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Study on Underwater Image Processing Techniques

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Abstract: *Image processing is extensively used to improve the quality of photos with scattering and poor contrast. Image processing is used in many fields of computer vision, including underwater image processing. It is necessary to process underwater photographs in order to improve the poor image quality caused by light scattering and refraction. As depth deepens, different colors are absorbed by the adjacent medium specific wavelengths. This research describes an effective approach for enhancing underwater photographs that have been deteriorated owing to medium absorption and scattering. Image processing has been used to develop certain approaches for improving the quality of underwater photographs. This study also discusses some of the algorithms for enhancing the quality and resolution of photographs. Using an edge detection robustness criterion performance of filtering will be evaluated and also the color correction.*

Keywords: Image quality, filtering, underwater image enhancement, contrast

I. INTRODUCTION

Underwater photography is widely used to observemarine resources and to observe the underwater infrastructure. Now a day underwater image processing has very vast importance in computer vision. The images captured underwater are suffered from so many disturbances. Scattering, refraction of light, and absorption are three major underwater image impairments, and these impairments are responsible for low brightness, low contrast, and introduction of noise. As the light travels deep into the water, the intensity of light gets poor, and so that the image gets affected by poor visibility and contrast.

Visible red light contains considerably greater energy over invisible infrared radiation and is much more quickly absorbed by water than some other visible wavelengths, according to research. When it reaches the depth of the water level, it exhibits the impact of light color. At 20 meters, it reflects the color of the substances in the water, making redfish seem nearly black. Longer wavelength light that is absorbed more rapidly than short wavelength light. Higher-energy light having short - wavelength, like blue, can dive deeper as a result. Figure 1 represents the effect on light in deep water level.

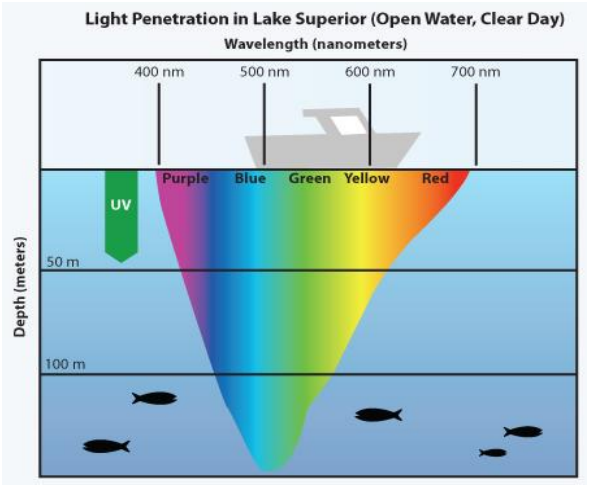

Figure 1. Effect of light color in deep water level.

With the advancement of image processing technology, the quality of underwater images is being improved. Picture enhancement improves image quality while also helping to improve the overall appearance of the image. There are so

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many algorithms are proposed and implemented on underwater image processing. Image processing is mainly introduced in two ways is Image enhancement and Image restoration technique.

Throughout the image restoration process, the image enhancement approach increases the information quantity and quality of the original data, as well as the noisy and fuzzy image. Marine biology can benefit greatly from underwater picture processing. The focus of this research is on several picture enhancing approaches in underwater image processing.

II. LITERATURE SURVEY

There are so many algorithms and techniques in underwater image processing to enhance underwater image quality. Some methods are used to strengthen underwater images, such as the white balance method, color correction algorithms, and contrast enhancement [1]. Underwater images are affected mainly by non-uniform lighting, so some processes correct the non-uniform lightening effect [2]. As the seawater level's depth increases, the underwater light attenuation leads to unusual color change, depending on the organic compound dissolved in water and on the wavelength [3].

As they move further into the sea, the underwater sights usually become blue and greenish. As the light intensity drops, underwater photographs are subjected to issues such as noise, distortion, poor contrast, and low visibility. Some algorithms aid in the restoration of color, information loss, and difference [4, 5]. Image enhancing technologies are divided into two categories: spatial domain and frequency domain. All image enhancing procedures in the frequency domain approach are done on the Fourier transform. The image's Fourier transform is computed first, followed by the inverse Fourier transform of the resulting picture. The pixel values of pictures are operated in the spatial domain manner [6].

Some of the image processing methods utilized for underwater picture improvement include white balance, color correction, and contrast enhancement [7].The contrast enhancement approach involves histogram equalization [8]. This approach is based on color correction and is based on the retinex model underwater image improvement method; this process applies a different strategy to strengthen the reflection and lighting components of the underwater picture [9], and the results are integrated. A color correction approach is created based on the automated color equalization model [10]. Unsupervised color correction approach underwater picture improvement based on color equalization and contrast correction is suggested [11], which includes Histogram equalization. For underwater pictures, color casting is created by the various absorption capacity for different wavelengths; the backward reflecting effect reduces the contrast in images. The picture characteristics are often blurred as a result of the forward scattering phenomenon [12].

After a distance of 4-5meters, the clarity of underwater pictures rapidly declines as the depth of the water will increase. Researchers have created a variety of hardware platforms including cameras [13, 14], which are currently being used in a variety of industries. The majority of the approaches suggest modifying grayscale picture quality measures, while a few apply by transforming a color image to a grayscale image [15] or combining the measure values with various weights by assessing the quality in each color component separately[16]. The fundamental purpose of image processing is to minimize noise and improve quality [17]. a noise removal method based on a standard median filter has been proposed. A new technique provided a revolutionary denoising method and increasing nearly uniform illumination homomorphic filtering to reduce the additive noise found in underwater pictures [18]. The laser imaging modality is among the most modern imaging technologies for processing underwater photographs; it works by picking reflected light out from object.

III. METHODOLOGY

Underwater image processing has many applications, such as underwater archeology, ocean engineering, and underwater photography; therefore, it is necessary to have quality in an underwater scene's photos. The literature survey focuses on underwater imaging enhancement, image analysis , and recent work on machine learning approach [20], as stated by several authors.Generally, the medium of water and the particles which are suspended in the water have some properties like scattering and absorption effect on the light. Because of these, some issues are there, like distortion and low visibility of images underwater.

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One of the methods, which is dependent on local and global level histogram equalization and contrast enhancement techniques, is beneficial for picture improvement. The Retinex-inspired approach is used to choose a picture first. To produce the contrast-enhanced image, several color modifications are made using global equalization of the histogram, followed by local equalization. Then, using a dual image multi-scale fusion approach [21], these two pictures are fused.To evaluate the algorithm results, it is equally important to have some of the underwater image processing datasets. Fish4Knowlege dataset is one of the databases for the detection and recognition of images. SUN is another database for scene recognition and object detection. For autonomous marine robotics,the MARIS dataset is used. In the sea-thru dataset, it contains 1100 underwater images are present [22].

IV. CONCLUDING REMARK

This work providesvarious underwater image processing techniques for image enhancement. All methods have given proper justification for the strategies they are using to improve the image enhancement up to a better level. All the researchers have addressed the issue related to uneven light distribution in the water. Various authors have worked on underwater image processing for enhancing the image quality for the same they have given multiple algorithms. However, still, because of the light effect, we did not get enough accuracy. Work done using local and global equalization of histogram and duel image multi-scale fusion could notachieve consistency in the background color of images taken underwater. Future work will focus on the effect of turbidity in underwater image processing at different levels.

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