Under Water Image Dehazing Using Gaussian Filter and Laplacian Pyramid

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ABSTRACT

This paper proposes a novel single-image approach for enhancing underwater images that suffer from degradation due to medium scattering and absorption. The method does not require specialized hardware or knowledge of underwater conditions or scene structure. It relies on blending two images that are derived from a color-compensated and white-balanced version of the original degraded image. Weight maps are used to promote the transfer of edges and color contrast to the output image, and a multiscale fusion strategy is employed to avoid artifacts in the reconstructed image. Qualitative and quantitative evaluations show that the enhanced images and videos exhibit better exposedness of dark regions, improved global contrast, and edge sharpness. Furthermore, the algorithm is reasonably independent of camera settings and improves the accuracy of several image processing applications, such as segmentation.

Keywords: under water dehazing, image enhancement, color correction, fusion

I. INTRODUCTION

The underwater environment is important for several reasons. It is home to a diverse range of marine life, which plays a crucial role in the ecological balance of our planet. Underwater ecosystems also provide important resources for human beings, such as food, medicine, and minerals. In addition, underwater environments offer many unique attractions for tourism and recreational activities, such as scuba diving and snorkeling.

In addition, underwater research is important for various scientific fields, including marine biology, oceanography, and environmental science. Studying the underwater environment can help us better understand our planet, its history, and its future. It can also help us identify and address environmental problems, such as pollution and climate change, that affect both marine and human life. Finally, the development of technologies and techniques for exploring and working in the underwater environment can have many practical applications, such as offshore oil and gas exploration, underwater construction, and defense operations.

Underwater imaging faces unique challenges due to light attenuation caused by absorption and scattering effects. This results in poor visibility, with distant objects appearing misty and colors appearing faded. Traditional enhancement techniques are limited, and additional challenges such as color casts and backscatter further reduce visibility. Underwater imaging is also complicated by movement, water currents, and specialized equipment and techniques are required to capture clear and detailed images.

This paper introduces a novel approach for removing haze in underwater images using a single, conventionally captured image. The approach involves fusing two inputs: a contrast-corrected version and a sharpened, white-balanced version. The white balancing stage removes color distortion caused by light scattering. The multi-scale fusion process ensures a seamless blending without artifacts, resulting in a more natural-looking image. This method offers an effective solution for enhancing underwater image quality.

II. METHODS AND MATERIAL

A. Color Correction

Color correction is a method used to correct the color distortion in underwater images caused by the scattering of light in water. This distortion can lead to images that appear bluish-green or yellowish. Color correction aims to adjust the color balance of the image to make it appear more natural and accurate.

There are two types of color correction methods: statistical analysis and histogram equalization. Statistical analysis methods use statistical techniques to analyze the color distribution of the image and adjust the color balance accordingly. Histogram equalization methods adjust the histogram of the image to improve the contrast and visibility of the image.

B. Fusion

Fusion is a method used to combine multiple images of the same scene to produce a single image that has improved visibility and clarity. This method can be particularly useful in underwater imaging, where the images can be degraded due to the scattering of light in water. There are two types of fusion methods: image-based fusion and sensor-based fusion. Image-based fusion methods combine multiple images of the same scene that have different exposure settings or perspectives. Sensor-based fusion methods combine optical and acoustic sensors. Fusion methods can be effective in improving the visibility and sharpness of underwater images.

III. LITERATURE SURVEY

Simon Emberton et.al [1] This paper presents a new method for improving the visibility in underwater images and videos by identifying and separating the regions that contain only water, known as pure haze regions. These regions have a color that is similar to the haze that needs to be removed for dehazing. The paper proposes a semantic white balancing approach that uses the dominant color of the water to address the spectral distortion in underwater scenes. To validate the effectiveness of the proposed method, the researchers conducted extensive subjective evaluation tests using images and videos captured in different water types.

Y. Liu, S. Rong, et al[2] The quality of underwater images is often poor due to low visibility caused by absorption and scattering, which creates haze and other limitations. To address these issues, a novel dehaze method is proposed in this paper. The method is based on the observation that most pixels in underwater images tend to distribute nearby a specific plane in RGB space. This observation is called the color space dimensionality reduction prior.

By projecting all pixels to this plane, known as the UV color space, the color distribution can be reduced from the three-dimensional space (RGB space) to a new two-dimensional space (UV space) without causing excessive color shift. By carefully setting the haze-free boundary in UV space, the image transmission can be obtained and an excellent dehazed image can be produced. The results of experiments show that this method is competitive compared to other mainstream underwater single image dehazing methods.

J. Y. Chiang and Y. -C. Chen[3] This paper proposes a new approach to fixing these problems usingg a dehazing algorithm. It estimates the distance between objects and the camera, segments the foreground and background of the image, and checks for the presence of artificial lighting. After compensating for artificial light, it corrects the haze phenomenon and color changes along the underwater propagation path. It then estimates the water depth in the image scene and adjusts color based on the amount of attenuation of each light wavelength.

IV. PROPOSED SYSTEM

Step 1: Input image is taken. Here there are various types of images that are collected and used. The data sets used here are obtained from UIEB, TURBID, and WHOI(Woods Hole Oceanographic Institution).

Step 2: The input image is pre-processed using histogram equalization and contrast stretching. Then, dehazing is performed on the second input image using the dehaze function where the input image is subjected to contrast stretching and then sent to guided filter for haze removal. Here, the haze removal process is fastened by the help of box filter. The first and second input images are then displayed.

Step 3: A weight map is generated for both the histogram equalized image and the contrast stretched image. The luminance and saliency weight maps are calculated for the first (Histogram equalized image) and the second (contrast stretched image after haze removal) input image. The resultant weight maps for both inputs are calculated by adding the luminance and saliency weight maps.

Step 4: The normalized weight maps for both inputs are calculated by dividing the resultant weight maps by the sum of the resultant weight maps. Gaussian pyramids are then generated for the normalized weight maps.

Step 5: Laplacian pyramid decomposition is performed on each color channel of both input images separately. The Laplacian pyramid consists of several levels of high-pass filtered images, each level capturing different scales of detail in the image.

Step 6: The fusion process is then performed by multiplying each level of the Laplacian pyramid of each color channel with the corresponding level of the Gaussian pyramid of the normalized weight map for each input image. The resultant pyramids are then added to obtain the fused pyramid.

Step 7: A fused image is reconstructed by performing pyramid reconstruction on each color channel separately. The reconstructed color channels are then combined to obtain the final fused image.

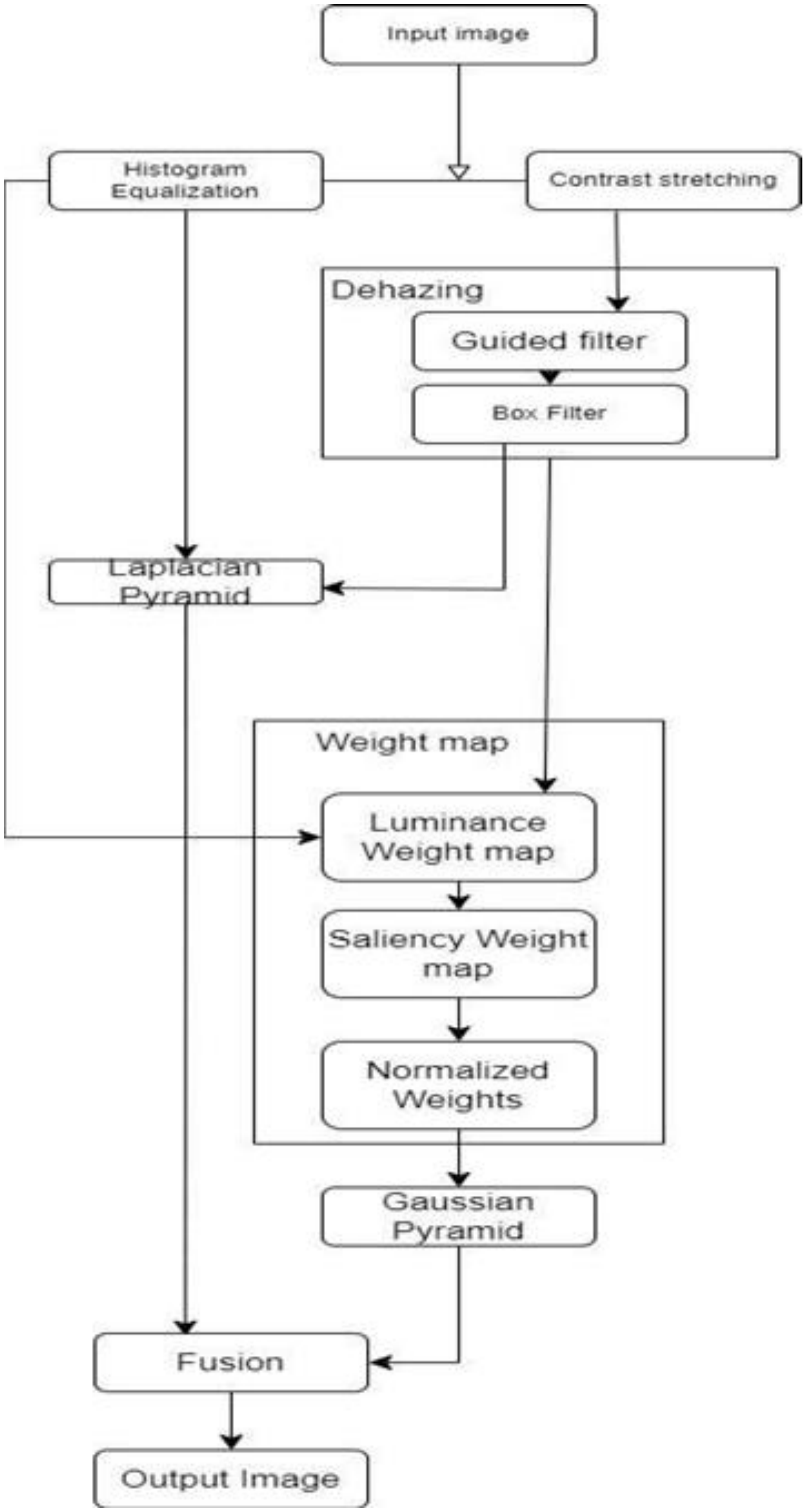
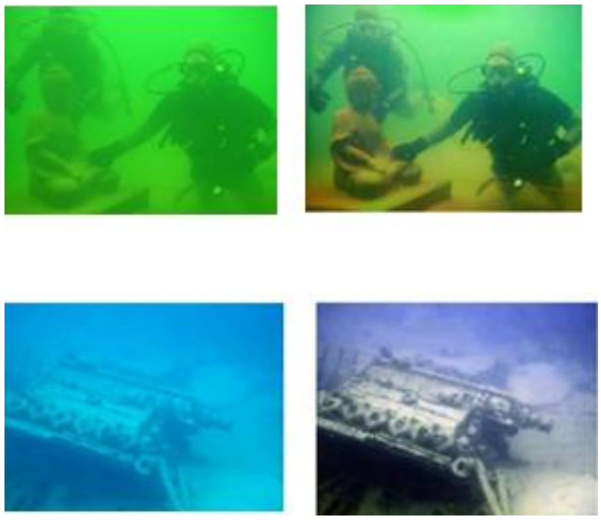


Figure 1:Proposed system

V. RESULTS



Original image Dehazed image

VI. CONCLUSION

It enhances underwater images to correct color distortion caused by attenuated wavelengths, fog, blur and other factors. The image is clearer and can be used by researchers to study about marine world

VII. REFERENCES

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