International Journal of Engineering Research and General Science Volume 4, Issue 6,November-December, 2016
ISSN 2091-2730

STUDY OF EFFICIENT IMAGE PROCESSING ALGORITHM FOR SIDE SCAN SONAR IMAGES

S.Karthik[1]
AP/ECE,Mahendra Institute of Technology,Namakkal,Tamilnadu , India
S.Dineshkumar[2]
AP/ECE,Mahendra Institute of Technology,Namakkal,Tamilnadu , India
P.Navaraja[3]
AP/ECE,Mahendra Institute of Technology,Namakkal,Tamilnadu , India

karthikss42@gmail.com

Abstract- This manuscript proposes an optional effective sonar image augmentation algorithm. The system essentially composes of two steps, together with noise minimization and image sharpening. The sonar image is first de-noised using filters, and then it is enhanced using unsharp masking and histogram equalization. The planned algorithm has been verified on many sonar images of different underwater structures, and shows its efficiency comparing to some well-known sonar noise reduction methods applying for sonar image processing.

Keywords: Sonar image processing, Filtering, Denoising

I. INTRODUCTION

The superiority of sonar images is repeatedly reduced by noise and/or blur. They therefore usually lead to mistaken analysis and reduce the ease for human, semi-automatic and automatic explanation. In reality, many efficient de-noising techniques have been introduced for sonar data such as median filters, local statistic methods, and wavelet transform etc. Median filters are utilized for de-speckling due to their robustness against the impulse noise while preserve image features. Lee filter form an output by computing a linear combination of the centre pixel intensity in a predefined size of filter window with the average intensity of the window. Kuan filter has the same formulation with Lee filter although the signal model supposition and derivations are different. These two filters achieve a balance between straightforward averaging in homogeneous regions and identity filter where the edges and point feature exist. Frost filter achieves a balance between averaging and all pass filter by forming an exponentially shaped filter kernel. This filter is measured as an adaptive Wiener filter that convolves the pixel values within a fixed size window with an exponential impulse response. The retort of the filter varies locally with the coefficient of variation.

The image is first changed into the wavelet domain. Then the wavelet coefficients that are slighter than a predefined threshold are measured as noise, and they should be removed. Thus the previous information on input data plays an imperative role in choosing the optimal threshold value. The image is changed into wavelet domain, and then the MAP filter, so-called the Bishrink filter, is utilized for noise suppression.

Though, most of the on top of mentioned methods focuses on the noise reduction. Thus ruling an alternative algorithm, which can offer noise reduction together with image de- blurring, is the main motivation of this study.In this study, an efficient Side scan Sonar image enhancement is presented. In the primary step, the sonar image is undergone noise reduction process by means of Wiener and median filters. Then the filtered image is de-blurred and enhanced contrast using unsharp masking process and histogram equalization.

II.THE PROPOSED IMAGE ENHANCEMENT ALGORITHM

The algorithm is summarized in Figure 1. On the other hand, in this study the input sonar images are assumed to be geometric and slant-range correction before applying the proposed algorithm. The algorithm principally consists of two steps, noise cancelling and image sharpening. The Weiner and median filters are utilized to suppress noise, and then the filter image will be de-blurred and enhanced using unsharp masking and histogram equalization.

Wiener filter is one of the well-liked techniques for taking away of blur in images owed to linear motion or unfocussed optics. The Wiener filtering executes an optimal tradeoff sandwiched between inverse filtering and noise smoothing. It can remove the noise and the de-blurring simultaneously, and the Wiener filtering is optimal in terms of the mean square error. In other words, it minimizes the overall mean square error in the process of inverse filtering and noise smoothing.

• No decrease in contrast crossways steps, since output values obtainable consist only of those present in the locality .

• Median filtering does not move borders, as can take place with predictable smoothing .

•since the median is fewer responsive than the mean to extreme values, those extreme values are more effectively removed.

Unsharp masking is one of the well-liked ways of image sharpening. In the unsharp masking process, an image is sharpened by ornamental the high frequency components of the image, which is mostly enhancing the edges. Thus, to boost sharpness in an image we require a good high-pass filter. Unsharp masking is done by adding up a portion of high- pass filtered image to the unique image. In more details, the unsharp masking procedure increases the sharpness of the edges in the image and thus reduces the blur or the tediousness in the image. It is believed that presentation of unsharp masking depends on the high-pass filter used, and there are many mask filters can be used such as Gaussian, Lapacian, Lapacian of Gaussian, Sobel, Prewitt.

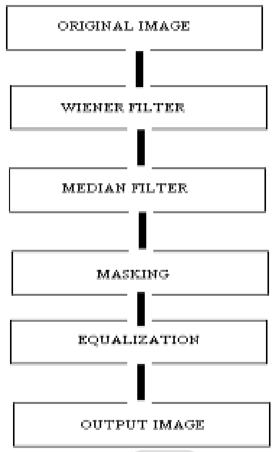

Fig. 1 Sonar image enhancement algorithm.

Histogram equalization is a method in image processing of contrast adjustment using the image's histogram This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In many practical applications, histogram equalization can lead to better detail in photographs that are over or under-exposed. A key advantage of the method is that it is a fairly straightforward technique and an invertible operator. So in theory, if the histogram equalization function is known, then the original histogram can be recovered, and the calculation is not computationally intensive.

The sonar images of some underwater structures were recently collected in Korea in 2013 including the swimming pool, spillway, and floodgate. Some selected data are used to verify the performance of the proposed methods.

III. CONCLUSIONS

This study introduces an alternative effective algorithm for sonar image enhancement. The proposed algorithm consists of two steps including noise reduction and image enhancement. The Wiener and median filters are used for de- noising, the filtered image is then enhanced using unsharp masking and histogram equalization. The experimental results show that the proposed algorithm is efficient in terms of noise reduction, and sharpening side scan sonar images.

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