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Underwater Image Enhancement Using NPEA

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***Abstract*: Light scattering (LS) & color change are 2 major issues in underwater images (UI). Because of LS, incident light gets reflected & deflected various times via particles visible in the water. This degrades visibility & contrast of UI. A novel multi-scale fusion (MSF) technique for single image dehazing has also been proposed to create further nature visual revival result. Though, naturalness is necessary for image enhancement (IE) to attain pleasing perceptual quality. In this paper, we have used NPEA to improve the contrast of the image.**

***Keywords*: Underwater image enhancement, Multiscale fusion, NPEA propose work, white balancing, Luminance Weight map, chromatic Weight map, saliency Weight map.**

1. Introduction

IE recover visibility of one phase or section of the picture. It refers to the sharpening of picture features like boundaries, or contrast to have a graphic exhibit. Mostly helpful for demonstrating & investigation. This procedure will not amplify the intrinsic data of the picture. IE utilizes qualitative subjective demand to generate an additional visually pleasing picture. Acquiring a clear picture in underwater (UW) surroundings is a vital problem in ocean engineering. UI has an essential function in a technical task like monitoring sea life and evaluate geological or biological surroundings. Capturing picture UW is demanding, generally because of haze reason via light that is reflected via surface and is deflected and scattered via water element. Light scattering and color change (LS and CC) consequence in contrast loss and color deviation in picture obtains UW. Haze is foundation via suspended element like sand, minerals, oceans and rivers. As light reflected via objects propagates headed for the camera, sections of light assemble this suspended element. In nonexistence of blackbody radiation, multi-scattering procedure. As an example, it is presented in Fig. 1.

LS & CC can be accurate via contrast enhancement & image dehazing (ID) method. The ID is basically an under-constrained issue. The common standard of resolve alike issues is consequently to investigate further priors or constraints [1].

Further, this paper is structured as follow. Section II shows various techniques and descriptions of the proposed system, Section III illustrate literature survey of the previous scheme, Section IV presents propose work and Section V presents experiment result analysis and conclusions of the study are shown in section VII.

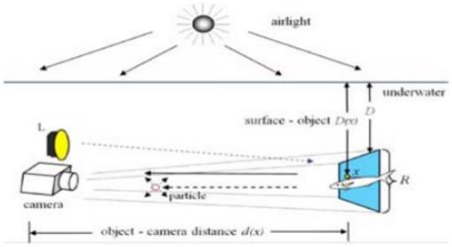

Fig. 1. Natural light enters from air to a UW scene point

2. Using Techniques

In this paper we have used these techniques which are described below:

A. Multiscale fusion

To progress enhanced visual property, the latest MSF technique is engaged to recover picture quality. For the latest MSF technique in the gradient domain, subsequent to have picture via gradient domain, few pixels may have intensity ideals outside the standard range of luminance module. Because of the reason that is fused gradient is via merging numerous picture gradients & consequence, maximum differences among neighboring gradient values exist, perhaps foremost to the reconstructed picture with a maximum dynamic range of pixel intensities. Linear mapping of pixel intensities of reconstructed luminance channel can be done like resultant intensities lie within the essential range [2].

B. NPEA

A naturalness preserved enhancement algorithm (NPEA) for non-uniform lighting pictures. Consequently, in sort to improve facts with NP, the proposed algorithm intends to recover local variation of picture & conserve global trend of intensity at a similar time. The lightness-order-error (LOE) calculates for NP is projected to evaluate improved pictures. LOE calculate, that execute well in accordance with objective evaluation on NP. Consequently, physics position of sight, here 2 methods are constraints. The 1st detail constraint, that reflectance may bind to proper range via considering the property of reflectance. The 2nd is NP constraint, that relative sort of lighting in diverse local locations ought not to be altered considerably [3].

C. White balancing

The algorithms & method utilized to achieve color constancy in imaging scheme have ordinary aim to render white objects as white beneath some light source & are usually referred to as gray balance or white balance (WB) method. The linear models of WB correction function on 2 color channels and therefore additional diminish computational complication of system. Additionally, this technique of WB correction does not initiate some important alter in picture brightness as a green channel, that supply mainly to the perception of brightness, is left unaltered. WB presentation of the planned system has been validating on the position of pathological pictures. WB correction parameters are intended as per necessities of linear alteration reproduction utilized via WB correction phase [4].

D. Luminance Weight map (LWM)

The LWM utilizes normalized luminance matrix to advance WM of atmospheric air light (AAL). Subsequent to refining pixel-wise irregular LWM via a guided filter, with an adaptive post-processing system it alters a variety of LWM matrix to hold dense hazy images (DHI). In investigational consequences & proportional investigations exhibit that our physically-based algorithm can get obvious and maximum contrast haze-free images (HFI), even for DHI. In this paper, easy and effectual LWM for single picture dehazing. This prior remuneration much from the observation that AAL only closely relates to the luminance channel of HSV HFI [5].

E. Chromatic Weight map (CWM)

The absorption of colors having a huge wavelength guide to failure of colors in the picture. So, restoration of colors is making certain via utilizing CWM. As color is the property of saturation, utilized CWM that process on raising saturation of color balanced & contrast enhanced pictures [6].

F. Saliency Weight map (SWM)

Firstly, here it points out restrictions of current SWM IQA technique in considering saliency features (SF) from reference pictures. As pictures inspection process is classically executed on the distorted picture in the actual world, SF via distorted picture may discover. Combat probable overlapping belongings among ordinary SF amid real and distorted pictures, nonlinear additive techniques are utilized in combining SM via actual and distorted pictures. With our linear/nonlinear additive techniques considered SM, it directly weights local distortion map and then concluding objective picture quality scores can be calculated [7].

3. Literature Survey

Changli Li et. al. [2018] A new underwater picture restore algorithm considered on enhanced background light (EBL) estimation & automatic WB (AWB) is accessible to concluded efficiency of preceding algorithm for underwater picture restore. The improved method of estimating EBL can diminish the impact of light & white substance in water and EBL precision. AWB algorithm can decrease color distortion & obtain an obvious picture with restored picture color correction [8].

Xin Sun et. al. [2017] In the area of machine vision and IE is a significant subject. Because of the turbid water medium, the complex underwater environment presents a major challenge to machine vision. Serious scattering and absorption complicate the noise distribution of the underwater pictures. In this article, a model for improving underwater images based on profound CNN networks of encoding-decoding. We use the layers of convolution to encode while layers of deconvolution to decode [9].

Cheolkon Jung et. al. [2017] In this document, we suggest tone mapping in pictures considered on perceptual quantization (PQ) preserved by naturalness. PQ is transferred occupation considered in contrast sensitive feature (CSF) of Barten that reflects the human visual perception of luminance and we embrace it to produce a restriction curve for perceptual contrast improvement. Experimental findings show that the suggested technique improves contrast in pictures while maintaining naturalness successfully [10].

Gür Emre Güraksin et. al. [2016] Underwater pictures have bad contrast and resolution because of absorption & dispersion of light in the UW setting. The scenario usually leads to a color that has become more dominant than the others. It has, therefore, become a challenging job to analyze underwater pictures efficiently and to identify any object underwater. In this article, an underwater improvement method was suggested using the algorithm of differential evolution [11].

Amjad Khan et. al. [2016] Mainly UW pictures comprise a layer of haze that is created in turbid water by suspended particles that generate dispersion and light absorption. Absorption restrictions visibility owing to light attenuation picture characteristics, eventually, UW pictures captured alike medium by the camera are hazy & degraded evaluate to ordinary pictures in use. In this article, propose wavelet-based fusion technique to improve & dehumidify UW corroded pipeline pictures. [12]

Yujie Li et. al. [2015] This article discusses the fresh method of improving optical shallow ocean pictures or videos using a pre-descatter technique of quick dark channels. Absorption, dispersion, & color distortion are 3 main underwater imaging distortion concern. Fresh shallow water imaging system to compensate for attenuation discrepancy beside propagation path & efficient UW prospect enhancement system. [13]

4. Proposed Work

A. Problem statement

1. In negative weather conditions, images have less capacity when image fusion is performed using a single sensor fusion method.
2. It's not readily noticeable at night because of camera elements, whether it's in the daytime or at night.
3. More energy from the source is needed for the better.

4. The worst output will be given due to rain or fog visualization if one clicks the two source pictures in this form of weather circumstances.
5. There are enormous chances of information loss in this process.
6. It requires to be properly maintained.
7. When pictures are merged, data processing is very slow.

B. Propose methodology

In our suggested job to maintain naturalness while improving information, an improved algorithm for preserving naturalness is suggested to evaluate improved pictures, first of all, measure for preserving naturalness can be implemented. Secondly, decompose the picture in the spectrum that ensures that the reflection is limited. Third, the illumination process, that the details of enlightenment will not flood owing to spatial variation as preserving categorize of lightness. After improvement, the image's ambiance should not be significantly altered, no light source brought into the scene, no halo effect should be added and no blocking effect.

C. Proposed Algorithm

1. Browse original image from the dataset.
2. Use white balancing to get enhance image we get two outputs.
3. Apply luminance, chromatic and saliency weight map on the first input image.
4. Again apply a weight map to the second input.
5. Normalize all inputs of the weight map.
6. Get a new image by multi-scale fusion.
7. Use NPEA to improve the contrast of the image.

D. Flow chart

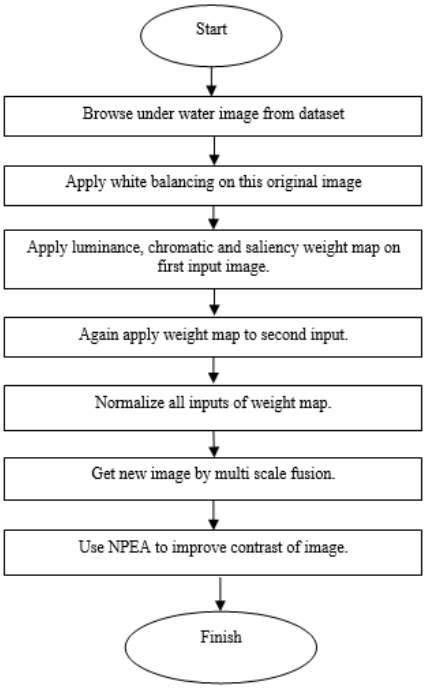

Fig. 2. Flow chart of proposed work

5. Experiment Result Analysis

In our experiment first, we take an image from dataset then in the original image we apply a White balancing image. We use several images and in first input image apply luminance, chromatic and saliency weight map, so we have now two inputs for two images. Apply to normalize WM on mutually input and we get the new image by MSF as dehazed image. In our proposed work, we use NPEA to improve the contrast of the image.

The experimental analysis uses underwater image enhancement pictures for performance evaluation. To quantitatively compare the outcomes of the above techniques, we use UCIQE and the patch-based contrast quality index (PCQI) to assess the contrast differences. The algorithm is intended with the Image Processing toolbox on MATLABR17. This algorithm is contrasted with various algorithms in this application. As we saw in an experimental result that output of all the above-mentioned techniques is compared on the basis of their corresponding UCIQE and PCQI values and the following table shows the output.

First, we run this code and obtained this type of menu bar:

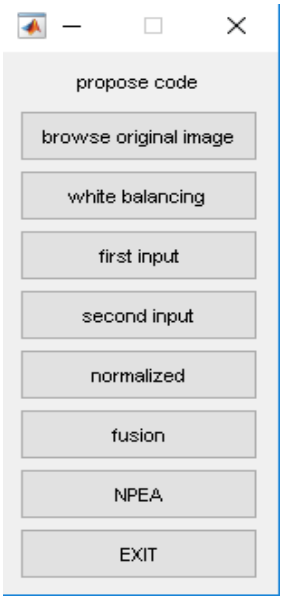

Fig. 3. In this menu bar, there are 8 steps

Fig. 4. First, we browse image from the dataset

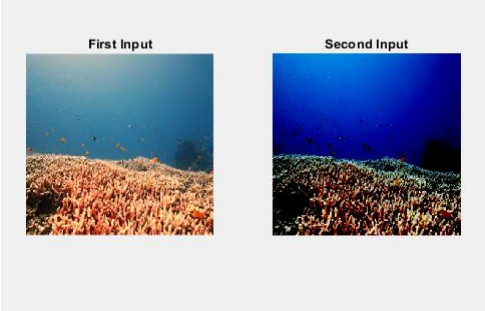

Fig. 5. White balancing image of this original image

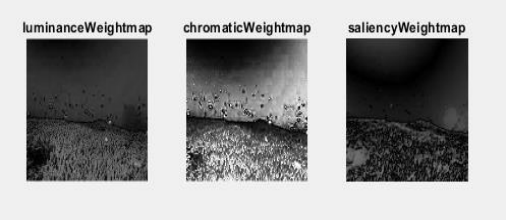

Fig. 6. Result for the first input

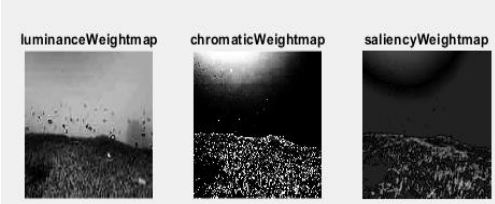

Fig. 7. Result for the second input

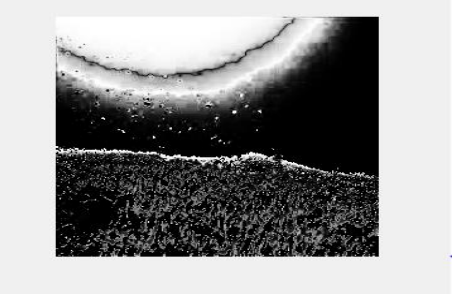

Fig. 8. Normalized weighted map

Fig. 9. Dehazed image

Fig. 10. NPEA

Table 1
Comparison of Base and Propose UCIQE

Image name	Base (UCIQE)	Propose (UCIQE)
1.jpg	1.2946	3.6302

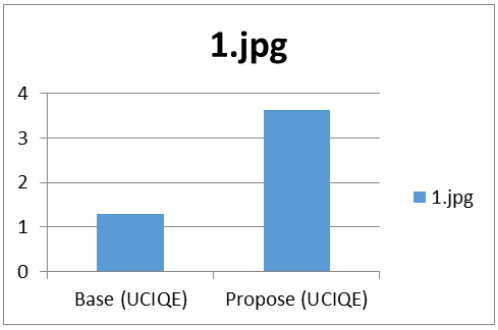

Fig. 11. Graphcomparison of Base and Propose UCIQE

Table 2
Comparison of Base and Propose PCQI

Image name	Base (PCQI)	Propose(PCQI)
1.jpg	0.9924	0.9919

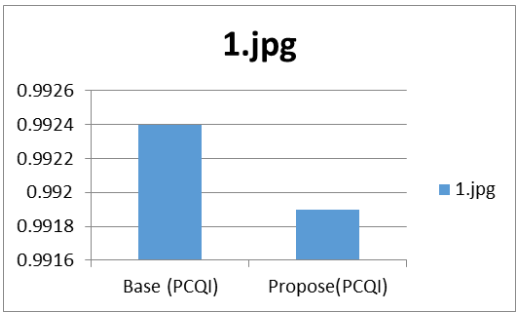

Fig. 12. Graphcomparison of Base and Propose PCQI

6. Conclusion

In marine research, underwater imaging plays a significant role. Underwater pictures are distinct from popular ones due to the unique physical characteristics of underwater settings such as complex noise distribution, severe scattering, and absorption. In underwater, owing to light absorption & radiation, visibility is small. UW pictures have fewer contrasts and resolutions as a consequence of these issues. In this paper, we proposed an underwater IE model considered using NPEA to improve the

contrast of the image.

Naturalist maintained improvement for non-uniform pictures of enlightenment that only improve picture information but also maintains naturalness. A new multi-scale image fusion technique has been suggested to mix dehazing pictures acquired by the distinct worldwide atmospheric light and enhance the visual effects of underwater picture restoration. Our method shows good performance in underwater image enhancement.

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