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Improved Approches Using YCBCR-RGB, And DCP, BBHE, MSR Based On Underwater Image Enhancement

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Abstract— **The processing of underwater image (UI) seize is essential because the great of UIs might also lead a few critical troubles whilst as compared to pictures from a clearer surroundings. A lot of noise happens because of low evaluation, poor visibility conditions (absorption of natural mild), non uniform lighting and little coloration versions, pepper noise and blur impact in the underwater pictures due to a lot of these motives variety of techniques are current to cure these underwater picture. Underwater environments often purpose color scatter and color forged at some stage in picture. Then discover whether or not it consists of the have an effect on of artificial mild or not. If it is sure eliminate it using suitable method after which cross for the CLAHE approach. Using this prior with the haze imaging color model estimates the thickness of the haze and recover a high quality hazefree image. This method does not require images with different exposure values, and is entirely based on the attenuation experienced by point across multiple frames. In propose paper ,MSR technique used because the underwater images is that uniform illumination and the contrast level is high of this technique in underwater Images , it impacts diffusion of light from all particles of various size ,High intensity in light ,high Perceivability conditions . Applying the prior into the haze imaging model, haze can be effectively removed. Though, haze can be removed effectively in this paper, color change distortion still exist in the underwater image. The implementation result is performed on underwater images. It takes low contrast underwater color images for evaluation. It estimates the value of PSNR, execution time and Entropy using below formulas. The algorithm is designed on MATLABR16 using Image Processing toolbox. In this implementation, this algorithm is compared with three different algorithms. As we seen in experimental result.**

Keywords—underwterimageenhancement;DCP;YCBCR-RGB;CLAHE;BBHE;PSNR;MSE.

I. INTRODUCTION

As a outcome of the negative visibility situations the environment of the world's oceans remains to be now not nicely. Explored for this intent UIE techniques are used, considering the earth is an aquatic planet and because the fact about 70%of its floor is covered by way of water. Now a day there's a strong interest in knowing what lies in underwater, and furthermore, this subject has made an value to the use of underwater sequences to monitor marine species, underwater mountains & vegetation, to achieve this cause it's surely fundamental to make use of the clear picture [1].

Clear UIs have a immoderate significance in scientific operations like taking a census of sea population. Almost usually UI going through low visibility problems. For taking pictures a transparent sizeable UI, water have were given to be a limpid or clear, however evidently the complete water is turbid with debris equivalent to sand, planktons, minerals. As outdoor pictures are distorted whilst you deliberate that of debris praise within the air, like that UIs additionally get distorted on account that of debris present within the water [2] UIs become more and more hazy or less obvious as water depth increases.

II. LITERATURE SURVEY

JingqiAo et al. [3] Brought a unique adjustment of Computation Unified Device Architecture with a wavelet tree dependent method for Image Compression (IC). Both transform in addition to encoding stage of the picture density manner have been upgraded for parallelization as well as efficiency. The proposed algorithm operated faster as compared to a lossless JPEG-XR method providing higher compression ratio. More improvements in speed and flexibility are additionally below present day exam.

ZhinoosRazaviHesabi et al. [4] present to Principal Component Analysis had been implemented on a series of images that combine to give the needed reference models. The outcomes conducted on X-ray photographs proven that the proposed method done 20% increment over the traditional lossless strategies of IC.

K.Rajakumar et. al. [5] analyzed the execution of Integer Multi-wavelet Transform (WT) method used for Lossless image density and discovered that it can without difficulty be applied in loss less picture density. The satisfactory of compressed portraits was once nearly the identical because the original image. The proposed technique gave higher outcomes while used with artificial picture as well as pictures that had excessive frequency facts

ArifSamehArif et al. [6] proposed a proficient method for compression of fluoroscopic pictures through the usage of loss much less method. The results of proposed technique showed an improvement in the compression ratio by approximately 400% when the comparison was made with existing techniques.

Klaus Hildebrandt, wt.al. [7]Anisotropic denoising focuses on the conservation of significant surface features like sharp edges and corners by employing smoothing relying on direction . For example, a sharp edge leftover sharp on smoothing across the edge.

Anutam, wt.al. [8]The most significant charactristics of an image noise removing model is that it should fully eliminate noise as far as possible as well as uphold edges. Discrete wavelet transform is omnipotent strategy in the arena of denoising .

III. PROPOSED METHODOLOGY

3.1 Problem statement:

In base paper A Hybrid DWT-DCLAHE technique for Enhancement of Low Contrast applied for Underwater Images.. The principle issue in IE underwater pictures is that non uniform illumination, low brightness, blurs impact in view of turbulence in the stream of water.

3.2 Proposed methodology

In propose paper, MSR technique used because the underwater images is that uniform illumination and the contrast level is high of this technique in underwater Images , it impacts diffusion of light from all particles of various size ,High intensity in light ,high Perceivability conditions .

3.2.1 YCBCR-RGB

YCBCR is a strategy of color spaces utilized for digital video and photography frameworks. Luminance (Luma Y) is the splendor that happens utilizing high contrast gray shades. In Chrominance (chroma [CB and CR]) the data of shading exist illuminate of flag primarily focused on “YCBCR” either in red or blue flag. The study on eyes of human reflects that luminance is sensitive but not as same to the chrominance. Along these lines the YCBCR color space technique makes utilization of its impact to demonstrate the variety of luminance and chrominance by sorting out the modules of the predefined images [9].

3.2.2. CLAHE

CLAHE shifts from ordinary adaptive HE (AHE) in its contrast constraining. It was acquainted with maintain a strategic distance from the over intensification of noise that in AHE. This is finished by restricting the contrast improvement of AHE.The method consist of few steps: 1. Get every one of the inputs: In picture, consider number of areas in row and column headings, number of bins for the histograms utilized as a part of building picture transform function (dynamic range), fix clip limit (normalized from 0 to 1) for contrast enhancement. 2. Pre-process the inputs: Find real clip limit by normalized value. Before breaking into areas, merge the image, if necessary. 3. Prepare each logical locale (tile) to deliver gray level mappings: In this stage separate a single picture area, make a histogram for this district utilizing the predetermined number of bins, make a mapping on premise of locale by clipping the histogram by utilizing clip limit. 4. Interpolate gray level mapping keeping in mind the end goal to merge final CLAHE picture: In this stage, remove cluster of four neighboring mapping functions, handle picture area somewhat covering each of the mapping tiles, separate a single pixel, apply four mappings function to that pixel, and insert between the outcomes to acquire the output pixel; repeat over the whole picture [10].

3.2.3. DARK CHANNEL PRIOR

Dark channel prior method can produce a natural hazefree image. However, because this approach is based on a statistically independent assumption in a local patch, it requires the independent components varying significantly. Any lack of variation or low signal-to-noise ratio (e.g., in dense haze region) will make the statistics unreliable. Moreover, as the statistics is based on color information, it is invalid for grayscale images and difficult to handle dense haze which is often colorless and prone to noise [11]. Main contributions of dark channel method as follows:

1) The Separating an image into diffuse and specular components is an ill-posed problem due to lack of observations.

2) The observed color of an image is formed from the spectral energy distributions of the light reflected by the surface reflectance, and the intensity of the color is determined by the imaging geometry.

3) The dark channel is taken from the lowest intensity value among RGB channels at each pixel. The DCP approach is able to handle distant objects even in the heavy haze image. It does not rely on significant variance on transmission or surface shading in the input image. The result contains few halo artifacts. Like any approach using a strong assumption, our approach also has its own limitation. The dark channel prior may be invalid when the scene object is inherently similar to the air light over a large local region and no shadow is cast on the object.

3.2.4 Contrast Limited Adaptive Histogram Equalization (CLAHE) -It is generalized technique. By this method the image is divided into tiles. The gray scale is calculated for each tile on the basis of its histogram and transforms function that derives from the interpolation between the manipulated histograms of near-by sub-regions. CLAHE limits the noise enhancement by cut-out the histogram at a client.

3.2.4.1 CLAHE on HSV- HSV color model defines colors in particulars of the Hue (H), Saturation (S), and Value (V). HSV color model is cylindrical-coordinate representing points in an RGB color model. CLAHE is applied on V and S components.

3.2.4.2 CLAHE on RGB color model - RGB color model is an additive color model which represents hues regarding the measure of red, green and blue existence. CLAHE can be implemented to all the three parts i.e. red, green and blue separately. On combining the individual components of model full color effect RGB can be conssumate.

3.2.5 Multi Scale Retinex (MSR)

When the dynamic range of scene exceeds the dynamic range of the recording medium, there is a loss of information which cannot be recovered. Single-scale Retinex (SSR) can either provide dynamic range compression or tonal rendition but not both simultaneously. To combine the strength of various surround space Multi-scale Retinex (MSR) was developed. Multi-scale Retinex output is the weighted sum of the different SSR outputs. Mathematically:

$$R_{MSR} = \sum W_n R_{ni} \qquad i=1 \text{ to } n$$

where n is the number of scales, Rni is the ith component of the nth scale, RMSR is the ith spectral component of the MSR output, and Wn is the weight associated with the nth scale. In MSR the surround function is given by

$$F_n(x, y) = K \exp(-r^2 / C_n^2)$$

where Cn is the Gaussian surround space constant. Multi Scale Retinex combines the dynamic range compression of the Single-Scale Retinex with the tonal rendition to produce an output which encompasses.

Although MSR gives better results by combining dynamic range compression and colour rendition, it suffers from „graying-out‟ of uniform parts. This requires colour restoration after MSR. This can be solved by the method Multi Scale Retinex with Colour Restoration (MSRCR)[12]

3.2.6 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.[13]

3.3 Propose Algorithm:

1. Browse an underwater image from dataset.

2. Show image with the component of YCbCr.

3. Apply CLAHE method to show Image.

4. Use dark channel prior process.

5. Use BBHE image

6. Use proposed method Multi Scale Retinex (MSR).

7. Calculate Peak Signal Noise Ratio (PSNR) between input image and enhanced image.

$$PSNR = 10 \times log^{10} \frac{maxvalue(size(s))}{sqrt(mean(mean(MSE))}$$

8. Calculate entropy of an image:

$$E = -\sum_{i=0}^{N-1} (xi) logp(xi)$$

Where E: Entropy N: highest value of gray level p(xi): prospect of rate of xi Entropy is a calculation of uncertainty or turmoil of an object in this condition the dissimilar image between the filtered andthe noise free images.

9. Calculate the time of image.

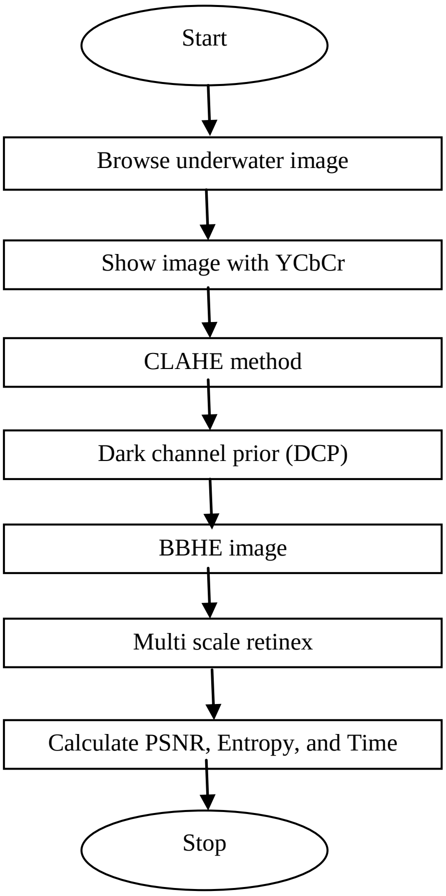

Fig. 1. Flow diagram of proposed methodology

Fig. 2.

IV. RESULT SIMULATION

The implementation result is performed on underwater images. It takes low contrast underwater color images for evaluation. It estimates the value of PSNR, execution time and Entropy using below formulas. The algorithm is designed on MATLABR14 using Image Processing toolbox. In this implementation, this algorithm is compared with three different algorithms. As we seen in experimental result.

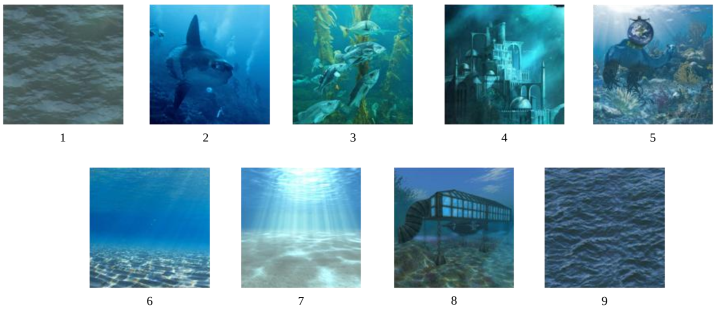

Fig. 3. Dataset of Underwater image

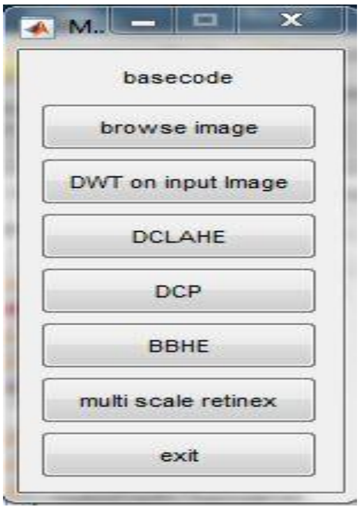

Fig. 4. In this menu bar there are 6 step

Fig. 5. Browse an underwater image from dataset

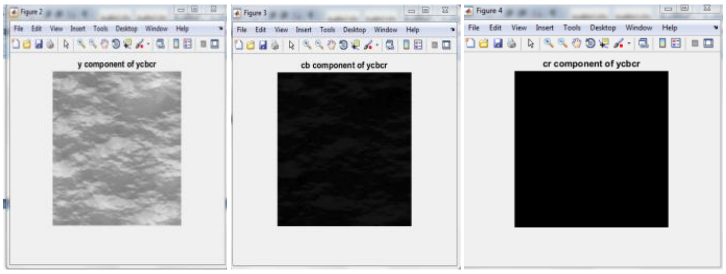

Fig. 6. Show image for YCbCr component

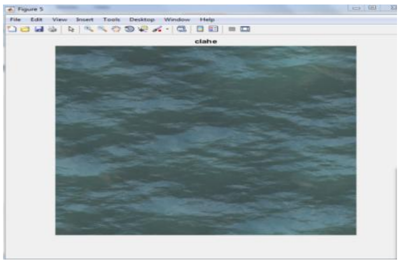

Fig. 7. Apply CLAHE technique

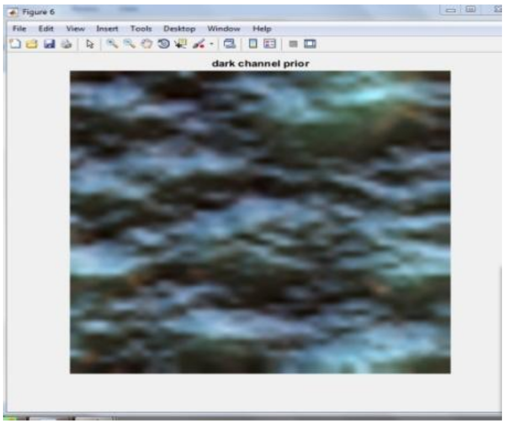

Fig. 7 Apply DARK CHANNEL PRIOR

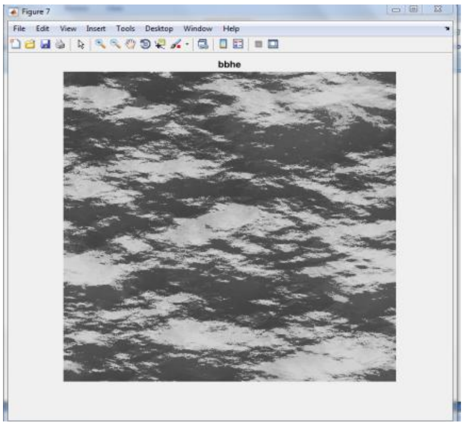

Fig. 8 Apply BBHE

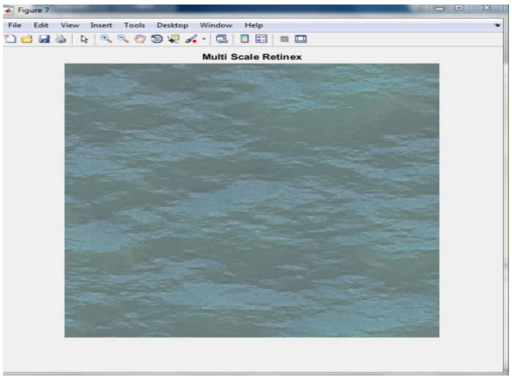

Fig.9 Apply MULTI SCALE RETINEX

TABLE I. RESULTS FOR IMAGE 1.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	8.4967	0	0.9285
DCP	8.4395	7.3491	10.2800
BBHE	13.8558	5.5517	0.8930
MSR	32.8583	5.9479	3.2799

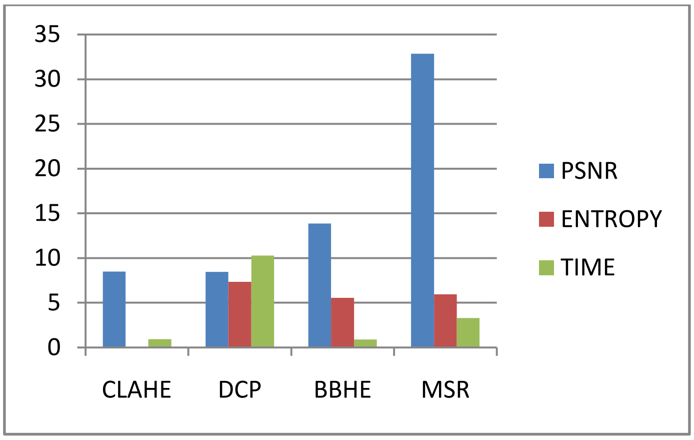

Fig. 10 Graph.1. comparison on Base techniques and propose technique using image 1.

TABLE II. RESULTS FOR IMAGE 2.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

TABLE III.

Methods	PSNR	ENTROPY	TIME
CLAHE	6.3277	0.7175	0.9384
DCP	6.3075	7.1402	10.4027
BBHE	23.7610	7.0890	0.7146
MSR	31.3780	70.1766	3.3327

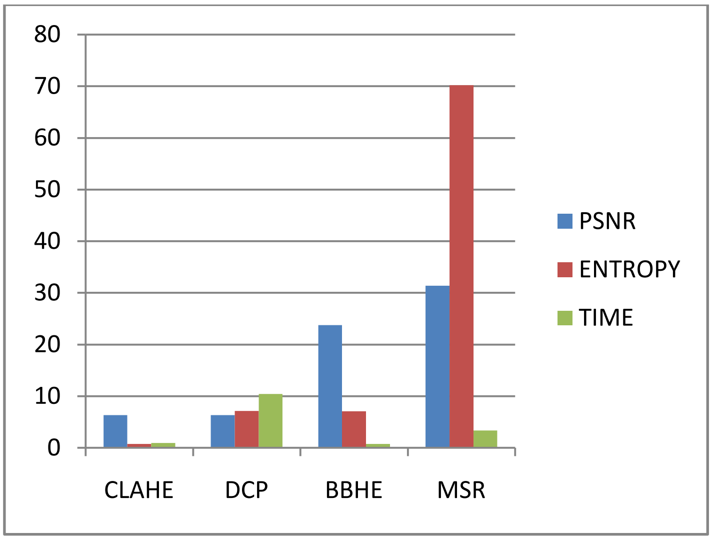

Fig11 Graph.2. comparison on Base techniques and propose technique using image 2.

TABLE IV. RESULTS FOR IMAGE 3.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	PSNR	ENTROPY	TIME
CLAHE	7.2865	0.6705	0.9328
DCP	7.2536	7.5417	10.4294
BBHE	15.8087	6.8063	0.8234
MSR	30.2590	7.5090	3.3185

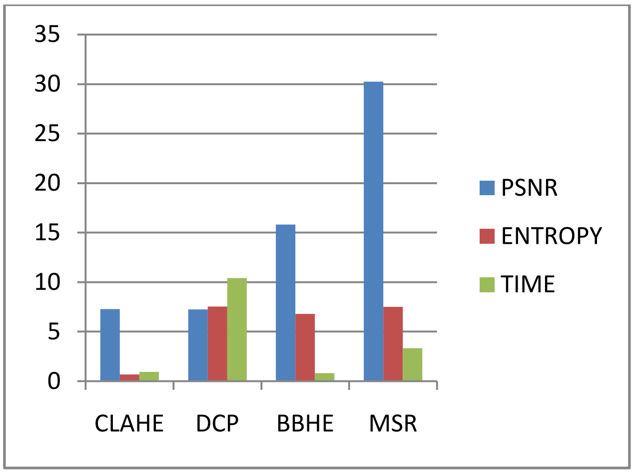

Fig.12. Graph.3. comparison on Base techniques and propose technique using image 3.

TABLE V. RESULTS FOR IMAGE 4.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	PSNR	ENTROPY	TIME
CLAHE	7.3772	0.3105	0.9482
DCP	7.3413	7.4151	10.4304
BBHE	18.6219	7.1933	0.8220
MSR	30.7755	7.3635	3.3931

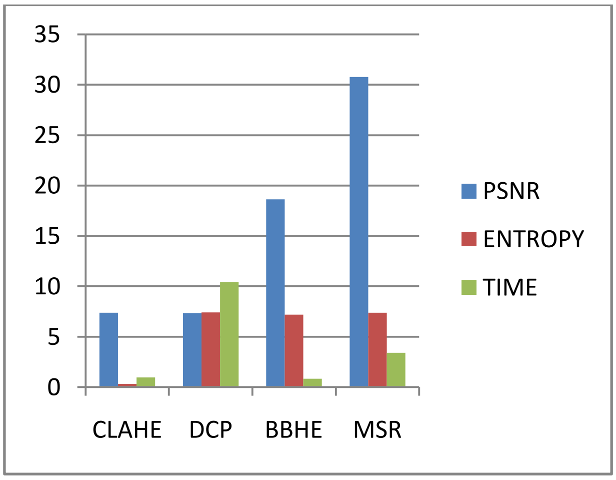

Fig.13. Graph.4. comparison on Base techniques and propose technique using image 4.

TABLE VI. RESULTS FOR IMAGE 5.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	15.8603	0.0404	0.9288
DCP	5.8301	7.7584	10.2477
BBHE	17.2912	6.8273	0.7532
MSR	30.2516	7.2161	3.3656

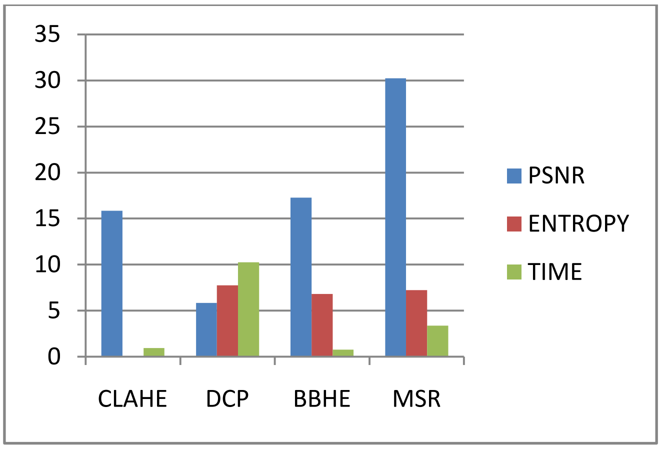

Fig.14. Graph.5 comparison on Base techniques and propose technique using image 5.

TABLE VII. RESULTS FOR IMAGE 6.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	5.9978	0.6642	0.9920
DCP	5.9781	7.1211	10.1945
BBHE	12.4383	5.6574	0.7426
MSR	30.0231	7.0947	3.4149

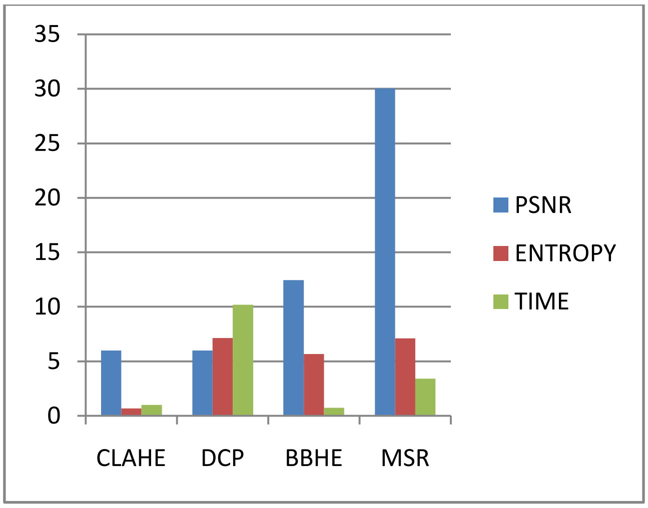

Fig.15. Graph.6 comparison on Base techniques and propose technique using image 6

TABLE VIII. RESULTS FOR IMAGE 7.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	2.8126	0	0.9419
DCP	2.7932	7.6137	10.1956
BBHE	9.9925	4.0680	0.8452
MSR	31.1529	5.2995	3.3886

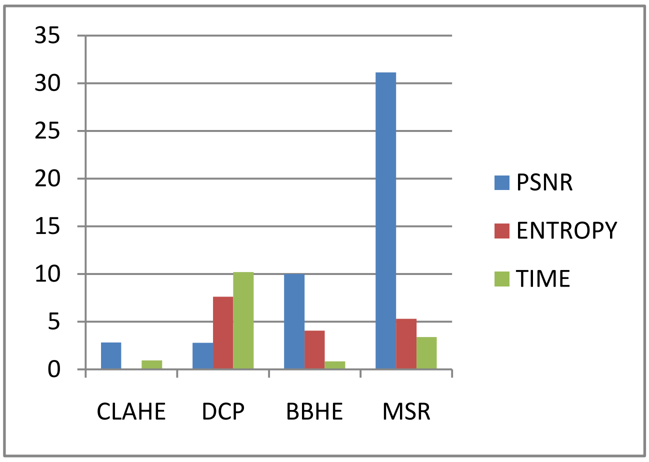

Fig. 16 Graph.7.comparison on Base techniques and propose technique using image 7.

TABLE IX. RESULTS FOR IMAGE 8.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	8.5923	0.180	0.9507
DCP	8.5395	7.1976	10.1422
BBHE	18.4553	6.3314	0.7176
MSR	31.4401	7.1702	3.4414

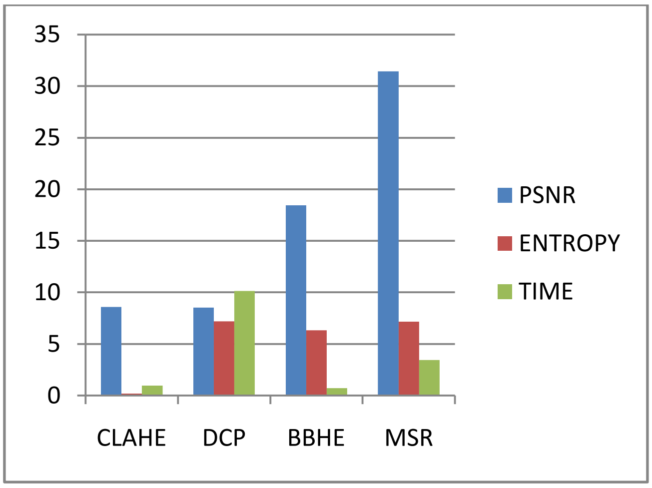

Fig. 17. Graph.8 comparison on Base techniques and propose technique using image 8

TABLE X. RESULTS FOR IMAGE 8.JPG COMPARISON ON BASE TECHNIQUES AND PROPOSE TECHNIQUE

Methods	**PSNR**	**ENTROPY**	**TIME**
CLAHE	9.3834	0	0.9433
DCP	9.3273	7.4049	10.3022
BBHE	16.1829	6.0361	0.8516
MSR	32.1479	6.7643	3.4722

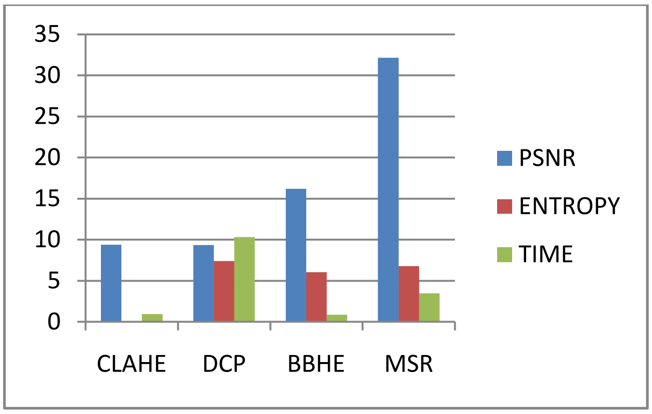

Fig.18. Graph.9 comparison on Base techniques and propose technique using image 9.

Conclusion

In this work, the proposed technique presents that underwater image enhancement using DCP. The experimental results demonstrate superior haze removing and color balancing capabilities of the DCP algorithm over traditional dehazing and color methods. However, the salinity and the amount of suspended particles in ocean water vary with time, location, and season, making accurate measurement of the rate of light energy loss is difficult. The dark channel prior is based on the statistics of the underwater images. Applying the prior into the haze imaging model, haze can be effectively removed. Though, haze can be removed effectively in this paper, color change distortion still exist in the underwater image. Wavelength compensation of enhancement technique to be used for color change distortion in future.

In future we have planned to work for more number of image characteristics for object recognition and to work in real time application.

Moreover the study of underwater acoustic communication can be studied under dynamic environment and determination of the carrier frequency for the same can be done and after that broadcast bandwidth can be defined.

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