International Journal of Advanced and Innovative Research (2278-844)/

Volume 7 Issue 8

Development of Efficient enhancement technique for Underwater Image Enhancement using Median Filter and HSV Stretching and (MFHS)

Chanchal kumar Gohiya, *GNCSGI, Jabalpur*
Prof. Agranshu Dwivedi, *GNCSGI, Jabalpur*

Abstract: Underwater environments generally cause color cast or color scatter while photography. color scatter is due to haze effects appearing when light reflected from thing which absorbed or may be scattered several times by particles of water. Thesis work present a novel procedure for which is a special integration for various available techniques also it has new approach in order to image stretching and image equalisation. Proposed procedure enhances shallow ocean optical images or videos using stretching cum equalizing cum median filter and also as per wavelength properties. Our key contributions are proposed include a novel shallow water imaging model that compensates in order to attenuation discrepancy along propagation path and an effective underwater scene enhancement scheme recovered images are characterized by a reduced noised level, better exposure for dark regions, and global contrast where finest details and edges are enhanced significantly.
Keywords: HSMF: HSI stretching and Median Filter, ACCLAHE: Adaptively clipped contrast limited histogram equalization, WCID: Wavelength compensation and image Dehazing

I-INTRODUCTION

The work done in area for underwater image enhancement till now either using mean or median filters or by using various color stretching methods or by using equalizing, however no one has presented a modal which is integrated for various technique, Thesis work present a novel procedure for which is a special integration for various available techniques also it has new approach in order to image stretching and image equalisation [5]. Proposed procedure enhances shallow ocean optical images or videos using stretching cum equalizing cum median filter and also as per wavelength properties.

II-METHODOLOGY

The work done in area for underwater image enhancement till now either using mean or median filters or by using various colour stretching methods or by using equalizing, however no one has presented a modal which is integrated for various technique, Thesis work present a novel procedure for which is a special integration for various available techniques also it has new approach in order to image stretching and image equalisation. Proposed procedure enhances shallow ocean optical images or videos using stretching cum equalizing cum median filter and also as per wavelength properties. Our key contributions are proposed include a novel shallow water imaging model that compensates in order to attenuation discrepancy along propagation path and an effective underwater scene enhancement scheme. Recovered images are characterized by a reduced noised level, better exposure for dark regions, and global contrast where finest details and edges are enhanced significantly.
Figure 1 shown below shows design work flow proposed by base work 3

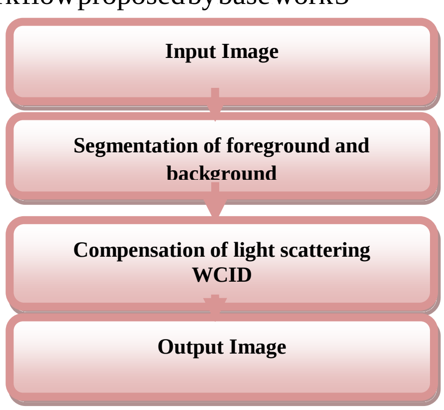

Figure 1: Design flow for base work-3.

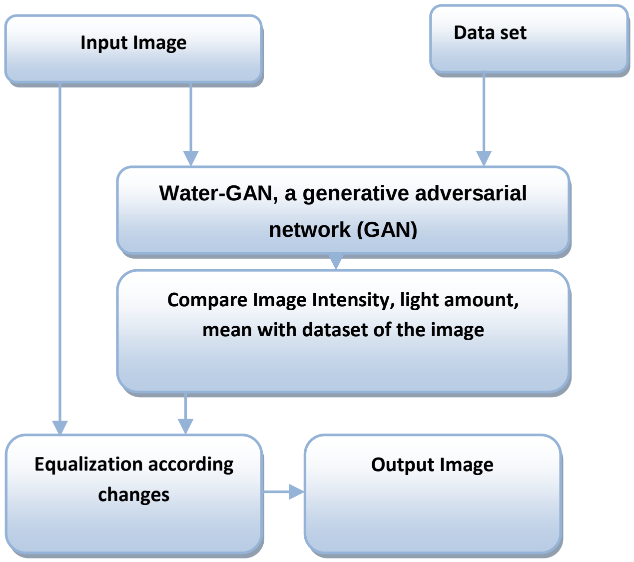

Figure 2 shown below shows design flow for base work 2.

Proposed thesis work proposes a procedure to reconstruct underwater images that which is a combination for a wavelength compensation and de-hazing algorithm (IDWC). One has to determine distance between objects and camera using dark channel prior, then haze effects cause by Color scatter may be removed by de-hazing algorithm. Next, one has to estimation photography scene depth using residual energy ratios in order to each. According to attenuation for every wavelength, reverse compensation conducted to restore all distortion from Color cast. Proposed work has used slide stretching in order to de-hazing. Firstly, proposed work use contrast stretching for RGB algorithm in order to equalizing color contrast in images. Then, proposed work applies intensity stretching and saturation HSI to improve true color and then resolve problem for lighting using wavelength compensation.

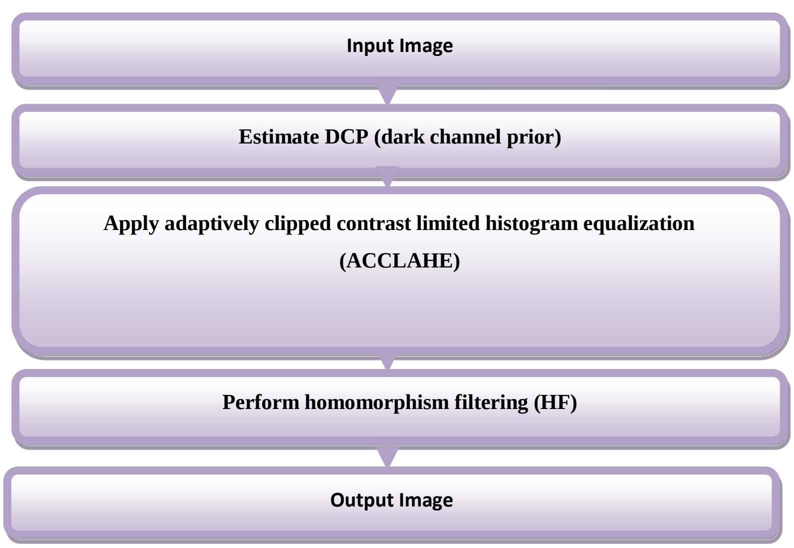

Figure 3 Design flow for base work-1.

Using this technique, proposed work may control contrast ratio in underwater images either by decreasing or increasing value. This is carried out by employing a histogram for digital values in order to an image and redistributing stretching value over image variation for maximum range for possible values [14]. Furthermore linear stretching from 'S' value may provide stronger values to each range by looking at less output values. Here a percentage for saturating image may be controlled in order to perform better visual displays [15].

The contrast stretching algorithm is used to enhance contrast for image. This is carried out by stretching range for color values to make use for all possible values. Contrast stretching procedure uses linear scaling function in order to pixel values. Every pixel is scaled using following function below:-

Po={(Pi-c)x(b-c)/(d-c)}+a

Where

Po is normalized pixel value;

Pi is considered pixel value;

a is minimum value for desire range;

b is maximum value for desired range

c is lowest pixel value present in image;

d is highest pixel value present in image"

As may be observed from figure 1 and figure 2 that they have various approaches proposed work is unique combination for both base work with modified equalizing and stretching approach.

Figure 3 shows flow for proposed work as first block is input image which may be any underwater image in any format jpg or bmp or any else, next RGB component isolation. A new equalizer been developed in order to equalizing RGB components which pull up all RGB components which are less than 50 by specific factor given to it also perform contrast stretching, than after new RGB starching performed in which $R_p>>R_g$ & $R_p>>R_b$ so R_p will pull up to 200 and R_g and R_b will pull down to 50, $R_p>>R_g$ & $R_p>>R_b$ so R_p will pull up to 200 and R_g and R_b will pull down to 50, $R_p>>R_g$ & $R_p>>R_b$ so R_p will pull up to 200 and R_g and R_b will pull down to 50. After RGB stretching HSV stretching performed and at last median filter for order 6 is been used this unique combination results very high quality output image as compare original underwater image.

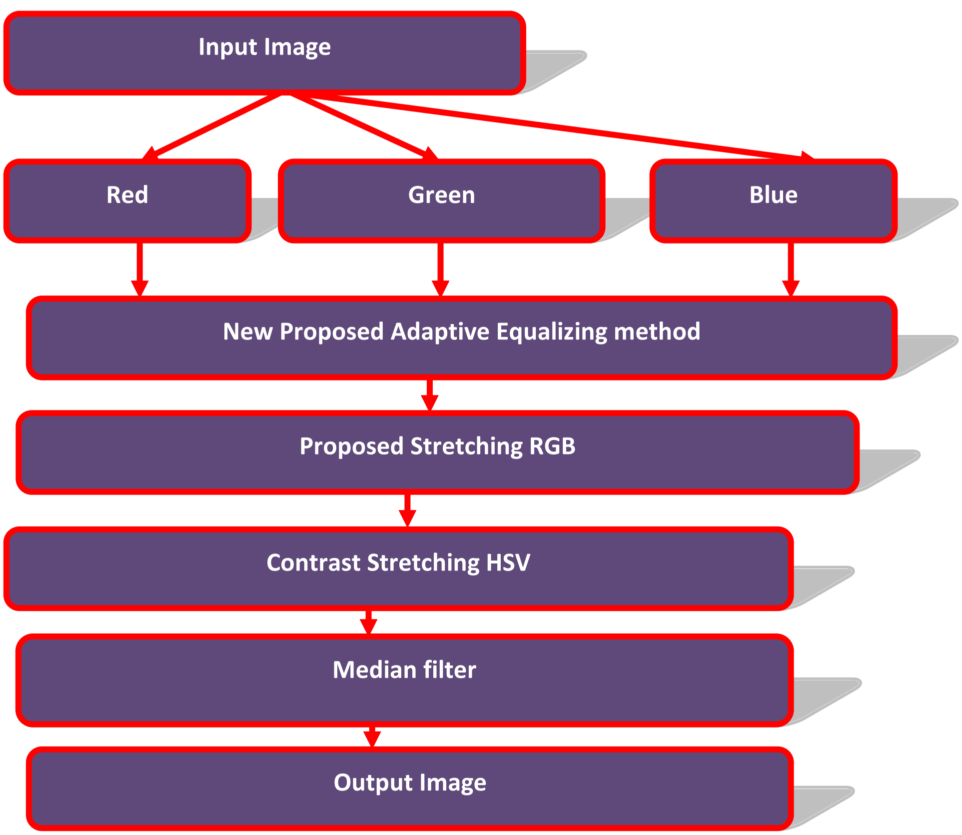

Figure 4: Proposed design flow processes.

Figure 4 above shows the proposed work flow diagram, the method can be understand by following steps:
Step 1 (input image): here we can input any image form our computer but we have take the standard MATLAB image of fish-1[3], fish-2[1]. Monster[1], fort[1], Nemo[1] and Lizard Island[2], the similar images has been taken by base works, so for fair comparison it was highly required to take standard images.
Step 2 (Red, Green and blue): red, green and blue part of the image gets separated for the conversion of 3-D color image into 2-D images for better analysis of the images.
Step 3 Adaptive Equalization: equalization performs individually on red, green and blue part of the images for enhancing the contrast of the image.
Step 4 RGB stretching: after performing adaptive equalization perform RGB stretching for enhancing colors in RGB image format.
Step 5 HIS stretching: after performing RGB stretching hue saturation and intensity conversion performs and HIS stretching done, it will be enhance the lightning in the image.
Let input image is x which is a RGB image
R=x(:,:,1)
G=x(:,:,2)
B=x(:,:,3)
First proposed adaptive Equalization need to be done

$$I = \frac{1}{3}(R + G + B)$$

$$A = cos^{-1}\left(\frac{(R - G) + (R - B)}{2\sqrt{(R - G)^2 + (R - B)(G - B)}}\right)$$

$$H = A \ \ when\ G > B$$

$$H = 360 - A \ \ when\ B > G$$

$$S = 1 - 3\left(\frac{Min(R, G, B}{I}\right)$$

Let 'img' is the HSI image and its intensity block is of 3x3 is as below, and the intensity need to enhance with K coefficient

$$I = \begin{bmatrix} a & b & a \\ c & d & b \\ d & b & e \end{bmatrix}$$

Table 1 Histogram equalization algorithm.

Pixel intensity	**a**	**B**	**C**	**D**	**e**
Pixel value	f1	f2	f3	f4	f5
Probability	f1/9	f2/9	f3/9	f4/9	f5/9
Cumulative probability	F1/9	$\frac{f1 + f2}{9}$	$\frac{f1 + f2 + f3}{9}$	$\frac{f1 + f2 + f3 + f4}{9}$	$\frac{f1 + f2 + f3 + f4 + f5}{9}$
CP*k	K*F1/9	$\left\{\frac{f1 + f2}{9}\right\} * K$	$\left\{\frac{f1 + f2 + f3}{9}\right\} * K$	$\left\{\frac{f1 + f2 + f3 + f4}{9}\right\} * K$	$\left\{\frac{f1 + f2 + f3 + f4 + f}{9}\right. * K$
Floor rounding	Na= floor(K*F1/9)	$Nb = floor\left[\left\{\frac{f1 + f2}{9}\right\} * K\right]$		$Nc = floor\left[\left\{\frac{f1 + f2 + f3}{9}\right\} * K\right]$	

		$Nd = floor\left[\left\{\frac{f1+f2+f3+f4}{9}\right\} * K\right]$	$Ne = floor\left[\left\{\frac{f1+f2+f3+f4+f5}{9}\right\} * K\right]$

$$I_e = \begin{bmatrix} Na & Nb & Na \\ Nc & Nd & Nb \\ Nd & Nb & Ne \end{bmatrix}$$

I_e is the intensity frame of HSI image of MxN DWT applied on 'I'

RGB-HSI stretching

let (x,y) are the pixels coordinates of 'p' in space domain
then W is the reflection component and Z illumination component then

$$p(x,y) = W(x,y)Z(x,y)$$
$$where\ Z(x,y) = \sum_{r=-\infty}^{\infty} \sum_{s=-\infty}^{\infty} F(r,s).p(x-r,y-s)$$
$$F(x,y) = \lambda.e^{\frac{-(x^2+y^2)}{c}}$$
$$p(x,y) = W(x,y)\{F(x,y) * p(x,y)\}$$
$$w(x,y) = log_{10}\big(W(x,y)\big) = log_{10}\big(p(x,y)\big) - log_{10}(F(x,y) * p(x,y))$$
$$w(x,y)\ will\ be\ the\ ratinex\ enhance\ of\ p(x,y)$$

let (u,v) are the pixels coordinates of 'q' in space domain

III-RESULTS

Based on our methodology, final proposed work has developed results with software tool MATLAB and enhances quality for underwater images. Proposed work has developed this tool using an object-oriented programming language. simulations is been done in order to various underwater images and quality for all for them is been improved with very good amount in research work I am showing results of various test images fish-1[3], fish-2[1]. Monster[1], fort[1], Nemo [1] and Lizard Island[2]

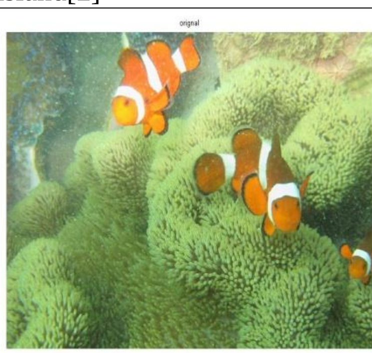	
Figure 1 Original test images for gold fish	Figure 2: Enhanced Image of Nemo

International Journal of Advanced and Innovative Research (2278-844)/

Volume 7 Issue 8

Figure3: testimage LizardIsland image analysis.

Table2: observed results

Testimage	MSE	SNR
Fish1	0.00196	89.5178
Fish2	0.0015948	87.7243
Fort	0.004318	76.3761
Monster	0.001513	67.2707
LizardIsland	0.007986	61.7178
Nemo	0.004599	96.9254

Table 2 above shows results observed in order to three test images. Table 4.2 shown below shows comparative results in which our proposed design result are been compared with other work for same goal.

Table3: comparative results

PSNR Comparison			
	MFHS	ACCLAHE and Homomorphism Filter	WCID
Fish1	89.5178		78.88
Fish2	87.7243	68.965	
Fort	76.3761	69.877	
Monster	67.2707	60.999	
Nemo	96.9254	69.877	

Table3 MSE comparison

MSE comparison		
	Proposed	Water-GAN
LizardIsland	0.007986	0.103

It may be clearly observed from table and figure above that in order to proposed work achieve highest PSNR (Peak Signal to Noise ratio) as compare with base papers in order to all three test images. In base paper work 1 nemo test image is been taken and they achieve PSNR for 26.96 and in base work three in order to test image nemo they achieve PSNR for 9.6 only however in proposed work it is 46.2 which is much higher than both base paper 1 and 3, same results may be seen in figure 4.18 which prove that proposed work is better than all base work.

IV-CONCLUSION

The results shows that IDWC simultaneously resolved problem for Color scatter and Color casting also enhanced image contrast and calibrated Color cast and produces high quality underwater images or videos. In present paper, proposed work used slide stretching algorithm applies on both RGB and HSI color models in order to enhancing underwater images. Main advantage for using two stretching models is because helps to equalize color contrast any type for images and also mention problem for lighting. Proposed approach has produced good results. Quality for images is statistically observed through histograms. Future work will include further evaluation for proposed approach. It may be clearly seen that proposed procedure is best among available procedure with very high PSNR means significantly remove noise and very less MSE hence it has very low error.

REFERENCES

[1] Sonal Dixit, Sandeep Kumar Tiwari, Pankaj SharmaUnderwater Image Enhancement using DCP with ACCLAHE and Homomorphism Filtering, International conference on Signal Processing, Communication, Power and Embedded System (SCOPES)-2016, 978-1-5090-4620-1/16/2016 IEEE

[2] Jie Li, Katherine A. Skinner, Ryan M. Eustice3, and Matthew Johnson-Roberson, WaterGAN: Unsupervised Generative Network to Enable Real-time Color Correction of Monocular Underwater Images, IEEE ROBOTICS AND AUTOMATION LETTERS. PREPRINT VERSION. ACCEPTED JUNE 2017, 2377-3766/2017 IEEE.

[3] John Y. Chiang and Ying-Ching Chen Underwater Image Enhancement by Wavelength Compensation and Dehazing, IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 4, APRIL 2012, Digital Object Identifier 10.1109/TIP.2011.2179666

[4] John Y. Chiang, Ying-Ching Chen, and Yung-Fu Chen, Underwater Image Enhancement: Using Wavelength Compensation and Image Dehazing (WCID), J. Blanc-Talon et al. (Eds.): ACIVS 2011, LNCS 6915, pp. 372–383, 2011. Springer-Verlag Berlin Heidelberg 2011

[5] Huimin Lu, Seiichi Serikawa, UNDERWATER SCENE ENHANCEMENT USING WEIGHTED GUIDED MEDIAN FILTER

[6] Kashif Iqbal, Rosalina Abdul Salam, Azam Osman and Abdullah Zawawi Talib, Underwater Image Enhancement Using an Integrated color Model, IAENG International Journal of Computer Science, 34:2, IJCS_34_2_12, Advance online publication: 17 November 2007

[7] Balvant Singh , Ravi Shankar Mishra , Puran Gour, Analysis of Contrast Enhancement Techniques For Underwater Image, International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 1, Issue 2

[8] R. Schettini and S. Corchs, “Underwater image processing: state for art for restoration and image enhancement methods,” EURASIP Journal on Advances in Signal Processing, 746052, 2010.

[9] Y. Y. Schechner, N. Karpel, “Recovery for underwater visibility and structure by polarization analysis”, IEEE Journal for Oceanic Engineering, Vol. 30, No. 3, pp. 570-587, 2005.

[10] S. Bazeille, I. Quidu, L. Jaulin, J.P. Malkasse, “Automatic underwater image pre-processing”, in : Proc. for Caracterisation Du Milieu Marin (CMM’06), pp.1-8, 2006.

[11] R. Fattal, “Single image dehazing”, ACM Transaction on Graphics, vol.27, no.3, pp.1-8, 2008.

[12] K. He, J. Sun, and X. Tang, “Single image haze removal using dark channel prior”, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.33, no.12, pp.2341–2353, 2011.