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# Deep-Water Image Enhancement by Guided Filtering

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***Abstract: Enhancement of deep-water or underwater images is necessary due to number of challenges that occurs because of the water medium that supports scattering, absorption and haziness. Enhancement of images has used a technique that will be done using box filtering and guided filtering that preserves the edge factor and smoothens the image which will undergo dark channel prior algorithm to clear the hazes in the image. In this paper, it shows the preprocessing with box filtering and also guided filtering for preserving the edges of the input image using a guidance image that is an input image itself.***
***Index Terms: Guided filtering, fast box filtering, edge preserving, underwater images***

## I. INTRODUCTION

A lot of techniques has been present to build the underwater images visibility. Captured images of underwater has got number of problems mainly because of the medium characteristics. Light wavelengths has an important part in colour variations in an image s some of the light rays gets absorbed as it travels inside the water medium. Some challenges has made to discover a new techniques to enhance the images. Histogram equalization, CLAHE, adaptive histogram were some of the techniques that were present as universal for image enhancement. At present, there exists a particular methods for removal of unwanted factors in an image.

In this paper, initially the pixel averaging will be done using box filtering to get the mean of the image. Guided filtering is applied later to get the edge factors and it also smoothens the input image. A guidance image will be taken to guide the image in recovering the factors, input image itself will act as a guidance image here. This technique has been an efficient one in obtaining a number of factors like edges, smoothness and averages the pixel before processing to make sure it is done evenly.

## II. LITERATURE SURVEY

The technique wavelength compensation and image dehazing (WCID) is implied that improves the visibility of underwater images. It measures the depth of a material and the camera in accordance with the wavelength and separates the foreground and background, if an artificial light is present then it removes it and compensates by measuring the scene range from depth D with D+R, R is the range of image depth. With the residual energy ratios of various colour channels that are occurred in background light the depth of the water is measured in the image scene. The distortion the wavelength of light colour change compensation is done to get the colour balance. Using the truth patches of colour images and YouTube videos downloaded the wavelength compensation and image dehazing algorithm has been evaluated subjectively and objectively which gives a haze free colour balanced image [1].

A linear colour attenuation prior technique is approached that's based on the brightness and saturation imbalance of pixels in the images with haze that shows the quantity of haze and makes a linear model that is advantageous in edge preserving. With the proposed methodology, depth mapping will be pursued and even the radiance of the scene has got easily. The method discussed provides a greater efficiency and a better dehazing results. By pursuing the depth maps with this linear model parameters, the image radiance will be taken back [2].

The light waves undergoes absorption and scattering in the water medium as it travels. An algorithm to get over of it has proposed that has a colour correction and illumination adjustment. Initially a colour enhancement method is used then the gamma correction has been implemented and the illumination mapping will be carried on that to pursue the illumination adjustments. This method gives a simple processing method and a better visual persistence [3].

Retinex based enhancing method has come up for colour correction strategy in the beginning. Later the variational framework for retinex to pursue the detailed brightness level. Where at last the reflectance and illumination are made better in quality. The enhanced image is taken by combining that and the result has been better with colour correction for getting a clear image. This methodology requires different degrees of polarization of images [4].

The noise level function (NLF) is launched to measure and remove the colour noise, that removes of a single image with the help of piecewise smooth image models. NLF function represents the level of noise as a function of brightness of image. The noise has been taken off with the pixel value projection onto the RGB value with each segment. The image has divided into the piecewise regions and mean shows the brightness measurement and the Gaussian conditional random field (GCRF) is introduced for clear image with the noisy input [5].

The underwater image enhancement is necessary for clarity of an images. A technique known as dark prior channel is approached followed with soft matting and HSV filtering to take the information of faded factors in an image. Dark channel prior approximates the transmission and restores the images, HSV filtering transfers the RGB to HSV to obtain the saturation. Comparing the PSNR and MSE parameters a good quality of enhanced image is obtained [6].

## III. PROPOSED METHOD

The images captured underwater undergoes pre-processing initially with the fast box filtering it basically averages the pixel around. It segments the image into horizontal and vertical directions, replaces it and join to get the mean. Guided filtering is applied after preprocessing that preserves the edge factors and smoothens the image. Here in guided filtering, input image itself is taken as the guidance image with the box filtered image. Figure 1 shows the complete block diagram of proposed method.

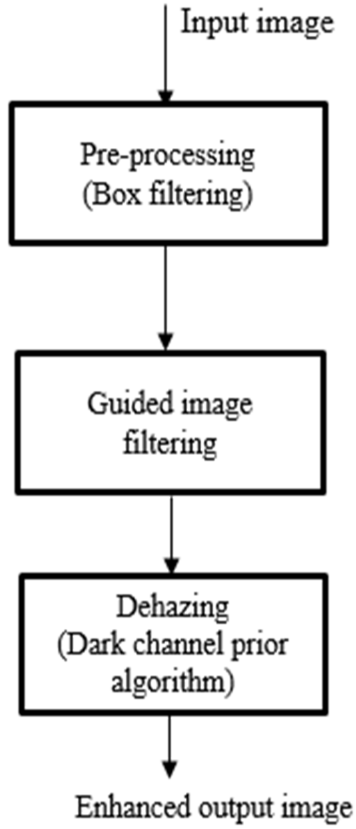


Figure 1: block diagram of proposed method

The preprocessing with the box filtering is done initially and the normalization of box filtering is as shown,

$$O(x, y) = \frac{1}{(2r+1)^2} C(x, y) \qquad (1)$$

Guided filtering is derived with many parameters and is given as follows to smoothens and preserving the edges,

$$q_i = a'_i I_i + b'_i \qquad (2)$$

Where, $a'_i$ is the mean of ‘a’ and $a_k = \frac{\frac{1}{|\omega|}\sum_{i \epsilon \omega_k} I_i p_i - \mu_k p'_k}{\sigma_k^2 + \epsilon}$ and $b'_i$ is the mean of ‘b’ and $b_k = p'_k - a_k \mu_k$

## IV. RESULTS

The results have obtained for guided filtering algorithm which shows the smoothness in an image and the edge factors that has been preserved. Figure 2 and figure 3 shows the results of guided filtering algorithm. The image gets converted into gray image to get the more detailed factors and the results are obtained as follows.

Figure 2: Source image

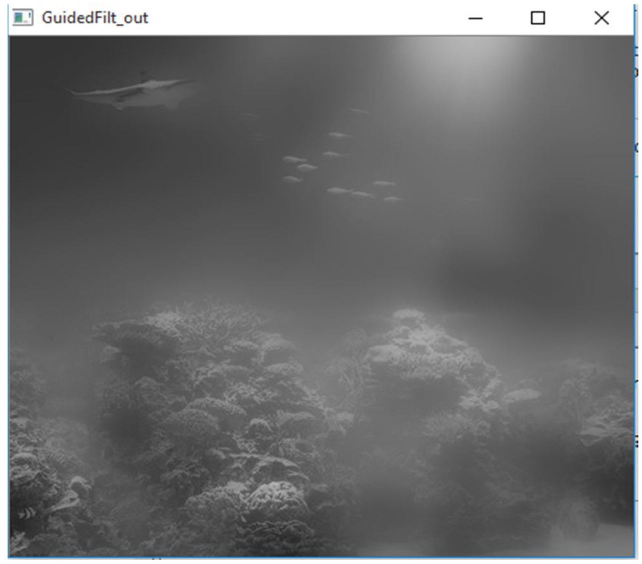


Figure 3: Guided filter output

## V. CONCLUSION AND FUTURE WORKS

Guided filtering algorithm has an important role in smoothening of an image and preserving of edges. Guided filtering accompanied with the fast box filtering which gives the mean of surrounding pixels is proposed that provides an image which could later processed with dark channel prior algorithm that will be in the future works. An effective results using guided filtering has been accomplished.

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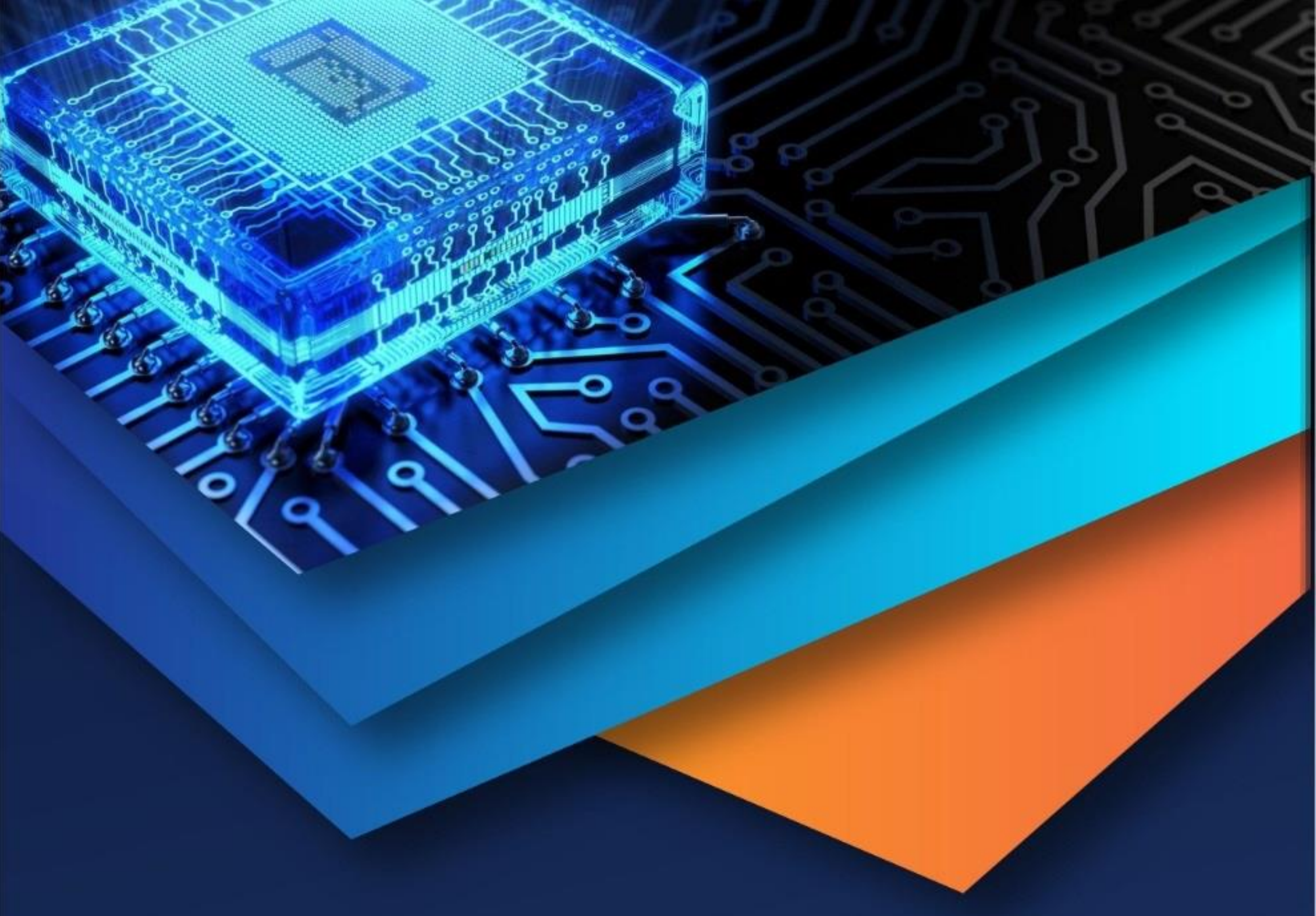


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