COMPARATIVE ANALYSIS FOR ENHANCEMENT OF UNDERWATER IMAGE BY PRESERVING EDGE COMPONENT AND ENHANCING CONTRAST AND RESOLUTION

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Abstract : The Underwater pictures normally experience the ill effects of non-uniform lighting, low differentiation, obscure and decreased hues. Shading disperse is brought about by murkiness impacts happening when light reflected from items is consumed or dissipated on various occasions by particles in the water. This thus brings down the perceivability and complexity of the picture. In view of explicit transmission properties of light in the water, Underwater picture additionally experiences restricted range, non uniform lighting, low complexity, shading lessened, and significant haze In this thesis a picture based preprocessing method has been proposed to upgrade the nature of the Underwater pictures. The goals of this methodology is to Firstly, apply mix of Preprocessing channels in particular Noise Removal Filter, Median channel and Wiener channel to the corrupted Underwater pictures and lessens Underwater irritations and furthermore improves picture quality. Furthermore, the immersion and force extending of picture is utilized to build the genuine nature and take care of the issue of lighting. It is made out of a few progressive free preparing advances which right non uniform brightening, smother commotion, upgrade differentiate, modify hues and jelly Edge Component. At long last, Performance of Each channel is analyzed on certain parameters like PSNR and MSE.

Keywords - Image Enhancement, Underwater Images, Edge Components, Filters, PSNR etc.

1. INTRODUCTION

Underwater pictures are basically described by their poor perceivability since light is exponentially lessened as it goes in the water and the scenes result inadequately differentiated and dim. Light lessening limits the perceivability separate at around twenty meters in clear water and five meters or less in turbid water. The light constriction procedure is brought about by retention (which evacuates light vitality) and dissipating (which alters the course of light way). The ingestion and dissipating procedures of the light in water impact the general execution of Underwater imaging frameworks. Forward dissipating (arbitrarily veered off light on its way from an item to the camera) for the most part prompts obscuring of the picture highlights. Then again in reverse dispersing (the part of the light reflected by the water towards the camera before it really achieves the items in the scene) by and large restricts the complexity of the pictures, producing a trademark cloak that superimposes itself on the picture and shrouds the scene. Retention and dispersing impacts are expected not exclusively to the water itself yet in addition to different segments, for example, broke up natural issue or little discernible skimming particles. The nearness of the coasting particles known as "marine snow" increment ingestion and dissipating impacts.

The perceivability range can be expanded with fake lighting however these sources not just experience the ill effects of the troubles portrayed previously (dissipating and retention), yet furthermore will in general enlighten the scene in a non uniform style delivering a splendid spot in the focal point of the picture with an ineffectively lit up territory encompassing it. At long last, as the measure of light is diminished when we go further hues drop off one by one relying upon their wavelengths. The blue shading ventures to every part of the longest in the water because of its most brief wavelength making the Underwater pictures to be overwhelmed basically by blue shading.

Underwater picture upgrade procedures give an approach to improving the item distinguishing proof in Underwater condition. There is part of research begun for the improvement of picture quality, however constrained work has been done in the region of Underwater pictures, on the grounds that in Underwater condition picture get obscured because of poor perceivability conditions and impacts like "ingestion of light", "impression of light", "bowing of light, "denser medium (multiple times denser than air)", and "dissipating of light" and so forth.

2. *UNDERWATER IMAGE DISTORTION*

Here, we briefly discuss a few problems, pertaining to underwater images, such as light absorption and the inherent structure of the sea. We additionally examine the impacts of shading in submerged pictures. With respect to light reflection, Church describes that the reflection of the light varies greatly depending on the structure of the sea. Another main concern is related to the water that bends the light either to make crinkle patterns or to diffuse it as shown in Figure 1. Most importantly, the quality of the water controls and influences the filtering properties of the water such as sprinkle of the dust in water According to Anthoni the reflected amount of light is partly polarised horizontally and partly enters the water vertically. An important characteristic of the vertical polarisation is that it makes the object less shining and therefore helps to capture deep colors which may not be possible to capture otherwise.

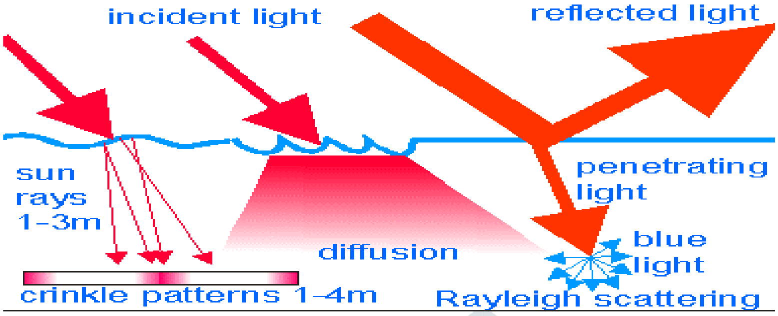


Figure 1.1Water Surface Effects

Another outstanding issue concerning the submerged pictures is identified with the thickness of the water in the ocean which is viewed as multiple times denser than air. Therefore, when light moves from the air to the water, it is partly reflected back and at the same time partly enters the water. The amount of light that enters the water also starts reducing as we start going deeper in the sea (as shown in figure). Similarly, the water molecules also absorb certain amount of light. Accordingly, the submerged pictures are getting darker and darker as the profundity increments. Not just the measure of light is decreased when we go further yet in addition hues drop off one by one relying upon the wavelength of the hues. For instance, above all else red shading vanishes at the profundity of 3m. Besides, orange shading begins vanishing while we go further. At the profundity of 5m, the orange shading is lost. Thirdly the vast majority of the yellow goes off at the profundity of 10m lastly the green and purple vanish at further profundity. This is appeared in Figure 2.

As a matter of fact, the blue color travels the longest in the water due to its shortest wavelength. This is the thing that makes the submerged pictures having been overwhelmed uniquely by blue shading. Notwithstanding inordinate measure of blue shading, the haze pictures contain low splendor, low differentiation, etc.

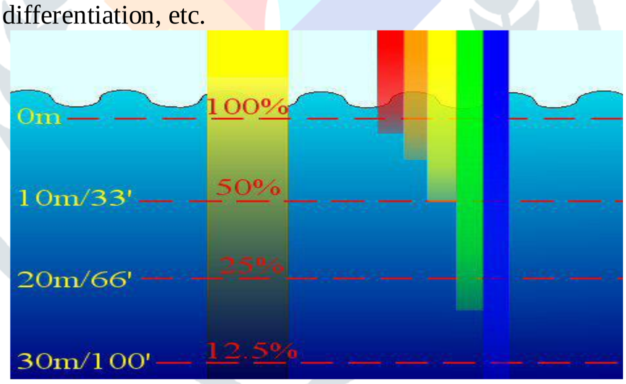


Figure 1.2 : Color Appearance in Underwater

3.TECHNIQUES TO ENHANCE UNDERWATER IMAGES

A typical Enhancement of Underwater image system consists of pre-processing, contrast stretching ,Edge preserving, increase Resolution and recognition and post processing stages. Here pre-processing can be further divided into sub steps like quality checking ,noise reduction and Filtering.

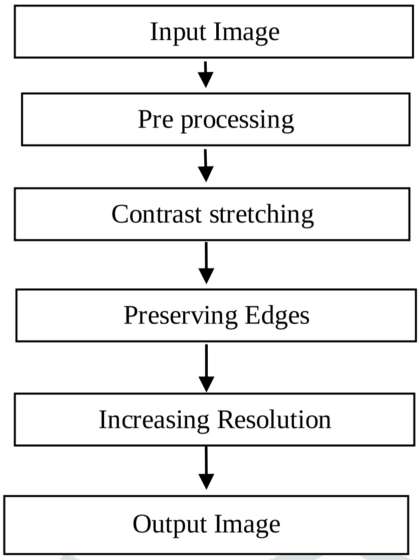


Fig: Flowchart of Proposed Methodology

3.1 Steps to implement the system are:

Step1: Pre processing:

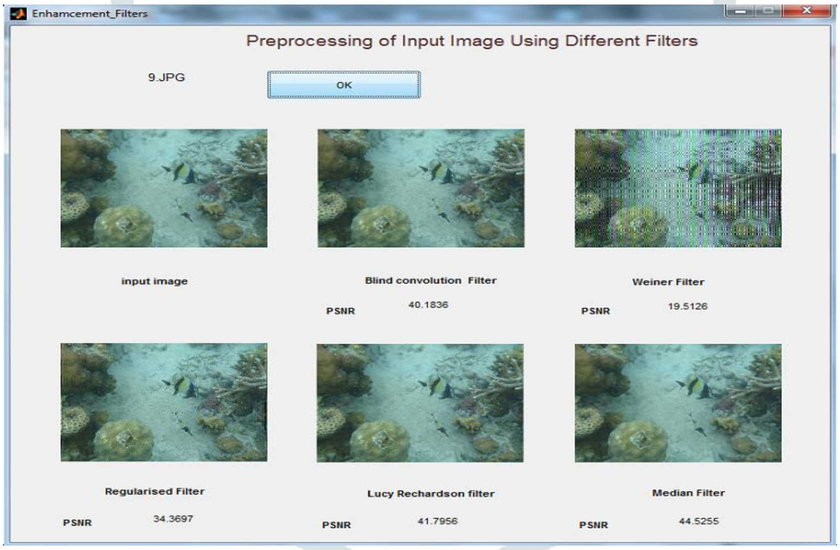


Figure 3.1 Analysis of Preprocessing filters

S.No.	Image	PSNR Values for different filters				
		Blind Convolution	Weiner Filter	Regularised Filter	Lucy- Rechardson Filter	Median Filter
1	9.jpg	40.2	19.5	34.4	41.8	44.5

Table 3.1 Comparison of Different preprocessing Filters

After applying in various images it is observed that output image shows a good PSNR values for median filter, hence it produces a good quality image as compared to all other images.

Step2: Apply Contrast Stretching

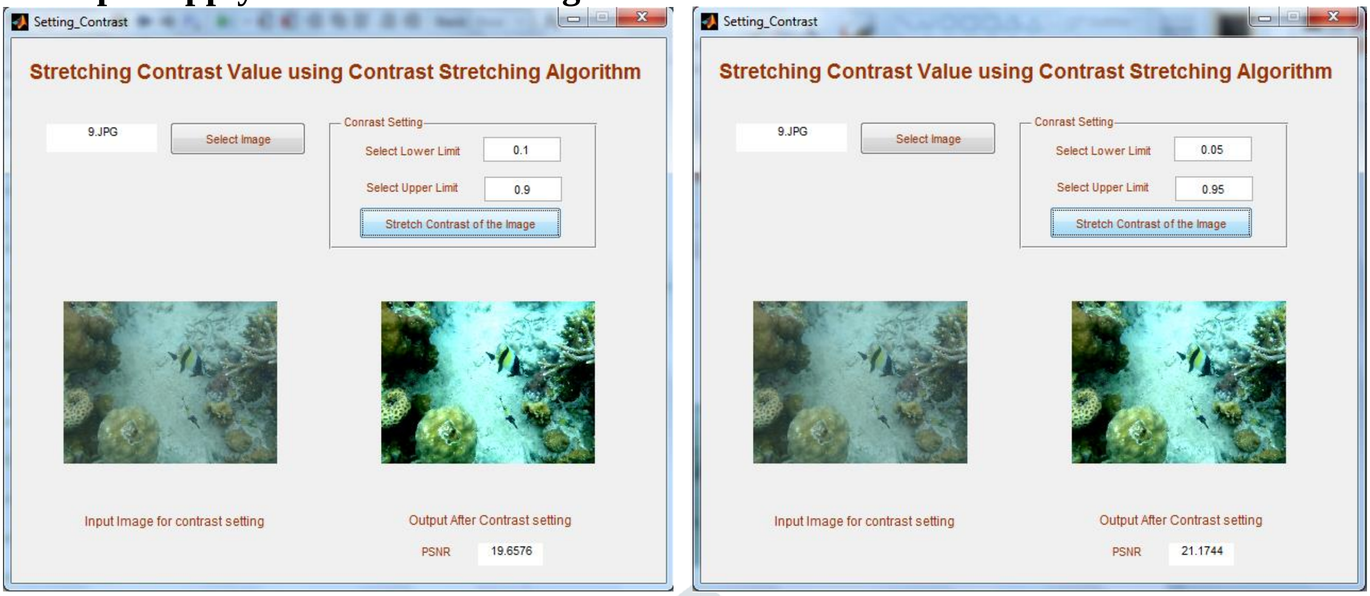


Figure 3.2 Analysis of contrast setting parameters

S. No.	Image	Contrast Limits		PSNR
		Lower Limit	Upper Limit	
1.	9. jpg	0.05	0.95	21.17
		0.10	0.90	19.65

Table 3.2 Effect of different contrast limits on image

Table 3.2 shows that the upper limit must be keep higher up to 0.95 and lower limit must be keep lower side near about 0.05 for good result.

Step3: Apply Edge Preserving Method:

Here, we are analyzing the output of two edge preserving method

1. Adaptive filter
2. Bi-letral Filter

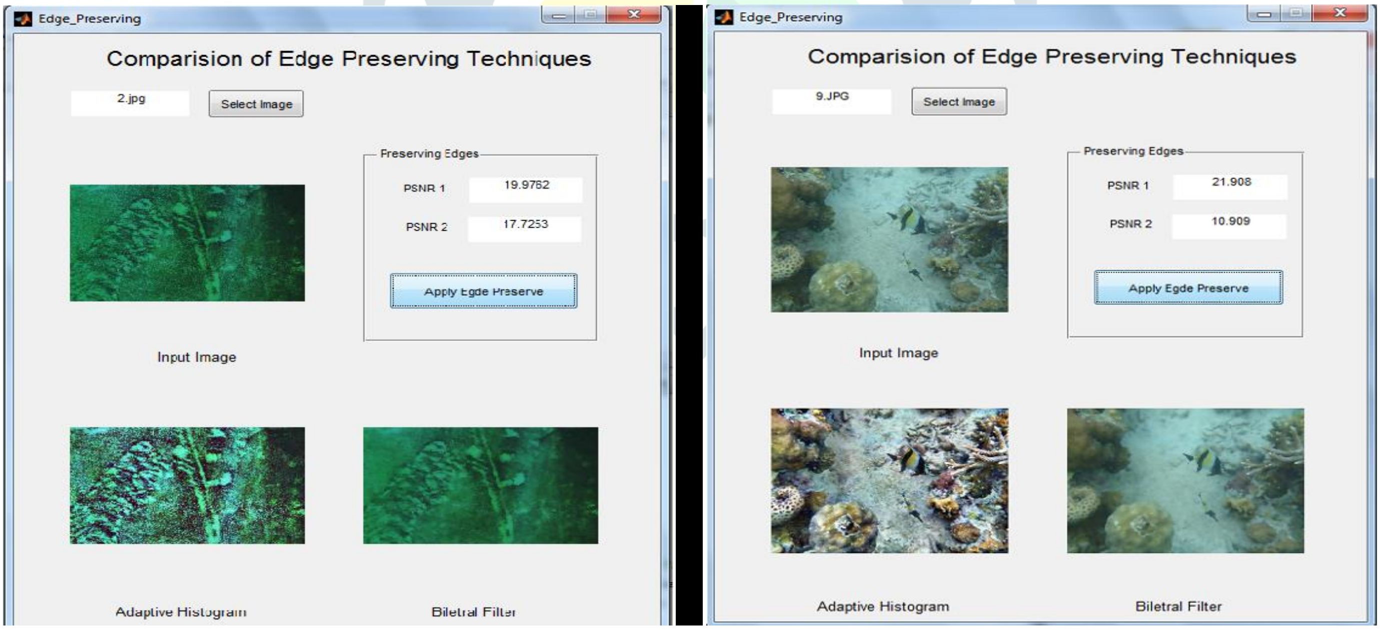


Figure 3.3 Analysis of edge preserving techniques

From figure 3.3 following table can be prepared

S. No.	Image	PSNR after applying Different Edge Preserving Techniques	
		Adaptive Filter	Biletral Filter
1.	2. jpg	19.97	17.72
2.	9.jpg	21.90	10.90

Table 3.3 Analysis of Different edge preserving techniques

From table 3.3 it can be observed that result of adaptive filter is much better then the bi letral filter.

Step4: Increasing Resolution of Image:

Using the transform function we have been able to stretch the saturation and intensity values of HSI color model. Utilizing the saturation parameters we can get the genuine nature of underwater image.

To increase the resolution of image we apply following methods

1. Using Linear Resolution
2. Using Spline Resolution

Figure 3.4(a) and 3.4 (b) shows the effect of different resolution methods on underwater images, the figure also shows the number of pixels increased after applying each method

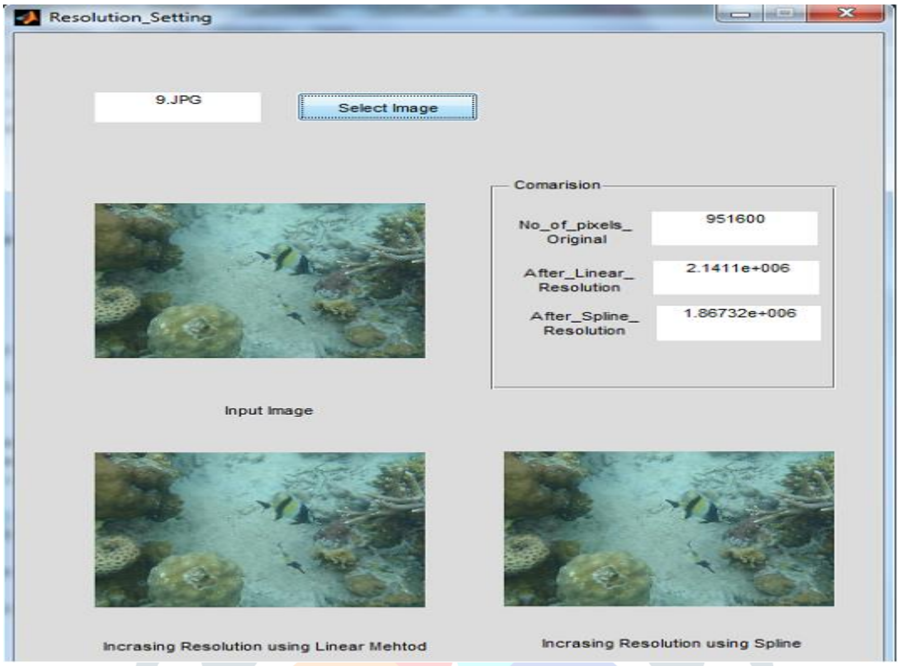
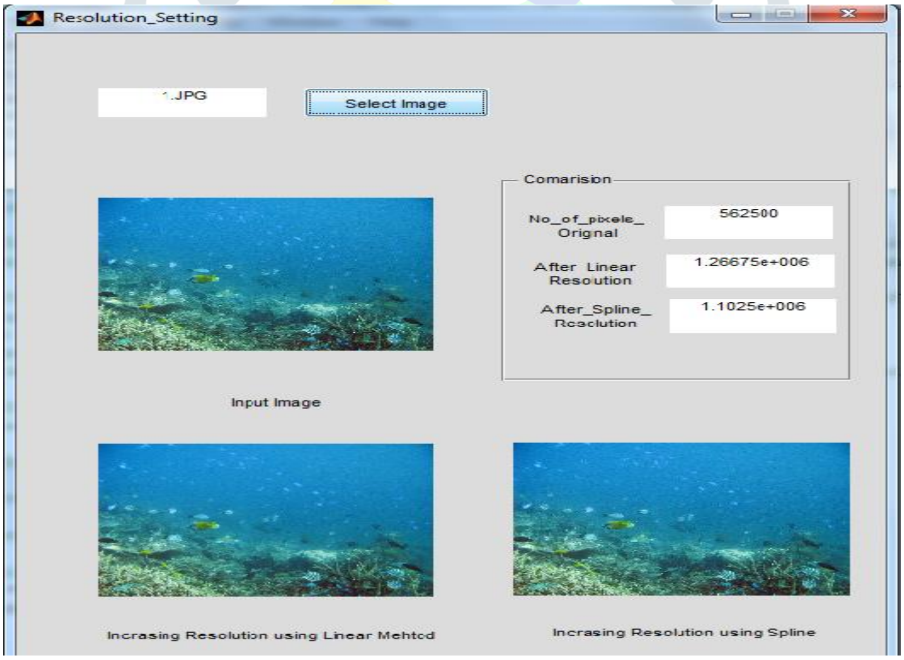


Figure 3.4 (a) Resolutions Setting of Images



Result of above figure may be concluded into following table:

S. No.	Image	Number of pixels in original image	Number of pixels in image after applying Different Resolution Setting Techniques	
			Linear Resolution Method	Spline Resolution Method
1.	9. jpg	951600	2141100	1867320
2.	2.jpg	562500	1266750	1102500

Table 3.4 Analysis of Different edge preserving techniques

Percent increment in Resolution:

1. **For image 9.jpg:**

Linear Method:	(2141100-951600)/951600=	1.24884
Spline Method:	(1867320-951600)/951600=	0.96230

Above calculation shows that, the resolution of image 9.jpg is increased by 124.8% in case of applying Linear method and it is increased by 96.23% when applying spline method. Hence we can choose Linear resolution method for this stage.

4.CONCLUSION

1. From table 3.1 it can be easily concluded that ,result of applying median filter on preprocessing is very good then the all other filters. It shows PSNR values near about 40 to 45 which is near about 10 -20 % more better then the other methods.

2. From table 3.2 it can be easily concluded that lower limit for contrast setting must be near to 0.05 and upper limit for contrast setting must be near to 0.95.

3. From figure 3.3 and table 3.3, it can be concluded that adaptive filtering technique performs much better then the bi-letral filtering technique.

4. From figure 3.4 and table 3.4, it can be concluded that, for setting resolution of underwater image, linear resolution techniques performs better.

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