

A Dual Mode Approach for Underwater Image Enhancement

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ABSTRACT

Enhancement of underwater image is one of the major areas of research in digital image processing. Underwater images are usually suffered from low intensity and noise. It proposes dual enhancement method. It is practically applied in both spatial and frequency domain. This paper is to enhance underwater image enhancement in both spatial and frequency domain. To enhance underwater images, we used an approach, such as two level noise removal and RGB intensity equalization. Noise removal is performed using spatial filter based and lossy image digitization such as PCA/JPEG2000 frequency domain based noise reduction. Histogram equalization is performed in both channels to get higher clarity.

Keywords: Image Enhancement, Spatial Domain, Frequency domain, RGB, Histogram Equalization, PCA, JPEG2000, Noise Filter.

I. INTRODUCTION

Underwater images are mostly affected by irregular light intensity and noise in water. This paper proposed to overcome those two problems.

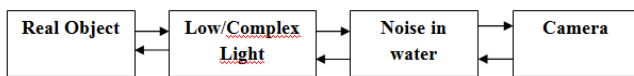


Figure 1. E.g. for underwater image processing problem

Normally water resists narrow light from sun and cannot resist infrared radiation from sun, this scattered IR rays can't able to see by human eye, but CCD or CMOS Camera can able to see or read IR waves. So, we get problem at the time of digitization.

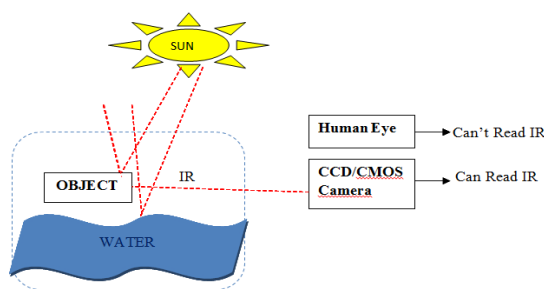


Figure 2. Complex Light Problem

IR waves affect Image intensity and other factors such as Color Data, so in the field of underwater Image digitization & enhancement need new algorithm or method to overcome this problem.

II. METHODS AND MATERIAL

1.1 Spatial Noise Removal

Spatial noise removal is performed by spatial lowpass noise removal filter. This will remove very low level or micro tiny details from image[1].

Example:

$$\frac{1}{9} \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} ; \frac{1}{5} \begin{pmatrix} & & 1 \\ & 1 & 1 \\ & & 1 \end{pmatrix}$$

0	0	0	0	0
0	0	0	0	0
0	0	1	0	0
0	0	0	0	0

1.2 PCA-Principal Component Analysis

Principal Component Analysis is frequently used in Signal Processing or Digital Image Processing for data dimension reduction[4]. PCA is used for reducing color information memory space.

PCA also used for determine Image object calculation.

$$X=[x_1, x_2, \dots, x_n]$$

$$Y=A(X-Mx)$$

For RGB compression

$$I=w_1R+w_2G+w_3B$$

1.3. Cohen-Daubechies-Feauveau wavelet (CDFW)

CDFW also called as Biorthogonal wavelets. CDFW used for lossy compression in image Digitization [2].CDFW used in JPEG 2000 compression module or program.

CDFW performed in frequency domain. This reduces image storage capacity by ignoring very small information from given image. Nano level information can't able to processed by human eye, so this method also ignore or remove unwanted noise from given image. E.g for CDFW

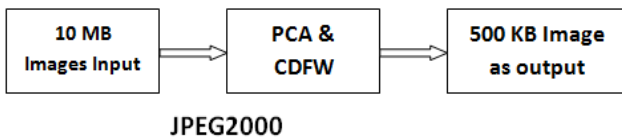


Figure 3. Block diagram of CDFW

1.4 RGB Histogram Equalization

RGB Histogram equalization performed individually in all three channels [3]. Traditional Histogram equalization methods only performed in single channel grayscale images. But, these methods equalize all three channels and merge to single image.

1.5 Algorithm

Mixed mode image enhancement of underwater image shows more accurate result than existing system of underwater image enhancement such as filter based or histogram based methods [3].

1.1. Read JPEG Image as Img

1.1.2. Convert Img →RGB Image and store to RGBImg.

2.1. Perform Spatial Noise Removal (RGBImg) →NewRGBimg

3.1. Convert RGB to YcBcR(NewRGB) and store to → NewYcBcR

3.2 Read (NewYcBcR) → NewImg2

4.1. Perform PCA (9/7(NewImg2)) → and store to lossyImg

4.2 Convert YcBcR to RGB (lossyImg) →lossyRGB

5.1 Read (lossyRGB) →R→G→B. Store individual channels as R, G, and B.

6.1. Perform Histogramequalization(R) →NewR

6.2. Perform Histogramequalization(G) →NewG

6.3. Perform Histogramequalization(B) →NewB

7.1. Combine RGB(R,G,B) →OutputRGB

7.2. Store as OutRGB

8.1. Show (OutRGB). “New Filtered Image”

8.2 Show (RGBImg). “Old Input Image”

1.6. Proposed System Block Diagram:

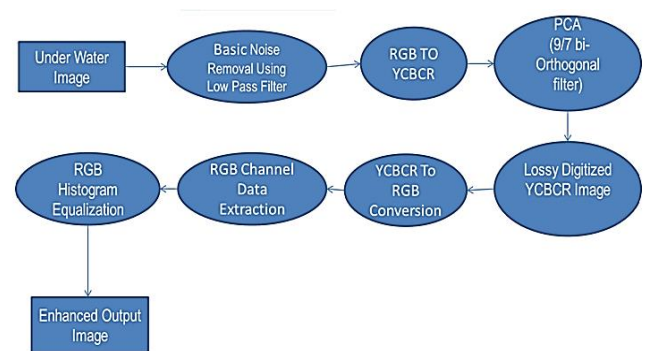


Figure 4. Block diagram of Proposed System

III. RESULTS AND DISCUSSION

Experimental Result:

INPUT



Intermediate Stage



Figure 5. Intermediate Experimental result

Final Output:



Figure 6. Final output

PSNR:

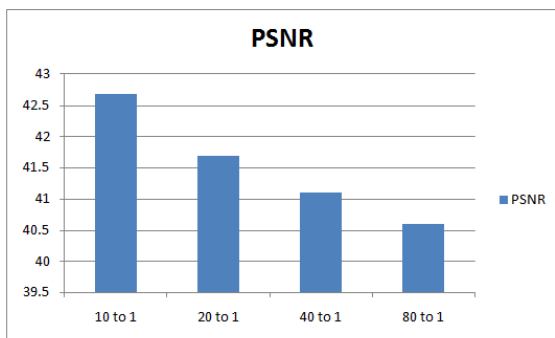


Figure 7. Graph of PSNR

IV. CONCLUSION

This paper is discussed about underwater Image enhancement using Dual (or) multi-mode Image enhancement methods. It successfully implemented spatial based noise removal; PCA/CDFW based noise removal and also RGB Histogram equalization methods [3]. This will give more accurate and efficient result than existing system of underwater image enhancement. Finally, this paper provides a comprehensive outlook

and gives a better solution for underwater image enhancement.

V. REFERENCES

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