Comparative Analysis of Underwater Image Enhacement Using Retina Model

Ms. Pranjali G. Maske[1], Prof.KanchanWarkar[2]
[1,2]*Computer Science & Engineering Dept., Bapurao Deshmukh College of Engineering of Engineering Sewagram (Wardha), Maharashtra, India*

Abstract **- An underwater picture enhancement model stimulated via the morphology and function of the retina version. So the primary objective of to expand this venture of an underwater picture enhancement is to recover the excellent of a blurriness snap shots That has been degraded because of scatters, noise and amalgamation inside the underwater images surroundings. Goals are create dataset and put into effect nice of pix with the assist of incorporated formal strategies. Thus to avoid the important issues of underwater image blurriness we want to comparative evaluation of underwater photograph enhancement. There are techniques are used for underwater photograph processing i.e. Photo enhancement and photograph restoration. Photograph enhancement is a method of enhancing the quality of image with the aid of improving its function. On this paper comparative evaluation of various enhancement strategies for such underwater pix is provided.**

Index Terms **- Underwater Image Enhancement, Adaptive Histogram Equalization (AHE), Dark Channel Prior (DCP), Peak Signal-To-Noise-Ratio (PSNR), Gray Level Co-Occurrence Integrated Algorithm (GLCIA).**

1.INTRODUCTION

Underwater photos frequently be afflicted by noise, colour distortion and coffee evaluation, due to the fact light is Attenuated when it propagates through water. These problems increase the issue of diverse obligations which includes automated fish and plankton detection and popularity. Consequently, many strategies have been proposed to recover or decorate the degraded underwater pics [1]. The noise discount strategies for underwater photographs could be roughly labeled as wavelet-primarily based and clear out based totally. The center-surround opponent mechanism of the bipolar cells and the feedback from amacrine cells to inter plexiform cells then to horizontal cells serve to enhance the rims and contrasts of the output image. The ganglion cells with color-opponent mechanism are used for color enhancement and coloration correction [2]. In recent times, underwater photo processing has made a high-quality identification in the discipline of studies because of developing call for a excellent great image In lots of packages. Taking a splendid excellent photo in the underwater environment is not a smooth venture, it calls for a few committed hardware [3]. While we capture a picture or video in underwater surroundings, the best of picture/video degraded due to scatters and amalgamation [5]. Therefore, the ones underwater images require enhancement for brilliant packages. In today's decay, the programs of underwater image processing have multiplied in various domain names like mine detection, underwater microscopic detection, independent underwater vehicles, tele conversation cable terrain scanning, and so on. In digital picture processing, fusion-based absolutely method, darkish channel preceding, coloration correction, however these are not applicable to underwater photo processing [8].

2. LITERATURE SURVEY

Yong-Jie Li et.al "Underwater Degraded Image Enhancement Using Retina Model, 2019" [1] Proposed the underwater image enhancement model stimulated thru the morphology and feature of the teleost fish retina. We aim to remedy the problems of underwater photograph degradation raised by means of way of the blurring and non-uniform color biasing. Because the primary layer of retina, the photoreceptors may be labeled into the rod and cone types, assisting transmit the obtained mild signal into the neural reaction horizontal cells (hcs) have the most important rf size in the retina, which makes it feasible to combine

the alerts from photoreceptors over distinctly huge regions.

Om Kumari Soni et.al "A Survey on Underwater Image Enhancement Technique, 2020" [2] Has provided the intention of underwater image enhancement is to recover the satisfactory that has been degraded because of scatters and amalgamation within the underwater environment. These photos suffer from robust absorption, low assessment, noise, and bad visibility. For that reason to avoid aforementioned problems of the underwater pictures, enhancement is wanted. This paper discusses numerous image enhancement strategies like histogram equalization, adaptive histogram equalization(ahe), clahe, histogram reducing, assessment stretching, darkish channel earlier notwithstanding seen and herbal underwater pix, sometimes brightness and excessive evaluation for the underwater image are also required for object detection, fish elegance, and plenty of others.

Kun Xie, Wei Pan et al "An Underwater image enhancement algorithm for Environment recognition and robot navigation mechanism, 2018"[3] On this paper they've furnished the underwater robot navigation and marine technology reputation, that's primarily based at the dark channel in advance version and underwater back-scatter version. The model that is used in this paper is extra sturdy. This paper proposes the usage of the darkish channel previous version for underwater surroundings popularity, in which underwater reflection models are used to gain better photos.

Donghui Wei et Al "A two-step approach for underwater image enhancement, 2017" [4] Have proposed the state-of-the-art approach to improve the underwater picture seen first-rate with the aid of the usage of a two-step approach. Firstly, a transmission map based totally absolutely enhancement is finished to increase the image worldwide assessment, just like the picture defog set of rules. Secondly, photo statistics are extracted and the nearby assessment is superior with the resource of making use of component-retaining filter. Experiments

3. METHODOLOGY

UIEB dataset (underwater image enhancement benchmark) dataset UIEB consists of subsets 890 raw underwater snap shots with corresponding excessive pleasant reference snap shots. 60 difficult underwater pix. The output photo is generated in the following format. Jpeg, png, jpg. The UIEB dataset (underwater picture enhancement benchmark) consists of 890 real underwater pics that have been captured beneath special lights conditions and have numerous coloration variety and degrees of contrast. The authors have furnished respective reference photos which can be coloration solid-free (have fantastically genuine colour) and feature advanced visibility and brightness as compared to the source picture. We test our model on this dataset, as this dataset acts as a actual world underwater dataset in regards photographs, acquired without artificial strategies.

Fig: UIEB Dataset for RGB and Gray Scale Images.

ALGORITHMS

A) Saliency map set of rules

Saliency map is a photo in which the brightness of a pixel represents. The motive of saliency map is to locate the regions which might be prominent or substantive at each area within the sight view. It's far used in numerous visible interest fashions. Why we use saliency map?

- We take an picture as input and we use the whole picture to predict the output.
- If we've a in reality big photo in which only some pixels the magnificence we need to expect so computing the complete image isn't always an awesome concept.
- Why we use a saliency map to highlight the critical regions of the picture and procedure only the crucial areas.

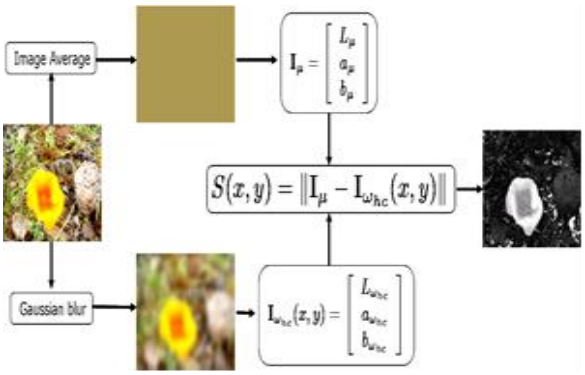


Fig Saliency Detection Algorithm

STEPS

1. Three capabilities extracted from input photographs.
2. Pictures are converted to crimson-green-blue-yellow coloration area, the snap shots are transformed to a greyscale.
3. The orientation characteristic is transformed using gabor filters with appreciate to 4 angles.
4. All of those processed photos are used to create Gaussian pyramids to create characteristic maps.
5. Feature maps are created, saliency map is the mean of all the characteristic maps.

DARK CHANNEL PRIOR

FORMULA: I(X; Y) = J(X; Y) T(X; Y) + A (1-T(X; Y))

- wherein i(x; y)-captured underwater picture,
- j(x; y) -proper image without degradation,
- t(x; y) - transmission
- a -homogeneous historical past light.
- the cause of dehazing is to retrieve j(x; y)
- from i(x; y) without knowing the values of a and
- t (x; y). Early underwater imaging strategies.

B) GLCIA (Gray Level Co-Occurrence Integrated Algorithm)

- It represents a faster set of rules to calculate co-occurrence texture functions.
- Produce a favoured approach for determining co-incidence possibility texture capabilities.
- This in comparison here calculate same texture function values.
- Set of rules efficiencies each pace and memory.
- The overall computation time is reduced from hours to mins for such imagery.

PSNR (Peak Signal-To-Noise-Ratio)

The term pinnacle sign to noise ratio is an expression for the ratio a few of the maximum possible fee (power) of a signal and the power of distorting noise that influences the extraordinary of its instance due to the fact many indicators have a totally dynamic variety, (ratio between the maximum essential and smallest feasible values of a changeable amount) the PSNR is typically expressed in terms of the logarithmic decibel scale.

PSNR= $20log_{10}$ $(\frac{MAX_f}{\sqrt{MSE}})$

Formulae 1: Peak sign to noise equation.

Where the MSE (Mean Squared Error) is

MSE = $\frac{1}{mn} = \sum_0^{m-1} \sum_0^{n-1} || f(i,j) - f(i,j)||^2$

Formulae 2: MSE Imply squared mistakes equation

MSE = $(\frac{1}{(m*n)}$*sum$(sum((f-g)^2)$

Formulae 3: MSE

PSNR=20*log (max (max(f)))/((MSE)^0.5)

Formulae 4: PSNR

DELAY (Time)

A time delay and integration or time postpone integration (TDI) charged couple tool (CCD) is an photo sensor for shooting images of moving gadgets at low light levels.

Correlation Values

Correlation is the process of transferring a filter mask often referred to as kernel over the photograph and computing the sum of merchandise at every place.

4. RESULT ANALYSIS

RGB Images

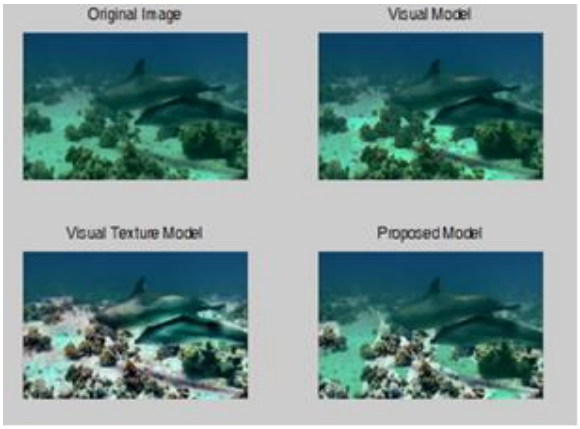
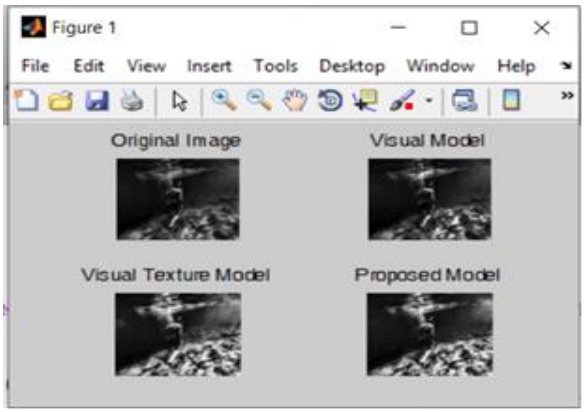


Image	PSNR (VM)	PSNR (VTM)	PSNR (PM)
100001.png	26.7858	29.3018	25.5587
10091.png	27.1658	27.2831	27.6918
10103.png	26.439	23.8698	27.0694
10167.png	26.2123	26.9856	26.0095
Image	Delay (VM)	Delay (VTM)	Delay (PM)
100001.png	0.7961	1.6089	1.4515
10091.png	1.0066	0.9184	0.2012
10103.png	0.5333	0.3864	0.2447
10167.png	0.3933	0.4674	0.1926
Image	Corr (VM)	Corr (VTM)	Corr (PM)
100001.png	0.919	0.9577	0.9357
10091.png	0.8803	0.788	0.9979
10103.png	0.9519	0.9329	0.9994
10167.png	0.4884	0.8073	1

Result Table 1: Comparison of Visual Model, Visual Texture Model and Proposed Model with RGB Dataset Images.

GRAY SCALE IMAGES



Result Table 2: Comparison of Visual Model, Visual Texture Model and Proposed Model with Gray Scale Dataset Images.

Image	PSNR (VM)	PSNR (VTM)	PSNR (PM)
1.jpg	24.8444	25.2835	25.7478
10.jpg	22.7478	24.4077	23.9961
11.jpg	19.7335	20.9526	20.5094
12.jpg	26.385	25.3149	28.2354
Image	Delay (VM)	Delay (VTM)	Delay (PM)
1.jpg	0.9764	1.3796	0.4816
10.jpg	1.4523	1.1987	0.337
11.jpg	1.3693	1.2463	0.2534
12.jpg	0.957	0.9299	0.2767
Image	Corr (VM)	Corr (VTM)	Corr (PM)
1.jpg	0.9309	0.8039	0.9762
10.jpg	0.9694	0.8724	0.9928
11.jpg	0.9714	0.8991	0.9834
12.jpg	0.9246	0.8794	0.9885

Direct Enhancement Algorithm	y1	y2	Coefficient Mapping	Brightness Adjustment	Dynamic Range Compression
Multi-scale unsharp-overlaying	0	0	Linear	No	No
Laine's Algorithm	0	0	Non linear	No	No
Tang's Algorithm	1	0	Linear	No	No
Proposed method	Var	Var	Non linear	Yes	Yes

Table 3: Assessment of current direct enhancement algorithms with proposed approach.

5. APPLICATIONS

1. Underwater Navigation

In the course of the navigation, the movement of underwater automobiles is based upon on the clarity of the underwater image/video to discover the previously constructed map.

2. Tracking of Underwater Objects

In lots of applications, the detection of underwater devices is hard to perform. In the underwater surroundings, the visibility is very horrible due to the optic digicam, there can be sunlight or turbidity within the environment of underwater.

3. Image sharpening and restoration

Photograph sharpening and healing refers right here to technique pics which have been captured from the contemporary camera to lead them to a better photograph or to control the ones snap shots in way to gain desired result.

6.CONCLUSION

On this paper, for comparative analysis of underwater picture enhancement using retina model, we have proposed to make the most photograph blurriness to degree the scene intensity in place of the usage of dcp and we advise a brand-new underwater photograph enhancement method which could solve the troubles caused by the mild absorption and particle scattering existed in the surroundings beneath water. The method improves the visible super of images and corrects the distorted color solid of uncooked photographs. Combining photograph blurriness with dcp we supplied appealing more images. The intensity

estimation based totally on blurriness is tested to paintings properly for an extensive form of pix.

REFERENCES

[1] Yong-Jie Li, Senior Member, IEEE, Ming Zhang, Qian Zhao, Xian-Shi Zhang, 2013 "Underwater Image Enhancement using Adaptive Retinal Mechanisms"

[2] Om kumarisoni, jamvant singh kumare branch of cse/it madhav institute of technology and science, gwalior (m.P.), india 2020 "a survey on underwater snap shots enhancement techniques"

[3] Kun xie,wei pan and suxiaxu fujian key laboratory of mind-stimulated computing technique and packages, college of records technological understanding and engineering, xiamen college,; (k.X.),2018"anunderwaterimage enhancement set of rules for environment reputation and robot navigation".

[4] Donghui Wei 1. School of Astronautics, BeijingUniversity2.BeijingElectroMechanicalEngineeringInstitute Beijing, 100191, IEEE,2017" A Two-Step Approach for Underwater Image Enhancement"

[5] Chong-Yi Li, Student Member, IEEE, Ji-Chang Guo, Run-Min Cong, Student Member, IEEE, DEC 2016" Underwater photograph enhancement dehazing with minimum facts loss and histogram distribution earlier.

[6] Shahan C. Nercessian, Student Member, IEEE, Karen A. Panetta, Fellow, IEEE, and SOS. S. Agaian, Senior Member, IEEE, 2013" Non-linear direct multi-scale photo enhancement primarily based on the luminance and contrast covering characteristics of the human visible gadget.

[7] hitam,m.s.yussof,e.walludin,andz.bachok,"mixture Assessment constrained adaptive histogram equalization for underwater photo enhancement," 2013.

[8] tatsuya baba, keishunakamura, seisukekyochi, and masahiro okuda,ieee 2017," image enhncement method for underwater images Based on discrete cosine Eigen basis transformation".

[9] Okay. Tang, j. Yang, and j. Wang, "investigating haze-applicable functions in a studying framework for picture dehazing," in proc. Ieee cvpr, jun. 2014, pp. 2995–3002.

[10] H. Lu, Y. Li, and S. Serikawa, "underwater photo enhancement the usage of guided trigonometric bilateral clear out and fast computerized color correction," in image processing (ICIP), 2013 20th ieee worldwide conference on. IEEE, 2013, pp. 3412–3416

[11] X. Fu, P. Zhuang, Y. Huang, Y. Liao, X.-P. Zhang, and X. Ding, "A retinex-based enhancing approach for single underwater image," in 2014.