Novel Approach of Underwater Image Enhancement by Convolution Base Grey Wolf Optimization with Total Variation

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Abstract- The sole of the proposed work is image enhancement approach which enhanced the Grey Wolf Optimization algorithm by finding color cast using Total Variation method and then removing the color cast by optimizing the correction method using Grey wolf optimization (GWO). The quality of underwater images is improved by using proposed approach which finds the intensity of color cast instead of assuming it. Computed results have enhanced visual details, contrast and color performance. In experiment five different images are used and show the results on two parameters PSNR which represent the quality of image and MSE represents the difference between original and enhanced image. These parameters compare on total variation method (existing) Total variation with grey wolf optimization (GWO).

Keywords- gwo, optimization, totalvaration

I. INTRODUCTION

Image Enhancement is the process of enhancing image quality underwater by de-noising. Underwater images are categorized by their poor visibility due to the light attenuation inside the water, which results in images with low brightness and low contrast Therefore, processing of such images is needed to improve the quality and to retrieve the information. Major work has been done in Image Color Correction and Image Enhancement to improve the quality of image.

Underwater imaging is done to explore the underwater image environment. These images are used for microscopic detection, mine detection, telecommunication cables, and underwater vehicles. These images are disrupted by noise, color distortion and scattering of light which causes blurness and greenish tone. Underwater image enhancement is divided into two methods that are image dehazing and image color restoration. This paper presented a detailed survey of the approaches and methods that used in underwater image enhancement and summary on underwater image processing methods [1].

Underwater image restoration is done on image blurriness and light absorption. In this paper, the author proposed depth estimation method for this work. Images are restored and enhanced by using Image Formation Model. It also estimates the maximum intensity of prior and dark channel prior. The depth of underwater scenes is estimated accurately by this method [2].

Visibility restoration is a process which belongs to reduce of removes the deterioration or degradation of images that have occurred due to relative camera motion, mis-focus of camera and atmospheric condition etc. In this part we are discussing on degradation occurred due to bad weather and in Haze weather conditions. Degradation in images also occurred due to scattering of light before reaching the camera due to large amount of suspended particles present in the water. This thing affects the monitoring system and smart transportation system. Scattering is occurred due to basic phenomena like attenuation and air light. Removal of Haze of fog from the image improves the robustness and stability of the visual system. It is a difficult task because fog depends upon unknown scene depth map information. Fog effect is the result of distance between camera and object. Hence removal of fog requires the estimation of airlight map or depth map. The current haze removal method can be divided into two categories: (a) image enhancement and (b) image restoration.

II. LITERATURE REVIEW

Image segmentation of underwater images is done in this paper by using co-saliency and local statistical active contour model. Co-saliency is detected by using cluster-based algorithm; it highlights the silent region of the image. Segmentation of the image is done by using region-based level set method. The proposed method of segmentation provides efficiency and quality of underwater images [3].Introduced a technique for contrast and visibility improvement in underwater images. Basically it is an integrated approach of enhanced background filtering and wavelet fusion methods. This approach minimizes the negative effects of color cast and low cast. It also improves the visibility and contrast of the image. It provides an effective way for detection and recognition process. Before removing the low frequency background image is sharpened it minimizes the noise from the image. Histograms are mapped to reduce the gap between inferior and dominant color channels after this wavelet fusion is applied. The result of the proposed is more effective and improves the image quality

[4]. In this paper, the author works on the contrast enhancement for underwater images in maritime border protection. This type of method is used to capture the unlawful materials. It is mainly used to detect the capsized boat in the water. This method reduces the color cast and enhances the image contrast. The computation consumption is low in the proposed method. It provides high throughput and effective frame rate [5]. In this paper, the author proposed relative global histogram stretching for water image enhancement approach. This approach consists of two parts that are color correction and contrast correction. In contrast correction method RGB color space is used and redistributes each RGB channel histogram. These dynamic parameters are related to intensity distribution of original image and wavelength attenuation of different color underwater. To reduce the noise from the image bi-lateral filtering is used and enhances the local information of shallow water image [6].In this paper, the author proposed a novel underwater image restoration method which is based on prior called adaptive attenuation-curve prior. This prior is based on the statistical distribution of pixel value. Pixels of the image are divided into clusters in RGB space. Power function is used to assign value to each cluster. Saturated constraints are used to reduce the noise and adjust three color channels [7].Underwater image restoration is done by using attenuation identification. In this work light propagation model is used as the transmission model. The proposed method is called as maximum attenuation identification. This method is used for deriving depth map from the degraded underwater images. This experiment is performed on three groups of images that are natural underwater scene, calibration model and color map model [8].The author demonstrated single-scale fusion which is used to merge the images. This method reduces the MSF only at single level and MSF is used at minimal loss of information. Underwater image enhancement is divided into two methods that are image dehazing and image color restoration. This paper presented a detailed survey of the approaches and methods that used in underwater image enhancement and summary on underwater image processing methods [9]. Introduced a hybrid approach DWT-DCLAHE method is used to enhance the low contrast underwater images. In this work DWT is applied on the RGB image on LL band. Then apply the DCLAHE on the luminance part of LL band. After this process convert the YCBCR to RGB format. DWT is used to merge the modified band. The result of the approach is applied to peak signal noise ratio (PSNR), entropy and time execution. This algorithm is compared with existing algorithm and it performs better [10].The author proposed image enhancement by using dark channel prior and luminous adjustment. Color distortion in images occurred due to absorption degrees changes according to light wavelength. The result of the paper shows the improved global contrast and better image preservation [11].

III. PROPOSED METHODOLOGY

In this section, the author describes the proposed methodology and its flow chart. In this work Images are changed into grey scale first and then find effective block. After this mix block is mixed with blurred image and then send this for optimization. If search is optimized properly then compute the total variation. Analyze the PSNR, MSE and Quality.

Grey Wolf Optimization: It is a meta-heuristic algorithm which simulates the leadership hierarchy and hunting behavior of wolves. The fitness of the wolves measured in the form of alpha, beta and delta. Grey wolves have the ability of memorizing the prey position and encircling them. The alpha as a leader performs in the hunt. For simulating the grey wolves hunting behavior in the mathematical model, assuming the alpha (α) is the best solution. The second optimal solution is beta (β) and the third optimal solution is delta (δ). Omega (ω) is assumed to be the candidate solutions. Alpha, beta and delta guides the hunting while position should be updated by the omega wolves by these three best solutions considerations.

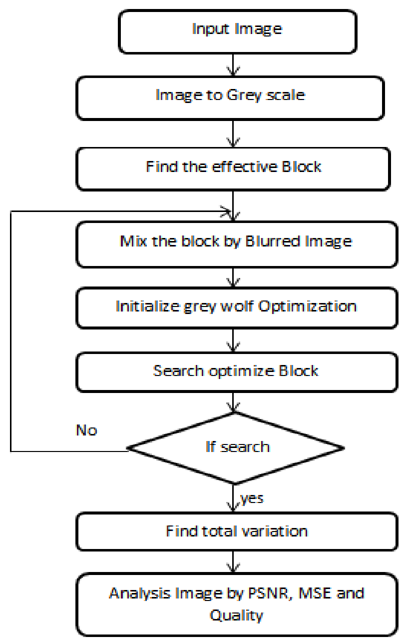

Fig.1 Flow Chart of Proposed Methodology

Methodology

Step 1: Input the Image.
Step 2: Convert Image to grey scale image.
Step 3: Find the effective block from the image.
Step 4: Mix the block with blurred image.
Step 5: Initialize Grey wolf Optimization algorithm.
Step 6: Search the optimized block.

Step 7: Check the search is optimized or not if optimized the go to step 8 otherwise go to step 4.
Step 8: Calculate the total variation.
Step 9: Analyze the PSNR and MSE of the Image.

IV. RESULTS

Table 1.1 Previous Results

Images	PSNR	MSE
Fish Image	30.13	25.23
Swimmer Image	40.23	22.34
Image 3	22.23	30.13
Image 4	20.64	33.67
Image 5	6.28	50.23

Above given Table 1.1 contains the values of PSNR (Peak Signal to Noise Ratio) and MSE (Mean Squared Error) of five images that are Fish Image, Swimmer Image, Image 3, Image 4 and Image 5.

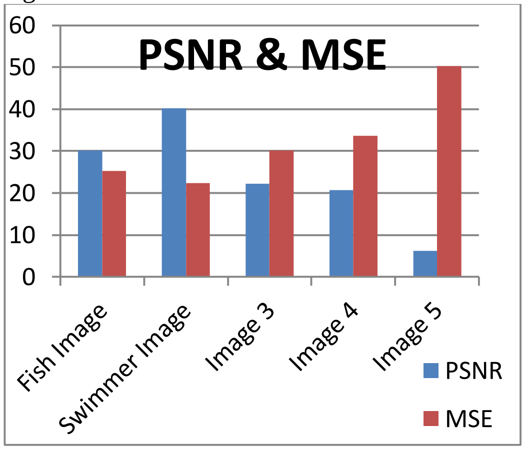

Fig.2: PSNR and MSE of 5 Images

Figure 2 represents the PSNR and MSE of the proposed and existing method s. The figure shows the results on the five images and that are Fish Image, Swimmer Image, Image 3, Image 4 and Image 5. Blue Line represents the PSNR of the images and Red line represents the MSE of the images.

Table 1.2 Proposed Results with Grey wolf Optimization

Images	PSNR	MSE
Fish Image	35.62	27.13
Swimmer Image	51.23	20.23
Image 3	26.13	21.23
Image 4	18.64	30.16
Image 5	15.24	42.13

Above given Table 1.2 contains the values of PSNR (Peak Signal to Noise Ratio) and MSE (Mean Squared Error) of five images that are Fish Image, Swimmer Image, Image 3, Image 4 and Image 5.

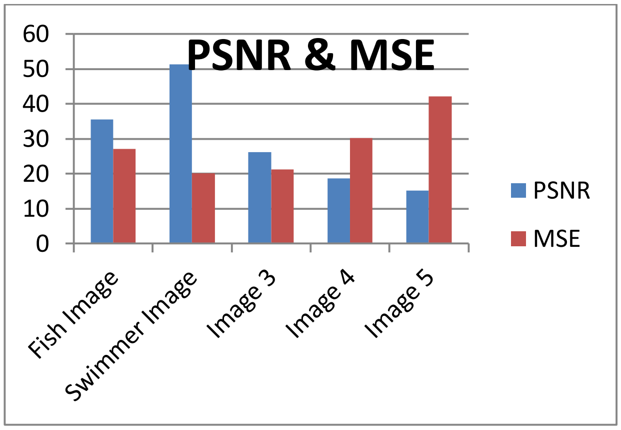

Fig.3: PSNR and MSE of 5 Images on proposed method

Figure 3 represents the PSNR and MSE of the proposed and existing method s. The figure shows the results on the five images and that are Fish Image, Swimmer Image, Image 3, Image 4 and Image 5. Blue Line represents the PSNR of the images and Red line represents the MSE of the images.

V. CONCLUSION

Underwater images suffered from the problem of bad visibility and color cast in the deep water. Color diminished appearance is also a challenging task in underwater imaging. In the latest researches color correction in images are also done by assuming the bluish color cast images. The poor visibility of the underwater images is due to light attenuation. Light attenuation results in poor contrasted and hazy images. It limits the visibility distance at about twenty meters in clear water and five meters or less in turbid water. Attenuation of light is caused by absorption which removes the light energy and scattering. Scattering and absorption is the two factors which affects the most on underwater imaging system. Image features are blurred because of forward scattering in which light is randomly deviated from object to the camera. Backward scattering is the process in which light is reflected by the water toward the camera and before it reaches the object in the scene it reduces the contrast of the image.

VI. REFERENCES

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