The underwater image enhancement and edge Preserving using Optimized GA

Sapna Yadav[1] , Bhupendra Verma[2]
Department of ECE
[1]NITM Datiya, India
[2]Assistant Professor,NITM Datiya, India

Abstract-*This Image enhancement (IE) methods present as a preprocessing step in object finding and credit in computer vision applications. The nature of underwater images (UI) is terrible because of precise engendering belongings of mild in water. In this manner, underwater image enhancement (UIE) is important to increment visible great. In this studies, supplied an UIE and Edge keeping the usage of an optimized genetic algorithms (GA).Utilizing GA Optimization, it's far accomplished through not unusual trade of genetic material between mother and father. Offspring's are framed from parent qualities. Wellness of offspring's is classed. The fittest human beings are accepted to breed as it were. In PC global, genetic material is supplanted through collection of bits and ordinary desire supplanted with the aid of a fitness function. Matting of mother and father is represented by using cross-over and mutation operations. The ordinary overall performance evaluation founded on the peak sign noise ratio (PSNR) and entropy. The comparison of our proposed is on PSNR which suggests better than previous strategies (Base, CLAHE and Homomorphic Filtering (HF) The experimental database contains underwater image, seawater image.*

Keywords*-*under water image enhancement; SPN; SN; GN; MF; WF;

I. INTRODUCTION

As a outcome of the negative visibility situations the environment of the world's oceans remains to be now not nicely. Explored for this intent UIE techniques are used, considering the earth is an aquatic planet and because the fact about 70%of its floor is covered by way of water. Now a day there's a strong interest in knowing what lies in underwater, and furthermore, this subject has made an value to the use of underwater sequences to monitor marine species, underwater mountains & vegetation, to achieve this cause it's surely fundamental to make use of the clear picture [1].

Clear UIs have a immoderate significance in scientific operations like taking a census of sea population. Almost usually UI going through low visibility problems. For taking pictures a transparent sizeable UI, water have were given to be a limpid or clear, however evidently the complete water is turbid with debris equivalent to sand, planktons, minerals. As outdoor pictures are distorted whilst you deliberate that of debris praise within the air, like that UIs additionally get distorted on account that of debris present within the water [2] UIs become more and more hazy or less obvious as water depth increases.

II. LITERATURE SURVEY

JingqiAo et al. [3] Brought a unique adjustment of Computation Unified Device Architecture with a wavelet tree dependent method for Image Compression (IC). Both transform in addition to encoding stage of the picture density manner have been upgraded for parallelization as well as efficiency. The proposed algorithm operated faster as compared to a lossless JPEG-XR method providing higher compression ratio. More improvements in speed and flexibility are additionally below present day exam.

ZhinoosRazaviHesabi et al. [4] present to Principal Component Analysis had been implemented on a series of images that combine to give the needed reference models. The outcomes conducted on X-ray photographs proven that the proposed method done 20% increment over the traditional lossless strategies of IC.

K.Rajakumar et. al. [5] analyzed the execution of Integer Multi-wavelet Transform (WT) method used for Lossless image density and discovered that it can without difficulty be applied in loss less picture density. The satisfactory of compressed portraits was once nearly the identical because the original image. The proposed technique gave higher outcomes while used with artificial picture as well as pictures that had excessive frequency facts

ArifSamehArif et al. [6] proposed a proficient method for compression of fluoroscopic pictures through the usage of loss much less method. The results of proposed technique showed an improvement in the compression ratio by approximately 400% when the comparison was made with existing techniques.

Klaus Hildebrandt, wt.al. [7]Anisotropic denoising focuses on the conservation of significant surface features like sharp edges and corners by employing smoothing relying on direction . For example, a sharp edge leftover sharp on smoothing across the edge.

Anutam, wt.al. [8]The most significant charactristics of an image noise removing model is that it should fully eliminate noise as far as possible as well as uphold edges. Discrete wavelet transform is omnipotent strategy in the arena of denoising .

III. PROPOSED METHODOLOGY

In order to deal with underwater image processing (UIP), we should recollect first of all the fundamental physics of the light propagation in the water medium. Physical properties of the medium cause degradation effects not present in normal images taken in air. UIs are basically characterized by using their bad visibility due to the fact mild is exponentially attenuated as it travels in the water and the scenes end result badly contrasted and hazy. Light attenuation limits the visibility distance at approximately twenty meters in clean water and five meters or less in turbid water. The mild attenuation method is due to absorption (which removes light energy) and scattering (which adjustments the course of mild route). The absorption and scattering processes of the mild in water have an impact on the general overall performance of UI imaging structures. Forward scattering (randomly deviated mild on its manner from an object to the digital camera) commonly results in blurring of the picture capabilities. On the opposite hand, backward scattering (the fraction of the mild pondered by means of the water toward the digital camera before it without a doubt reaches the objects inside the scene) normally limits the comparison of the pictures, producing a function veil that superimposes itself at the picture and hides the scene. Absorption and scattering results are due now not most effective to the water itself however also to different components consisting of dissolved natural remember or small observable floating particles. The presence of the floating particles known as "marine snow" (particularly variable in kind and attention) growth absorption and scattering outcomes. The visibility range can be extended with synthetic lights but those sources not only suffer from the difficulties described earlier than (scattering and absorption), but similarly have a tendency to illuminate the scene in a non uniform fashion, producing a shiny spot within the center of the photo with a poorly illuminated area surrounding it.

Speckle is a granular 'noise' that inherently exists in and degrades the nice of the lively radar, synthetic aperture radar (SAR), medical ultrasound and optical coherence tomography pictures. The massive majority of surfaces, artificial or herbal, are extraordinarily hard on the scale of the wavelength. Images acquired from these surfaces through coherent imaging systems along with laser, SAR, and ultrasound suffer from a not unusual phenomenon known as speckle. Speckle, in both instances, is broadly speaking because of the interference of the returning wave at the transducer aperture. The origin of this noise is visible if we model our reflectivity characteristic as an array of scatterers. Because of the finite decision, at any time we're receiving from a distribution of scatterers inside the resolution cellular. These scattered alerts add coherently; this is, they upload constructively and destructively depending at the relative phases of each scattered waveform. Speckle noise (SN) effects from those patterns of optimistic and destructive interference proven as vibrant and darkish dots within the picture.

Gaussian noise (GN) is statistical noise that has a possibility density feature (abbreviated pdf) of the ordinary distribution (also known as Gaussian distribution). In other words, the values that the noise can take on are Gaussian-distributed. GN is nicely described because the noise with a Gaussian amplitude distribution. Noise is modeled as additive white Gaussian noise (AWGN), wherein all of the pictures pixels deviate from their original values following the Gaussian curve. That is, for each image pixel with intensity value fij ($1 \leq i \leq m$, $1 \leq j \leq n$ for an m x n image), the corresponding pixel of the noisy image gij is given by, gi,j= fi,j + ni,j where, each noise value n is drawn from a zero - mean Gaussian distribution.

Salt and pepper noise (SPN) is a form of noise typically seen on images. It represents itself as randomly going on white and black pixels. A “spike” or impulse noise drives the depth values of random pixels to reach their maximum or minimum values. The resulting black and white flecks in the picture resemble salt and pepper. This form of noise is likewise due to errors in data transmission.

Median filtering (MF) follows this fundamental prescription. The MF is generally used to lessen noise in an image, really like the MF. However, it regularly does a better task than the suggest clear out of maintaining beneficial detail inside the picture. This magnificence of filter belongs to the magnificence of facet preserving smoothing filters which might be non-linear filters. This manner that for 2 photographs A(x) and B(x):

$$\text{Median}[A(x)+B(x)] \neq \text{median}\ [B(x)]$$

These filter easy the information whilst keeping the small and sharp info. The median is just the center fee of all the values of the pixels in the community. Note that this is not the same as the average (or mean); instead, the median has half the values in the neighborhood larger and half smaller. The median is a more potent "valuable indicator" than the average. In specific, the median is not often suffering from a small amount of discrepant values the various pixels in the community. Consequently, MF is very effective at eliminating numerous sorts of noise.

The wiener function is derived from the Wiener filter (WF) techniques which is also been a type of linear filter. Appling the WFs in a picture adaptively, tailoring itself to the nearby picture variance. It smoothen the image at low variance. Similarly, it also smoothen the picture more when the variance high. This filter provides better results compared to the linear filter. It performs well when the noise is constant-power "white" additive noise, such as GN.

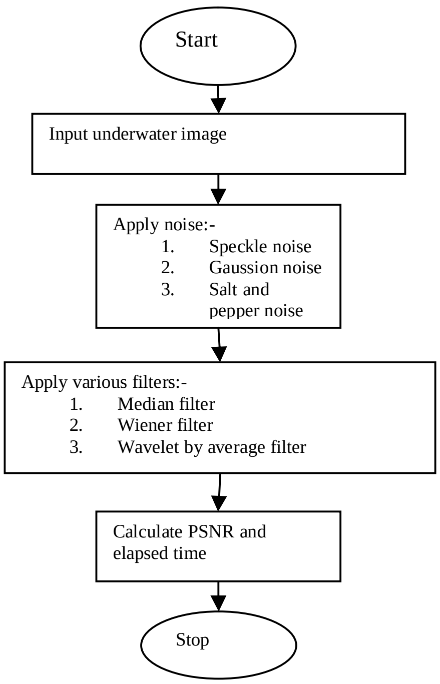


Fig. 1. Flow diagram of proposed methodology

IV. RESULT SIMULATION

Fig. 2. Underwater image dataset

Fig 3 Image enhancement using CLAHE and Base approach

Comparison of PSNR value of CLAHE and Base approach

Image	CLAHE-PSNR	Base approach-PSNR
1	11.2901	47.7178
2	15.471	47.6597
3	19.3978	47.6006
4	19.7511	47.6177
5	18.8848	47.58
6	14.8714	47.6258
7	9.25368	47.5656
8	15.9078	47.6613
9	14.334	47.702

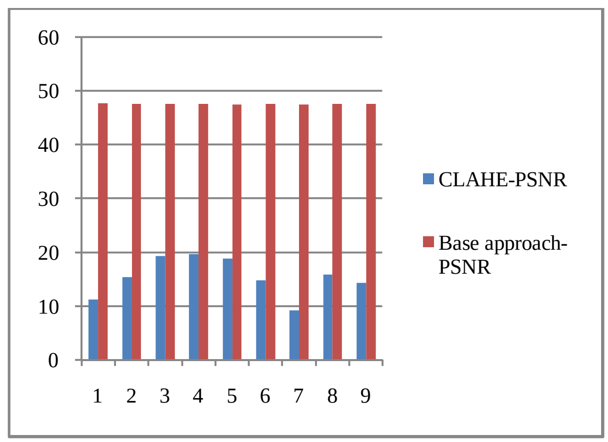


Fig 4 Comparison of PSNR value of CLAHE and Base approach

Comparison of processing time of CLAHE and Base approach

Image	CLAHE-Time	Base approach time
1	0.954492	1.80334
2	0.521832	0.57945
3	0.417388	0.5454
4	0.421435	0.527964
5	0.412794	0.543536
6	0.405259	0.525922
7	0.420822	0.489978
8	0.396419	0.511607
9	0.511534	0.514893

Fig. 5. Comparison of processing time of CLAHE and Base approach

Comparison Of Psnr, Mse And Time Of Median Filter, Wiener Filter And Average Filter On Speckle Noise

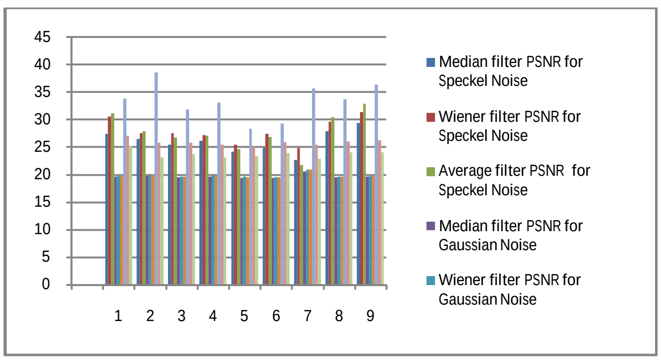
Image	Speckel Noise								
	Median filter PSNR	Wiener filter PSNR	Average filter PSNR	Median filter MSE	Wiener filter MSE	Average filter MSE	Median filter Time	Wiener filter Time	Average filter Time
1	27.4219	30.5741	31.1347	87.3982	58.3985	56.651	0.681492	0.682875	1.65305
2	26.5683	27.5009	27.9152	80.9376	58.3926	57.7835	0.0813959	0.150575	1.14578
3	25.4085	27.5783	26.7462	93.4565	67.8586	70.3731	0.0987711	0.129525	1.04293
4	26.1298	27.2376	27.138	85.5359	66.3008	66.4801	0.0841294	0.13692	1.08511
5	24.2242	25.4944	24.6708	103.657	87.503	87.6307	0.107604	0.128663	1.10981
6	24.8767	27.4485	26.8864	97.0566	64.9598	68.2051	0.0755298	0.125406	1.05828
7	22.7302	24.8302	21.7559	129.276	135.506	134.152	0.0757154	1.35363	2.62186
8	27.8666	29.632	30.4445	82.6379	60.3967	57.0675	0.151325	0.140455	1.21038
9	29.4244	31.3615	32.9093	76.2087	47.3556	45.2776	0.0943027	0.136201	1.11347

Comparison Of Psnr, Mse And Time Of Median Filter, Wiener Filter And Average Filter On Gaussian Noise

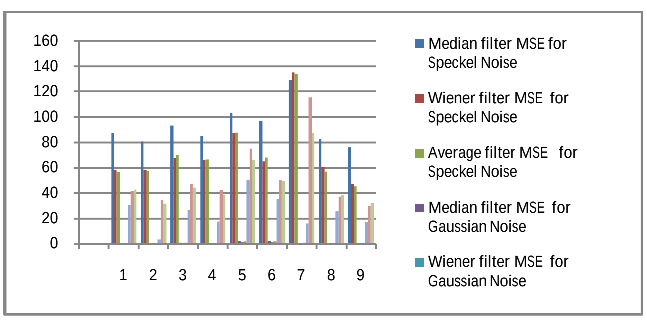
Image	Gaussian Noise								
	Median filter PSNR	Wiener filter PSNR	Average filter PSNR	Median filter MSE	Wiener filter MSE	Average filter MSE	Median filter Time	Wiener filter Time	Average filter Time
1	19.6091	19.757	19.7755	0.179058	0.178623	0.193409	0.078813	0.138214	1.15283
2	19.767	19.949	19.9817	0.058773	0.169304	0.19318	0.0793371	0.125953	1.09377
3	19.5181	19.6423	19.6246	0.872112	0.721462	1.0407	0.0765998	0.127087	1.16566
4	19.6942	19.8518	19.8353	0.635891	0.619709	0.900589	0.0772073	0.139205	1.12431
5	19.4208	19.6029	19.5736	2.71663	1.81179	2.17006	0.0783809	0.140349	1.11978
6	19.3662	19.5409	19.5125	2.39331	1.4862	2.00729	0.0883556	0.1256	1.10721
7	20.6365	20.9344	20.952	0.288834	0.898251	0.95192	0.0778594	0.124664	1.11856
8	19.5764	19.6996	19.7052	0.231071	0.277172	0.343674	0.0768608	0.124749	1.09901
9	19.7007	19.8173	19.8571	0.0694542	0.169945	0.166702	0.0775706	0.129965	1.1403

Comparison Of Psnr, Mse And Time Of Median Filter, Wiener Filter And Average Filter On Salt & Pepper Noise

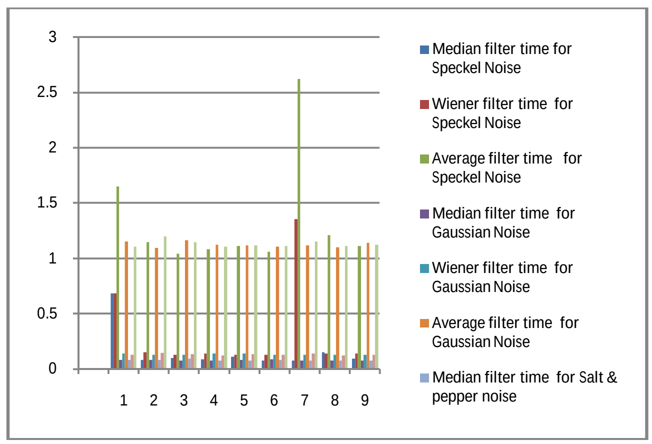
Image	Salt & pepper noise								
	Median filter PSNR	Wiener filter PSNR	Average filter PSNR	Median filter MSE	Wiener filter MSE	Average filter MSE	Median filter Time	Wiener filter Time	Average filter Time
1	33.8503	27.1399	25.2661	30.7259	41.7527	43.0835	0.079492	0.128274	1.10646
2	38.6375	25.8268	23.119	3.78257	34.6643	31.72	0.0795481	0.142148	1.19609
3	31.8594	25.8625	23.6749	26.9413	47.5233	44.202	0.0911507	0.130333	1.14535
4	33.1649	25.4843	23.1133	17.7759	42.5749	39.0937	0.0780215	0.124326	1.10833
5	28.3274	25.0612	23.3249	50.3538	75.3435	65.9971	0.0759679	0.133905	1.1177
6	29.3474	25.9018	23.9271	35.3824	50.5772	49.3718	0.0799567	0.125477	1.1122
7	35.6768	25.4938	22.9321	16.3992	115.616	87.3685	0.0777785	0.138054	1.15121
8	33.7486	26.0833	24.019	25.9634	37.388	38.3457	0.0765459	0.124472	1.11035
9	36.4484	26.299	24.036	17.149	29.9866	32.4794	0.0773956	0.129951	1.12157



Comparison of PSNR value of Median filter, Wiener filter and Average filter on Speckel Noise , Salt & pepper noise and Gaussian Noise



Comparison of MSE value of Median filter, Wiener filter and Average filter on Speckel Noise , Salt & pepper noise and Gaussian Noise



Comparison of processing time of Median filter, Wiener filter and Average filter on Speckel Noise , Salt & pepper noise and Gaussian Noise

V. CONCLUSION

In this work, the proposed technique presents that underwater image enhancement and edge preserving using optimized GA. It allows to performa robust search for discovery the global optimum. The result of the optimization be contingent on the chromosome encoding scheme and involvement of genetic operators as well as on the fitness function. Therefore, to getaextra accurate solution one needs to upsurge the length of the strings, though this will increase the computation time.The experimental effect suggests that the simpler performance as compared to previous ways on the basis of PSNR and entropy. The proposed hybrid method provides a better PSNR in underwater image enhancement where the difficult of low illumination and very poor contrast are prime problems. It can improve the images taken under blurry, stormy conditions. This system improves the image superiority and preserves the edges of an image. In the future work, we will try to decrease the computational time of GA and merge with other optimization algorithm.

REFERENCES

[1] PoojaSahu, Neelesh Gupta, Neetu Sharma "A Survey on Underwater Image Enhancement Techniques" International Journal of Computer Applications (0975 – 8887) Volume 87 – No.13, February 2014.

[2] BhanudasSandbhor* , G. U. Kharat "A Review on Underwater Image Enhancement Techniques" International Journal of Advanced Research in Computer Science and Software Engineering Volume 5, Issue 5, MAY 2015.

[3] JingqiAo, SunandaMitra& Brian Nutter, "Fast and efficient lossless image compression based on CUDA parallel wavelet tree encoding". IEEE Southwest Symposium in Image Analysis and Interpretation (SSIAI), pp. 21-24,2014.

[4] ZhinoosRazaviHesabi, Mohsen Sardari, Ahmad Beirami, FaramarzFekri, Mohamed Deriche, & Antonio Navarro, "A memOly-assisted lossless compression algorithm for medical images", IEEE International Conference in Acoustics, Speech and Signal Processing (lCASSP), pp. 2030-2034,2014.

[5] K.Rajakumar&T.Arivoli, "Implementation of Multiwavelet Transform coding for lossless image compression", IEEE International Conference in Information Communication and Embedded Systems (ICICES), pp. 634-637,2013

[6] ArifSamehArif, SarinaMansor, RajasvaranLogeswaran&Hezerul Abdul Karim, "Auto-shape Lossless Compression of Phmynx and Esophagus Fluoroscopic Images", Springer ScienceBusiness Media New York 2015.

[7] Klaus Hildebrandt, Konrad Polthier", Anisotropic Filtering of Non-Linear Surface Features", c The Eurographics Association and Blackwell Publishing 2004. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA., Volume 23 (2004), Number 3

[8] Anutam and Rajni," PERFORMANCE ANALYSIS OF IMAGE DENOISING WITH WAVELET THRESHOLDING METHODS FOR DIFFERENT LEVELS OF DECOMPOSITION, The International Journal of Multimedia & Its Applications (IJMA) Vol.6, No.3, June 2014, DOI : 10.5121/ijma.2014.6303