UNDERWATER IMAGE ENHANCEMENT

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ABSTRACT

The underwater optical images are commonly captured by camera but with different statistical features to natural images. Due to the refraction and scattering of light in different water types, the colours and shapes of objects can be twisted that are incapable of providing acceptable visual qualities. Thus, it is imperative to develop algorithms to enhance underwater images. Underwater images have mainly characterized by poor visibility and colour degradation, due to the harsh and complex underwater environment. These adverse effects limit many practical applications of underwater images and videos in marine biology, archaeology, and ecological exploration.

The main objective of our project is to recover the quality that has been degraded due to scatters and amalgamation within underwater environment. To improve the underwater navigation, The action of underwater depends on the clarity of underwater image and video. For the monitoring of underwater cables line and oil pipes. The underwater optical images are usually captured by camera however with completely different statistical options to natural images. because of the refraction and scattering of light in several water types, the colours and shapes of objects are often twisted that are incapable of providing acceptable visual qualities. Thus, it is imperative to develop algorithms to boost underwater images. Besides, the standard analysis of underwater pictures is additionally exploited as a criteria of underwater image improvement.

In the past decade, the connected problems have attracted extended attention. This paper presents a comprehensive review of the related techniques and their most up-to-date achievements. above all, we observe a huge trend of applying deep learning in underwater image process in a very tiny volume of knowledge. we have a tendency to hope our review may benefit each the beginners and also the consultants of this area for locating appealing and difficult analysis topics.

I. INTRODUCTION

The oceans occupy a large space in terms of the initial size of earth, and contain strange creatures and huge resources, which need to be explored and investigated. Underwater images play essential roles in exploring and protective the underwater world. With the booming development of vision technology and network instrumentation, underwater vision-related topics are attracting abundant attention due to their vital significance would like in several areas of marine.

However, the quality of an underwater raw image is sometimes insufficient for more. Underwater images have principally characterised by poor visibility and color degradation, because of the tough and complex underwater atmosphere. as an example, compared to blue and green light, the wavelengths of red and orange light are absorbed by the water rather more quickly. Thus, underwater pictures usually seem in a very blue-green tone. These adverse effects limit several useful applications of underwater images and videos in marine biology, archaeology, and ecological exploration. Thus, rising underwater image visibility is that the foremost task before processing it through high-level vision algorithms.

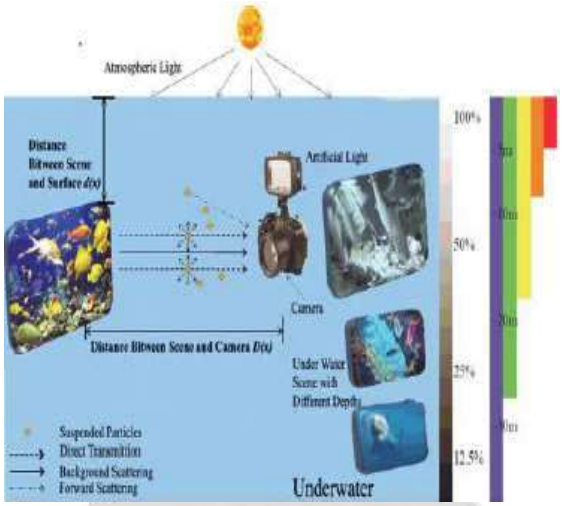


Figure. 1.1 The underwater image model changed with depth.

This brings appreciable attention to subjective tests based on the human observer's analysis, and objective models supported the algorithms estimation. In digital image process, there are several image improvement techniques are accessible, as an example, adaptive adaptive equalization, distinction restricted (CLAHE), and fusion based method. However, these aren't applicable to underwater image process, as a result of these ways are inappropriate for a physical model of underwater. Thus, several researchers have planned many various techniques for the underwater image improvement and quality analysis. The underwater image model changed with depth. To improve the visual quality of underwater image, few objective quality measurements are well-accepted to possess a high correlation with subjective opinions. as an example, a method was planned to live the sharpness of underwater image supported the weighted grey-scale angle (GSA), when it's been rotten by ripple rework. A method victimization the load data capability supported a cooccurrence matrix of a distinct direction so as to analyse the performance variance in step with the various parameters for any underwater moveable was planned. In distinction, the underwater pictures realize to differ and adjusted with a depth of water and lightweight propagation. The modification within the underwater image supported the depth of water and light absorbed. In this paper, we tend to provide a general read of a number of the foremost recent ways applied in underwater image improvement and quality analysis. we tend to conjointly want to supply students with some techniques that higher suits his downside or application.

II. RELATED WORK

The research of [1] for underwater image enhancement, A method is proposed to exploit image blurriness to measure the scene depth instead of using DCP. Combining image blurriness with IFM, we presented pleasing enhanced images. The depth estimation based on blurriness is shown to work well for a wide variety of images. The experimental results show that the proposed method can produce better enhanced underwater images in different lighting conditions compared to other IFM based enhancement methods.

The research of [2] a replacement image enhancement technique that uses Discrete wave remodel and K-L remodel was planned for low resolution underwater acoustic pictures. The planned technique decomposes the acoustic image into sub bands by DWT and enhances the LL sub band by K-L rework. The other sub bands were additionally interpolated and other with the difference image. The distinction image was obtained by subtracting the improved LL sub band with the initial LL component. the improved image was reconstructed by applying the IDWT by the measured sub bands. the standard of the image was compared over the SVD technique and the GHE techniques.

The research of [3] the hazy underwater pictures are enhanced in term of color and contrast by wavelet-based fusion approach. The qualitative results depict that the planned method has increased the standard of the hazy underwater pictures. The measure shows the standard of the image is additionally maintained. In future, a comprehensive comparative study can be performed on state of the art ways for quantitative analysis with the projected technique.

The research of [4] they've focused on the underwater image enhancement strategy with virtual retina model and image quality assessment. The virtual retina model has accomplished the image improvement by rising the

contrast of details and recovering the item colours whereas reducing the low abstraction frequency parts of scenes. After this, we've got explored an adaptive image improvement methodology supported the IQA. The performance of the planned methodology was compared with those of the traditional image enhancement strategies with respect to the recently defined performance assessment. Simulation experiments have shown that the present approach in this paper clearly and naturally handles satisfactorily the underwater image quality degradation.

The research of [5] tend to propose an effective and efficient two-step image improvement procedure for single underwater pictures. Focusing on the two major issues of underwater images color shift and low contrast. The projected methodology addresses these issues one by one. First, an efficient color correcting strategy supported linear transformation is introduced to deal with color distortion. Then, a unique optimum contrast method is planned to boost contrast in the meantime will reduce artifacts. Experimental results show that the methodology will generate promising results whereas comparison well with alternative methods. in addition, process times are given to indicate our methodology is appropriate for time period applications.

III. PROPOSED SYSTEM

In this segment, we will revaluate the recent approaches of aquatic image improvement. These approaches are classified into two groups, spatial domain approaches, and deep learning-based styles. The spatial- domain techniques have achieved productive development in the field of image improvement, and it has been adapted to overcome the downgrade of the aquatic image. A technique is a proposed system based on slide starching, which first uses the contrast stretching to balance the contrast in images also, saturation and intensity are applied for stretching of HIS (Hue, Saturation, Intensity) color space to increase the color.

In order to avoid the reduced contrast and non-uniform of color cast, the unsupervised color correction system has been proposed. At the start of balancing, the system applied to reduce the colorcast by starches red histogram to the right to increase the red and starches blue histogram to the left to drop the blue. A binary-image Rayleigh- stretched CLAHE system is proposed, which not only enhances the image contrast but also the image details by considering global and original contrast correction. The algorithm proposed makes better the contrast and brightness of aquatic images with minimal information loss and histogram distribution previous. The spatial- domain is mature and simple to apply. These kinds of approaches can be directly applied to aquatic images, which help to makes better the contrast. Since the color cast has not been completely considered and the noise cannot be suppressed well, by being achievements antiques and noise still present in the enhanced image.

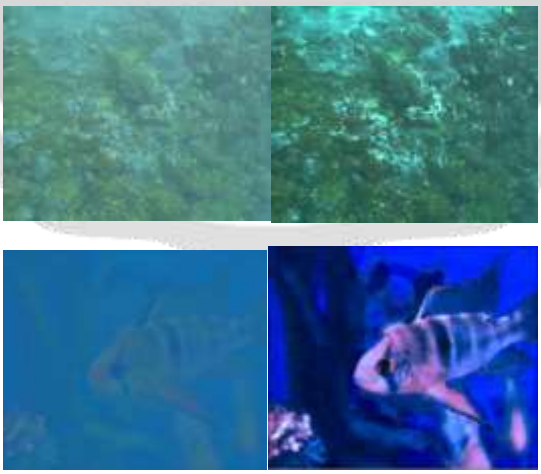


Figure. 3.1 Image enhancement performance of an example underwater image with high fuzzy degree.

Deep learning- based approaches have been used for image improvement based on the idea that secret features may be learned for quality improvement by using Convolutional Neural Network (CNN). The approach proposes a CNN- based underwater image improvement model, which trains an end- to- end conversion model between the hazed images and corresponding clear images. We must synthesize ten different marine image databases, also a CNN- based image enhancement model is employed to train the dataset and induce a clear aquatic image.

The performance was validated on the result and real aquatic image. A domain- inimical learning- based aquatic image improvement, can handle multiple types of aquatic images and induce clear images by learning domain agnostic features. likewise, the synthesized dataset cannot be a volition to the real data. The emulsion-based aquatic image improvement system uses the CNN for aquatic image improvement.

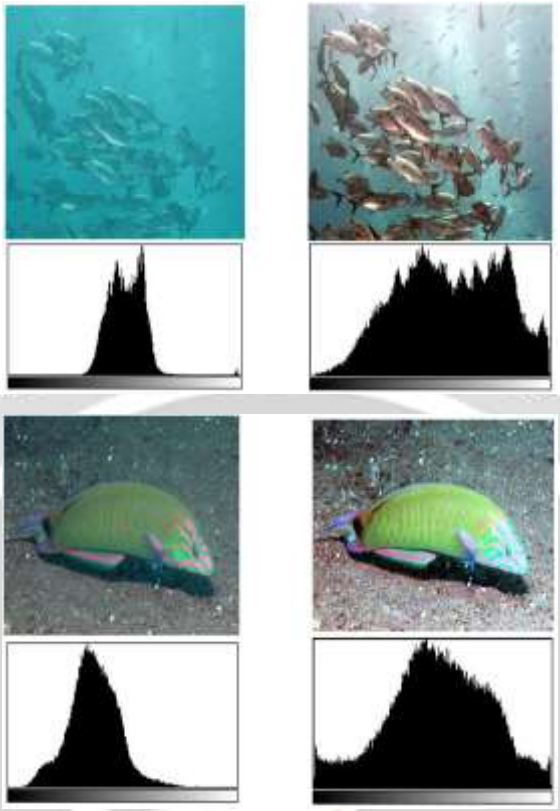
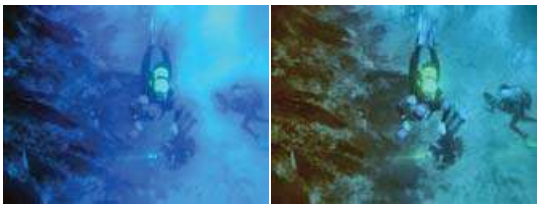


Figure. 3.2 Histogram of Results Before and After Enhancement

The authors constructed a large- scale and real-world aquatic image improvement Standard dataset. In addition, they proposed a completely connect CNN based on the constructed data. Despite the great work devoted to the deep learning- based image improvement, the performance of drawing methods calculates heavily on both network architecture and training data. Due to the use of synthetic aquatic images and the implicit drawbacks of deep- learning infrastructures, these models may only suit to some limited types of aquatic images. Traditional metrics for evaluating the quality of underwater images are irreplaceable due to the harsh underwater environment. The metrics can be divided into two categories: subjective evaluation and objective evaluation.

The underwater color image evaluation metric (UCIQE) which aims at false color underwater images. Three different enhancement methods are firstly applied in an underwater image selected from a real underwater image dataset. Then two quantitative evaluation methods named UIQM and UCIQE are employed to evaluate the results of enhanced images. The average quality score of each enhanced image.



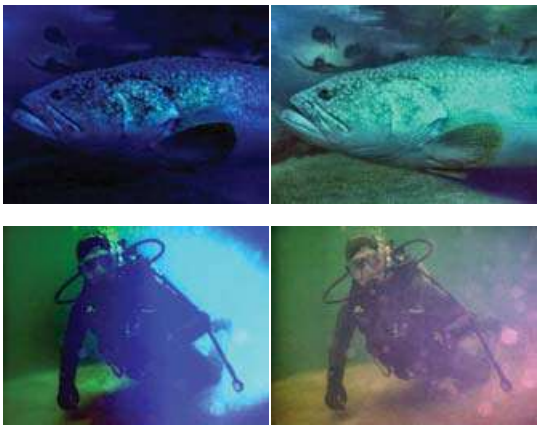


Figure. 3.5 Comparison of existing and proposed method.

Based on our proposed system we have a block diagram for the methodology We must synthesize ten different marine image databases, also a CNN- based image enhancement model is employed to train the dataset and induce a clear aquatic image. Then two quantitative evaluation methods named UIQM and UCIQE are employed to evaluate the results of enhanced images. The average quality score of each enhanced image.

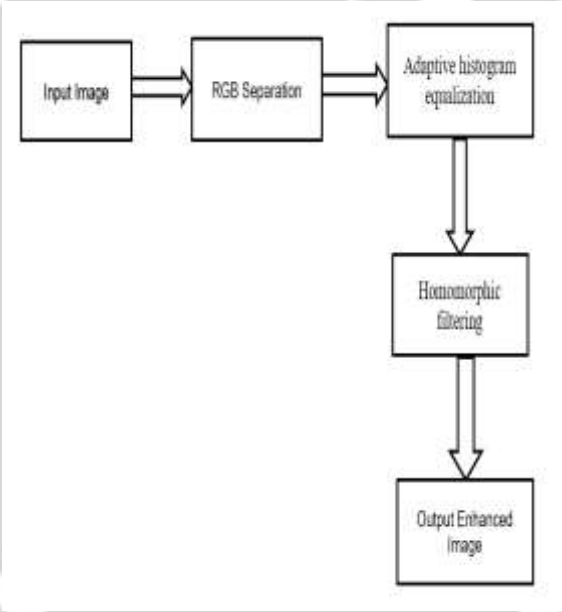


Figure. 3.6 Proposed block diagram

IV. RESULT AND DISCUSSION

The hazy underwater images have beenenhanced in term of color and contrast using CNN approach. The qualitative results depict that the proposed method has enhanced the quality of the hazy underwater images. The quantitative analysis shows the quality of the image is also maintained.

The subjective evaluation is indispensable as a benchmark, it is still time consuming and hard to be embedded into practical applications. Therefore, objective evaluation tends to be more accepted and reliable. Unlike classical metrics based on the pristine reference information, such as mean squared error (MSE) and peak signal-to-noise ratio (PSNR), the underwater image quality measure (UIQM) has been presented which can evaluate the quality of underwater images according to the following attribution: colourfulness, sharpness, and contrast.

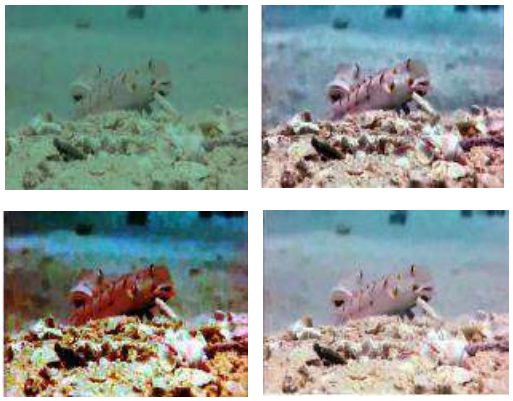


Figure. 3.4 Comparison of the underwater image enhancement methods.

V. CONCLUSION

The advancement and quantity evaluation approaches for aquatic images are new exploration fields that have great potential to help developers better to explore the aquatic terrain. In this paper, we primarily introduce the study advances related to both image enhancement and quality assessment of the aquatic images. We've also briefed the advantages and disadvantages of existing achievements material to the forenamed subjects. Eventually, a comprehensive performance comparison for aquatic images quality evaluation methods have presented.

VI. REFERENCES

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[3] Amjad Khan, Syed Saad Azhar Ali, Aamir Saeed Malik, Atif Anwer and Fabrice Meriaudeau Center for Intelligent Signal and Imaging Research (CISIR) Department of Electrical and Electronic Engineering Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia.

[4] Yaomin Wang, Ruijie Chang, RuiNian, Bo He1 , Xunfei Liu, Jen-Hwa Guo School of Information Science and Engineering No. 238 Songling Road Ocean University of China.

[5] Xueyang Fu, Zhiwen Fan, Mei Ling, Yue Huang, Xinghao Ding School of Information Science and Engineering, Xiamen University, China.