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# Underwater Image Enhancement using Python

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**Abstract:** *Since light is selectively attenuated and scattered as it passes through water, underwater imaging is severely affected. Such impairments restrict visual tasks and diminish image quality. There are several enhancing methods available to increase the quality of an underwater photograph. However, the majority of techniques cause distortion in the final photographs. The four-step suggested natural-based underwater picture colour enhancement (NUCE) approach is described below. The first phase presents a novel method for removing the underwater color cast. Gain factors, which are determined by taking into account the variations between the superior and inferior hue channels, are used to enhance the inferior color channels. The dual-intensity image fusion based on the average of mean and median values is offered in the second stage to create lower-stretched and upper-stretched histograms. The combination of these histograms considerably increases image contrast. Next, the swarm-intelligence-based mean equalization is suggested to enhance the output image's naturalness. The mean values of inferior colour channels are modified to be near to the mean value of superior colour channel by combining swarm intelligence algorithms. Finally, the unsharp masking method is used to sharpen the entire image. Experiments on underwater photographs recorded under varying settings show that the suggested NUCE approach offers improved output image quality while considerably outperforming existing state-of-the-art methods.*

**Keywords:** NUCE, Histogram, Swarm Intelligence

## I. INTRODUCTION

The advancement of marine research is becoming more reliant on underwater photographs taken mostly by autonomous underwater vehicles and remotely controlled underwater vehicles. However, underwater photos are difficult to analyze due to light absorption and scattering processes, which yield degraded underwater images, such as low contrast and false colours. A few significant parameters that influence the attenuation rate have been found, including water temperature and salinity, as well as the kind and number of floating particles present in the water. Furthermore, item colors are critical for underwater jobs and investigations. Serious degeneration makes it harder to extract information from an image. As a result, finding a way to recover the real color of an underwater photograph is a difficult undertaking. Underwater picture-enhancing techniques have been proposed to overcome these issues, according to reports. However, in some circumstances, existing approaches fail to properly address such issues, particularly when photos are acquired far beneath the bottom. As a result, it is critical for researchers to devise an effective technique for addressing the aforementioned issues. This research introduces a novel technique to enhance underwater pictures titled natural-based underwater image color enhancement (NUCE). The ones that follow are the primary contributions to be highlighted in this study. The proposed NUCE method reduces the underwater color cast by enhancing the inferior color channels based on gain factors. These gain factors are calculated by considering the differences between superior and inferior color channels.

To enhance the picture contrast, the suggested approach performs dual-intensity image fusion based on an average of mean and median values. To create lower-stretched and upper-stretched histograms, the average point is found and picked as the point of separation..

The swarm-intelligence-based mean histogram equalization is proposed in the third phase to increase the naturalness of the output image. The mean values of inferior color channels are changed to be near the mean value of outstanding color channels by the combination of the swarm's intelligence algorithm..

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## II. REVIEW OF LITERATURE

Underwater image enhancement via integrated RGB and LAB color models May 2022

Images taken underwater suffers from color shift and poor visibility because the light is absorbed and scattered when it travels through water. To handle the issues mentioned above, we propose an underwater image enhancement method via integrated RGB and LAB color models (RLCM). In the RGB color model, we first fully consider the leading causes of underwater image color shift, and then the poor color channels are corrected by dedicated fractions, which are designed via calculating the differences between the well and poor color channels

Color correction and adaptive contrast enhancement for underwater image enhancement May 2021

To address the color cast and low contrast of underwater photos, we offer a color correction and adaptive contrast enhancement method for underwater image improvement. In our work, we first develop the specific fractions for compensating the lower color channels, which are computed by taking the ratio of the differences between the upper and lower color channels into account.

## III. METHODOLOGY

*The* Four steps strategy followed in NUCE method:

1. Superior underwater color cast the neutralization technology
2. Based on the average of mean and median values, dual-intensity photos were combined.
3. Median equalisation based on swarm intelligence
4. Applying unsharp masking

Flowchart

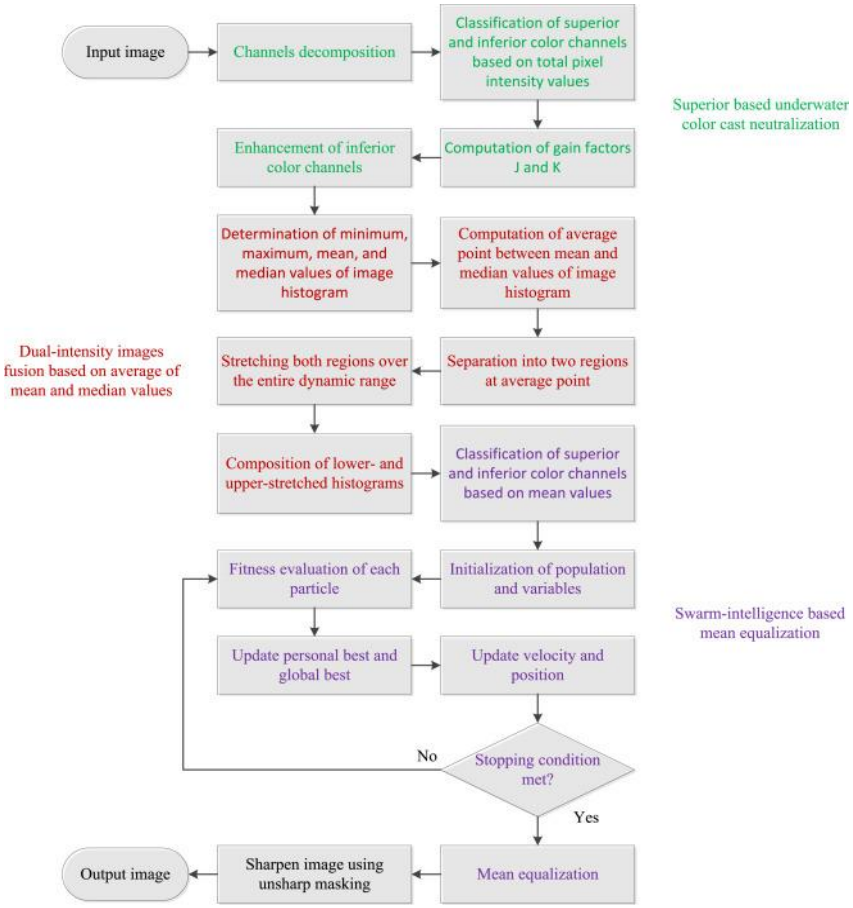


Fig 1. Flowchart of the system

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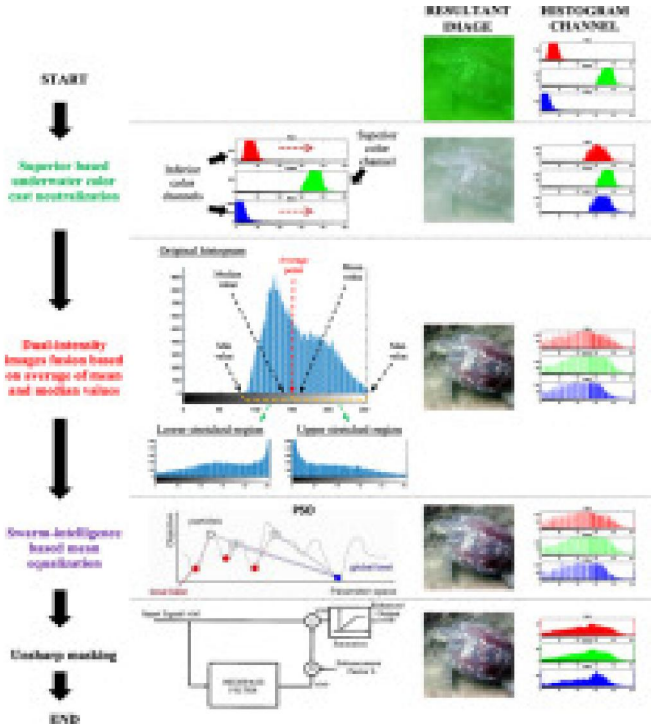


Fig 2. Graphical abstract

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## IV. RESULT

The proposed NUCE method is evaluated in comparison to several state-of-the-art methods, including grey world (GW), an integrated color model (ICM), unsupervised color correction method (UCM), dual-intensity images and Rayleigh-stretching (DIRS), integrated-intensity stretched-Rayleigh (IISR), recursive adaptive histogram modification (RAHIM), relative global histogram stretching (RGHS), and underwater light attenuation prior (ULAP).

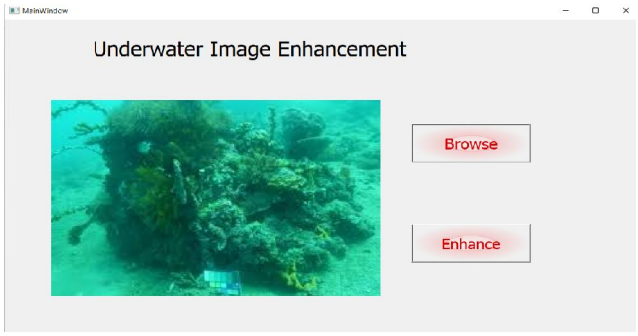


Fig 3. Input image

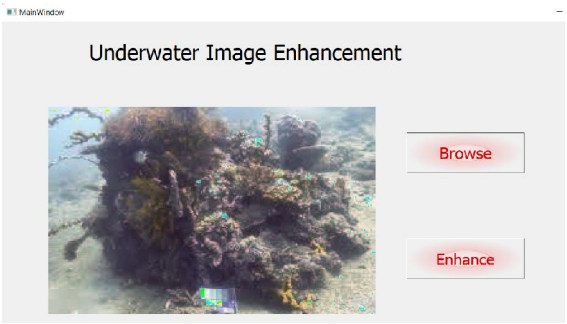


Fig 4. Output image

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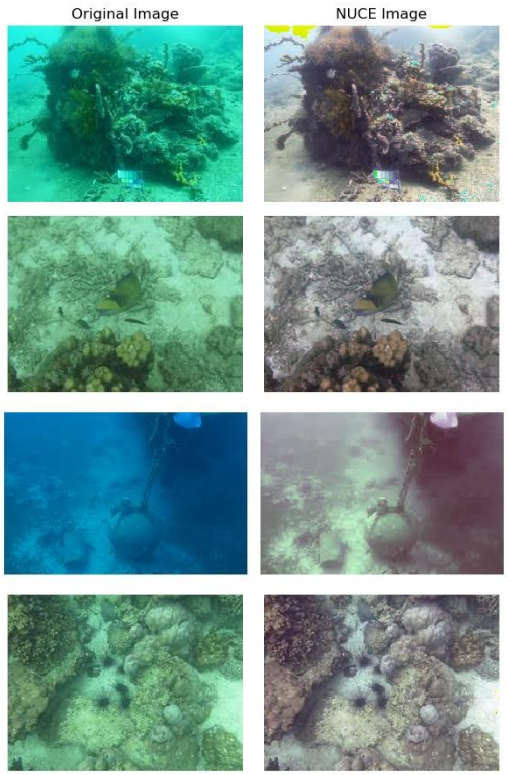


## V. CONCLUSION

In this research, the suggested NUCE approach is effectively used to improve the quality of underwater photographs. Motivated by natural landscape images, the suggested solution incorporates four basic phases, including a swarm-intelligence algorithm to equalise the mean values of all colour channel histograms. As demonstrated by the findings, the suggested technology is capable of enhancing diverse underwater sceneries with great visibility while also considerably reducing underwater color cast.

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