of the results, any person can observes that: 1) the compensation between the original image and the resulting-image is very high; 2) the running time is decreased. The running time is cleared(in case LL) as shown in Fig.9 for source images in Fig.8. The proposed method can be developed to work on most accurate levels of the image. And using methods of classification on the image to be processed. The work here has a dual function; 3) we can develop approach to work in several fields such as enhancement of satellite image and medical images; 4) the primal occupation as classifier where the data classification based on the colors that affect the image; 5) the secondary function as an evaluator compares the levels of light intensity and the contrast between the image and colors before and after treatment.



(a) Source image (b) Target image

Fig. 10: Stretching colors without wavelet

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