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A Review on Various Underwater Image Denoising and Enhancement Techniques

Miss. Rutika S. Ingole[1], Prof. C. J. Shelke[2]

M.E. Student, CSE, PRPCET, Amravati, Maharashtra, India[1]

Assistant Professor, IT, PRPCET, Amravati, Maharashtra, India[2]

Abstract: Nowadays, it is difficult for the researchers to remove noise from the original signal as well as to enhance the quality of the image. There have been various algorithms but each approach has its assumption, advantage and limitations. However light scattering and color change problems still exist in the underwater image. Scattering problem is arising due to the large suspended particles, which causes the degradation of the image. Color change occurs because different wavelengths are attenuated to different degrees in water, causing ambient underwater environments to be dominated by a bluish tone. This paper proposes a novel method based on multiscale product thresholding and weber's law in order to denoise and enhance the underwater image quality.

Keywords: Noise, Weber's law, Multiscale product thresholding etc.

I. INTRODUCTION

The quality of underwater image is different with it in the air area. The two main problems which arise in underwater images are light scattering i.e. which changes the direction of light path and color change. Absorption and scattering are the two basic process of light propagation in the water. The process of the light in the water can influence the overall performance of underwater imaging system. The eminence of underwater images plays a crucial role in scientific missions such as monitoring sea life, taking census of populations and assessing geological or biological environments. Capturing the images in underwater is difficult, mostly due to haze caused by light that is reflected from a surface and is deflected and scattered by water particles. Because of varying degrees of attenuation encountered by different wavelengths of light, underwater images always dominated by a bluish tone. Thus the light scattering and color change result in contrast loss and color deviation in images acquired underwater. An image is often corrupted by noise in its acquisition and transmission. Image denoising is used to remove the additive noise while preserving the important signal features and not altering the quality of the processed image. Image enhancement improves the visibility of the image. Light scattering and color change can be corrected by enhancing the contrast and image denoising techniques.

Objectives:

1. To develop a qualitative approach to produce a more visually pleasing image.
2. To simulate a model for underwater image denoising in order to improve the performance.
3. To simulate a model for underwater image enhancement.

II. LITERATURE REVIEW

R. Sathya, M. Bharathi and G. Dhivyasri [1] presented a Dark channel prior method which is used for removing the haze present in the underwater image. This approach is based on local patches in haze-free underwater images contain some pixels which have very low intensities in at least one color channel. By means of this prior with the haze imaging color model estimates the thickness of the haze and recovers a high quality haze free image. This method does not require images with different exposure values. This technique is completely based on the attenuation experienced by point across multiple frames.

LeiFei, Wang Yingying [2] presented a technique for the crisis of underwater image denoising. This method based on adaptive wavelet combining adaptive threshold selection with adaptive threshold selection with adaptive output of the threshold function. In this, first taking into consideration the underwater image with low signal to noise ratio (SNR), contrast imbalance and poor image quality. After this the next step is some pre-processing should be done before wavelet threshold denoising. Then, they adopt adaptive wavelet combining adaptive threshold selection with adaptive output of the threshold function for the image de-noising. Finally the simulation results show that this proposed method not only removes noise effectively, improves image output peak signal-to-noise ratio (PSNR), but also yields superior vision quality and embodies the superiority of wavelet denoising.

Yiwen Liu, Lingling Li, cuihua Li [6] proposes a denoising method based on wavelet threshold and subband enhancement method for image de-noising. This method uses soft threshold method for the minimum scale wavelet coefficients, takes further decomposing for other wavelet coefficient and takes effective enhancement and mixing threshold processing for each subband after being decomposed. Thus making full use of high frequency information of each of the multi-dimension can add image details and get a better enhancement and de-noising effectively.

Huimin Lu, Seiichi Serikawa [9] presents a method for underwater scene enhancement using weighted guided median filter. This method includes include an effective

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underwater scene enhancement scheme and a shallow water imaging model that compensates for the attenuation discrepancy along the propagation path. The improved images are characterized by a reduced noised level, better exposure of the dark regions, and superior global contrast where the finest details and edges are enhanced significantly.

Wan Nural Jawahir Hj Wan Yussof, Muhammad Suzuri Hitam, Ezmahamrul Afreen Awalludin, and Zainuddin Bachok[10] presented a Histogram equalization (HE) method. This method is of contrast adjustment using the images histogram and also works for to enhance a given image. In this method, transformation T is to be considered in such a way that the gray value in the output is equally distributed in [0, 1]. It is also called histogram flattening. Histogram equalization method in which histogram is modified by spreading the gray level areas. When an image's histogram is made equal, all pixel values of the image are redistributed so there are approximately an equal number of pixels to each of the user specified output gray-scale classes e.g., 32, 64, and 256. Contrast is increased at the most populated range of brightness values of the histogram. For very bright or dark parts of the image, it automatically reduces the contrast associated with the ends of a normally distributed histogram. It can also divide pixels into different groups, if few output values are over a wide range. But the difficulty with this method is that it is effective only when the original image has poor contrast to start with, otherwise it may degrade the image quality.

III. PROPOSED WORK

This paper proposed the architecture for to denoise and enhance the underwater image. The image denoising algorithm achieves near optimal soft thresholding in the wavelet domain for recovering original signal from the noisy one. For this, the proposed scheme uses multiscale product thresholding algorithm. Multiscale product thresholding algorithm includes first four steps given below. To achieve an enhancement of the underwater image our proposed scheme uses a method which is based on Weber's law. Weber's law is used to enhance the contrast of an image. This methodology is used to solve an optimization problem that maximizes the average local contrast of an image.

The steps for the image denoising and enhancement are as follows:

1. Perform image pre-processing on the image with noise: In order to achieve better de-noising effect, some pre-processing should be done before wavelet threshold de-nosing. The purpose of pre-processing is to reduce the illumination changes, sharpen the edge details, preserve details and eliminate the noise in the image. It is used to smooth textures and reduce artifact by deleting small image features amplified by filtering.
2. Estimate the noise variance.
3. Compute threshold selection for to denoise the image. So the selection of adaptive wavelet threshold will help to achieve better de-noising effect.
4. Obtain a denoise image.
5. Verify the contrast of an image.
6. Apply Weber's law for image enhancement.

The following figure shows the data flow diagram for the image denoising and enhancement:

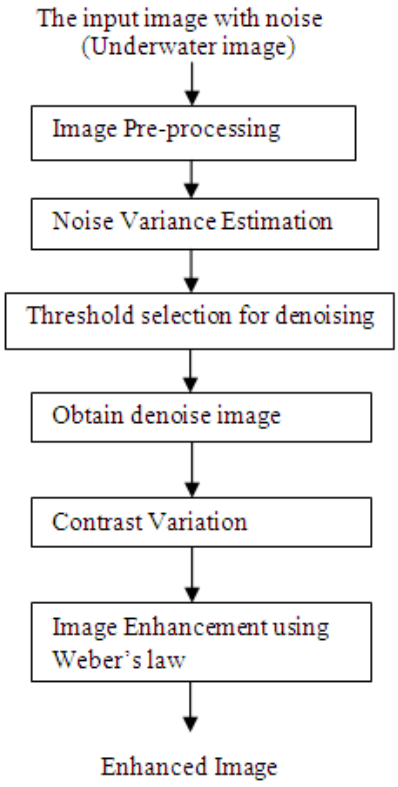

Fig. 1 Data flow diagram for image denoising and enhancement

IV. CONCLUSION

At present, scientists are eager to explore the underwater world. However, the area is still lacking in image processing analysis and methods that could be used to improve the quality of underwater images. Underwater image enhancement techniques provide a way to improve the object identification in underwater environment. There is a lot of research started for the improvement of image quality, but limited work has been done in the area of underwater images.

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