

A Survey on De-noising and Enhancement of Underwater Images

Saket Agrawal, Prof. R.G.Hirulkar, Department of Electronics and Telecommunication Engineering, Prof. Ram Meghe Institute of Technology & Research Badnera, Amravati-444701, Sant Gadge Baba Amravati University.
agrawal.saket8@gmail.com, ravihirulkar@gmail.com

Abstract- Underwater image pre-processing is completely needed due to the quality of images captured under water. Basically, underwater images suffer by quality degradation due to transmission of limited range of light, low contrast and blurred image due to eminence of light and diminishing color. When an underwater image is captured, pre-processing is necessarily done to correct and adjust the image for more study and processing. Different filtering techniques are available for pre-processing of underwater images. For the problem of underwater image de-noising, in this paper we have proposed a new method based on adaptive wavelet combining adaptive threshold selection with adaptive output of the threshold function and enhancement technique. Using peak signal-to-noise ratio (PSNR), removes noise effectively, improves image output and also yields superior quality and embodies the superiority of wavelet de-noising.

Introduction- Underwater instruments are used for remote sensing, as earth is an aquatic planet and as much as 80% of its surface is covered by water. Also, there is a strong interest in knowing what lies in underwater. The optical sensors are used in underwater instruments to capture acoustic signal and signals are then converted into images. The images are disturbed with transmission of limited range of light, disturbance of lightening, low contrast and blurring of image, color diminishing during capturing. The large disturbances change the image equality and they show large temporal and spatial variations. Therefore, the image must be pre-processed earlier operations like

segmentation and feature detection, which are the important processes in image processing. therefore to de-noise an image without affecting the image quality and boundaries in an image, edge preserving filters are used. Currently underwater image collection mainly depends on the video acquisition technology, but under the inspiration of underwater special environment, the collected images have different degrees of distortion, so it is necessary to deal with the collected underwater image. Due to the advantages of its low entropy, multi-resolution characteristics, removing the correlation as well as choosing base flexibility, wavelet de-noising method more and more attracts people's attention. This method conducts data processing in spatial domain, which can be adjusted automatically the output of the threshold function according to the intensity of the input signal.

The paper proposes a de-noising method based on wavelet threshold and subband enhancement technique for image de-noising. This method uses soft threshold method for the minimum scale wavelet coefficients, which takes further decomposing for other wavelet coefficient and takes effective enhancement and by mixing threshold processing for each subband after decomposed. Thus making full use of high frequency information of each multi-dimension can add image details and get a better enhancement de-noising effectively.

Literature Review- Luckily, there have been many different techniques to restore and enhance the underwater images by researches all around the world. Iman

Elyasi and Sadegh Zarmehi [1] proposed a work on Elimination Noise by Adaptive Wavelet Threshold which present a novel method of enhancing shallow ocean optical images or videos using weighted guided median filter and wavelength properties. Color distortion occurs because different wavelengths are attenuated to different degrees in water, causes ambient underwater environments to be dominated by a bluish tone. The recovered images are characterized by a reduced noised level, better exposure of the dark regions, which improves global contrast where the finest details and edges are enhanced significantly.

They [6], published a paper on Adaptive Wavelet Thresholding for Image Denoising and Compression which describes a novel method to enhance underwater optical images by dehazing. Scattering and color change are problems of distortion for underwater imaging. Scattering is caused by large suspended particles, like fog or turbid water which contains abundant particles, plankton etc.. The enhanced images are characterized by reduced noised level, better exposedness of the dark regions, improved global contrast and edges are enhanced significantly. In addition, our enhancement method is similar to higher quality than the state-of-the-art methods.

A paper [4] on Elimination Noise by wavelet threshold and subband enhancement describes Conventional methods of multi-focus image have high computation and cause blockage effect or artificial effect easily. An effective multi-focus image fusion scheme based on the lifting of wavelets is proposed in this paper. The local luminance contrast, which is represented by weighted region energies, and is calculated by the Gaussian kernel based on high-frequency details. Thus the energy-based image fusion instruction is applied to get a binary map by choosing the maximum energy between images. The performance of the proposed multi-focus image fusion technique is compared with

the existing methods by different function evaluation criteria. Experimental results show that the proposed method has a significant improvement of the fused image with no blocking effect or artificial effect. The proposed method performs the best in trade-offs in image processing speed and the quality of fused image comparing with conventional methods.

State of the Art of Restoration and Image Enhancement Methods on the Repeatability of SIFT and SURF Descriptors present ROV 3D project aims at developing innovative tools which link underwater photo grammetry and acoustic measurements from an active underwater sensor. The results will be 3D high resolution surveys of underwater sites. In this paper, we made an investigation to find at first a pre-processing method of underwater images that do not require a priori knowledge for finding a method to compute distances which will be less expensive in terms of execution time for finding corresponding points proposed by Corchs, Silvia and Schettini, Raimondo [2].

Proposed Work- The following figure shows Data flow diagram for image denoising and enhancement for the proposed approach:

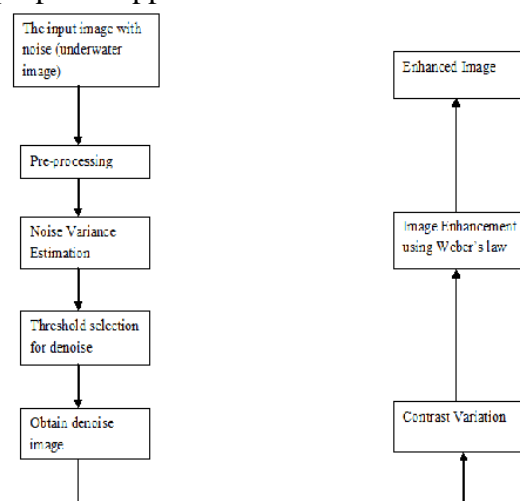


Fig. 1 Data flow diagram for image denoising and enhancement

We design architecture for to denoise and enhance the underwater image.

Image Denoising: The image denoising algorithm reaches nearby optimal soft thresholding in the wavelet domain for recovering original signal from the noisy one. The algorithm is very simple to implement.

Multiscale product thresholding algorithm contain the following steps: Perform image pre-processing on the image with noise: In order to achieve improved 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 parts, preserve details and reject the noise in the image. It is used to smooth textures and reduce artifact by deleting small image features amplified by filtering.

1. Estimate the noise variance.
2. Compute threshold selection for to denoise the image. The key of the wavelet threshold de-noising is the relation between wavelet coefficient and threshold. The choice of the threshold determines the coefficient of the wavelet reconstruction. So the selection of adaptive wavelet threshold will help to attain improved de-noising effect.

3. Obtain a denoise image.

- **Image Enhancement:**

To achieve an enhancement of the underwater image our proposed technique uses a method which is based on Weber's law. Weber's law is used to enhance the contrast of an image.

Conclusion- Underwater image suffer from different transmission properties of water, the transmission of limited range of light, low contrast, disturbance of lightening and blurring of images, diminishing color during capturing of image. Recently pre-processing is done only for color and correcting the non-uniform lights and intensity adjustment.

References- [1] Iman Elyasi and Sadegh Zarmehi, Elimination Noise by Adaptive Wavelet Threshold, World Academy of

Science, Engineering and Technology, United States, 2009, 56:462-466.

[2] Corchs, Silvia and Schettini, Raimondo, Underwater Image Processing: State of the Art of Restoration and Image Enhancement Methods, EURASIP Journal on Advances in Signal Processing ,Milan, Italy,2010, 2010:1-14

[3] Guangxiang Zhou, dandan Yang, A lifting wavelet de-noising method based on adaptive threshold, Journal of Guilin University of Electronic Technology, 2012, 32(2):150-153

[4] Yiwen Liu, Lingling Li, cuihua Li, Elimination Noise by wavelet threshold and subband enhancement, Journal of Xiamen University (Natural Science),2012, 5 1(3):342-347

[5] S. Sudha, G. R. Suresh and R. Sunkanesh, Wavelet Based Image Denoising Using Adaptive Subband Thresholding International Journal of Soft Computing, 2007, 2: 628-632.

[6] Chang S G. Yu B, Vetterli M. Adaptive Wavelet Thresholding for Image Denoising and Com- pression, *IEEE Trans. Image Processing*, 2000.9 (9): 1532- 1546

[7] Prabhakar C.J. #Praveen Kumar P.U.# Underwater Image De-noising Using Adaptive Wavelet Subband Thresholding, Proceedings of the 2010 International Conference on Signal and Image Processing, Piscataway, United States: *IEEE Computer Society*,2010: 322-327.

[8] Defeng Zhang, Digital Image Processing Using MATLAB. Beijing: Posts and Telecom Press, 2009, 10