Novel Approach of Underwater Image Enhancement by Convex Optimization with Swarm Intelligence

Er. Himanshu Kashyap[1], Er.Reena Sharma[2]
[1]*M.Tech Scholar, Department of EC, Punjab College of Engineering & Technology*
[2]*Assistant Professor, Department of EC, Punjab College of Engineering & Technology*

Abstract: In this paper, we develop a novel method for stitching underwater images. We adopt dehazing to not only improve the aesthetic quality of the images but also to enable feature detectors to accurately detect and match feature points. We also adopt guided image filtering to improve the speed of the dehazing algorithm. A novel idea proposed in this method is to use colour transfer to transform images into the same color space in order to reduce lighting in homogeneities which optimize particle swarm optimization. We further process our stitched results by applying a graph-cut strategy that operates in the image gradient domain over the overlapping regions to improve blurring and ghosting effects caused by local misalignments. Finally, we apply a transition smoothing method to produce more plausible results and to reduce the noticeability of the joining regions to an even higher degree.

Keywords: *underwater image ,PSO,blurness*

I. INTRODUCTION

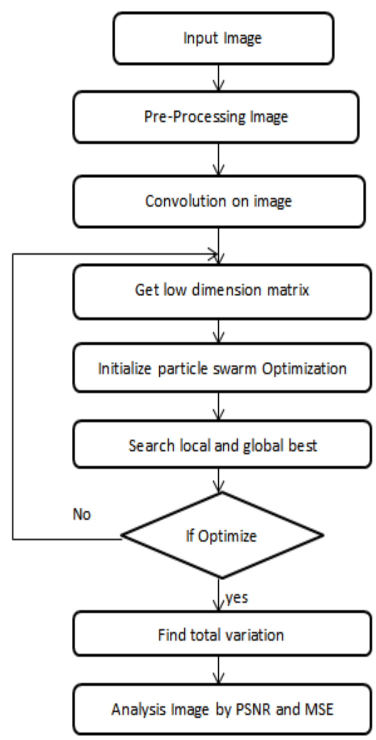
Underwater Image Enhancement: It is the process of enhancing image quality underwater by de-noising. Underwater images are categorized by their poor visibility due to the light attenuation inside the water, which results in images with low brightness and low contrast Therefore, processing of such images is needed to improve the quality and to retrieve the information. Major work has been done in Image Color Correction and Image Enhancement to improve the quality of image. Visibility restoration is a process which belongs to reduce of removes the deterioration or degradation of images that have occurred due to relative camera motion, mis-focus of camera and atmospheric condition etc. In this part we are discussing on degradation occurred due to bad weather and in Haze weather conditions. Degradation in images also occurred due to scattering of light before reaching the camera due to large amount of suspended particles present in the water. This thing affects the monitoring system and smart transportation system. Scattering is occurred due to basic phenomena like attenuation and air light. Removal of Haze of fog from the image improves the robustness and stability of the visual system. It is a difficult task because fog depends upon unknown scene depth map information. Fog effect is the result of distance between camera and object. Hence removal of fog requires the estimation of airlight map or depth map. The current haze removal method can be divided into two categories: (a) image enhancement and (b) image restoration. Ancuti, Codruta O., et al. proposed color balance and fusion for under water image enhancement. This method is proposed on single image and not required any additional hardware. In this associate weight maps are used to transfer the edges and color contrast to output image. Artifacts are created in low frequency component of reconstructed images. This method improves the global contrast, edges sharpness and reduced dark regions [1]. Huang, Dongmei, et al. proposed relative global histogram stretching for water image enhancement approach. This approach consists of two parts that are color correction and contrast correction. In contrast correction method RGB color space is used and redistributes each RGB channel histogram. These dynamic parameters are related to intensity distribution of original image and wavelength attenuation of different color underwater. To reduce the noise from the image bi-lateral filtering is used and enhances the local information of shallow water image [2]. Li, Chongyi, et al. under water image enhancement is done by image color correction method which is based on weakly supervised color transfer. This approach solved the problem of color distortion. In this approach multi-term loss function is used for measure adversial loss, similarity index measure loss, and cycle consistency loss. The results of the proposed approach are better in image enhancement and it improves the performance of vision tasks [3].

II. LITERATURE REVIEW

Underwater images are degraded by scattering of light and noise in the water. In this work polarization information is used which has efficiency to improve the quality of image in scattering medium. Non-uniform optical field image recovery method is proposed in this paper [4]. This method enhance the quality of image and gives better performance from existing method. The introduced approach is used to solve the problem of underwater depth map estimation problems that are occurring in low intensity of light. This problem is solved by using deep neural network by depth estimation. The results of the proposed approach outperforms and effective [5]. In Underwater images the physical properties of water lead to attenuation of light which travel through water channel. This generates the low contrast and color cast in images. In this paper the author proposed the combination of two approaches that are Adaptive linear stretch method to improve the image quality at low cost at the same time. Threshold id reduced from the histogram by using adaptable threshold. This method reduces the color cast and enhances the image contrast. The computation consumption is low in the proposed method [6]. Underwater imaging is done to explore the underwater image environment. These images are used for microscopic detection, mine detection, telecommunication cables, and underwater vehicles. These images are disrupted by noise, color distortion and scattering of light which causes blurness and greenish tone. Underwater image enhancement is divided into two methods that are image dehazing and image color restoration. Demonstrated a detailed survey of the approaches and methods that used in underwater image enhancement and summary on underwater image processing methods [7].The author worked upon the underwater wireless sensor networks. This network faces some issues like packet loss, battery and propagation delay. The sensor that are deployed in water called mobile and the main challenge in them are data packets. Various protocols are proposed for the reliable and safe data transfer but that are not fully reliable. Robust and efficient Routing protocol is proposed in this paper for static communication between two nodes in UWSN. It assigns the rank to each node for effective communication routing path. This protocol enhanced the packet delivery ratio[8].In this paper the author works on the underwater wireless sensor networks. The proposed method solves the mobility issue in the nodes present underwater. The author proposed 3 dimensional image enhancement approach named as KRUSH-D. This approach solves the mobility issue and maintains communication network at the same time. It uses Kruskal Algorithm for path selection and Euclidean distance method for distance measurement. This method provides a reliable communication network in underwater[9].Underwater image enhancement is attractive research area due to the degradation occurred by scattering and absorption of light. In this paper, the author proposed Retinex method which is a combination from retina and cortex. This method uses bi-lateratel and tri-lateral filters for the images. Performance evaluation of the proposed method is done by comparing with existing method [10]. In this paper, the author design and implement a low-cost guided image filter for underwater image enhancement. This method is based on TSMC and CMOS technology and operates on high power to support full HD image enhancement. It provides high throughput and effective frame rate [11]. Underwater image and video dehazing is done by using Haze region segmentation approach. It improves the visibility in images and videos by detecting the segmented image regions. Illuminant elimination is done by using white balancing approach. This method reduces the color cast and enhances the image contrast. The computation consumption is low in the introduced method [12].The approach proposed in this paper is used to solve the problem of underwater depth map estimation problems that are occurring in low intensity of light. This problem is solved by using deep neural network by depth estimation. The results of the proposed approach outperforms and effective [13].Underwater image enhancement is done by using wavelet decomposition. In frequency domain fusion based strategy is applied. This fusion process gives two inputs that are color corrected and contrast enhanced images which are extracted from the original underwater image. These images are divided into low and high frequency component by wavelet operator. Average weight is given to the low frequency for fusion and high frequency component by Multi-scale fusion process[14].

III. PROPOSED METHODLOGY

PSO stands for particle swarm optimization**.** PSO is a stochastic optimization algorithm which is based on the behavior of birds. It works similar to the genetic algorithm. In PSO is initialized with a group of random particles. In every iteration, each particle is updated by the two "best" values. The first best solution shows the fitness of the particles and this called as pbest. The second best value is tracked by the optimizer is the best value. This value is called as global best (gbest).When a particle takes part of the population as its topological neighbors; the best value is a local best and is called lbest.



Methodology

Step 1: Input the Image.

Step 2: Preprocessed the image and removes the noise data from it.

Step 3: Apply convolution Process on image.

Step 4: After convolution low dimension matrix is produced.

Step 5: Initialize the PSO algorithm.

Step 6: Search local and global best by PSO.

Step 7: Check the output is optimized or not if optimized the go to step 8 otherwise go to step 4.

Step 8: Calculate the total variation.

Step 9: Analyze the PSNR and MSE of the Image.

IV. RESULTS

In this section results and discussion is done on the basis of PSNR and MSE performance parameters. The results show on the different images and also difference in their existing and new outcomes.

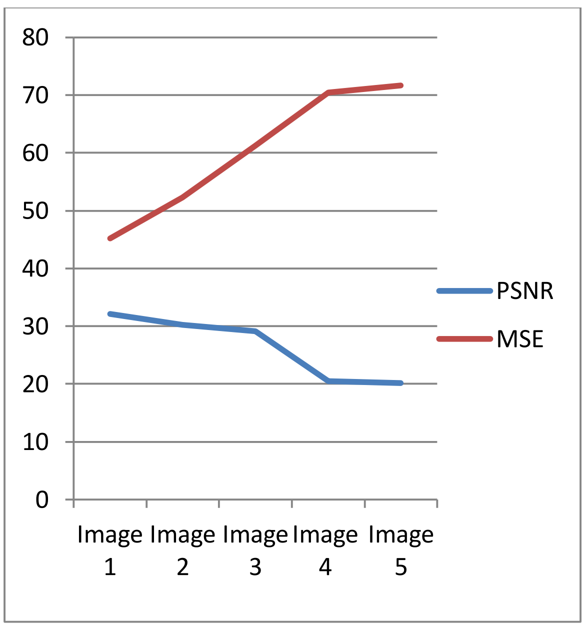


Figure 5.3 Graph of PSNR and MSE of previous results

Figure 5.3 depicts the PSNR and MSE value of the five images in existing approach. This graph shows two lines in which red line indicates the MSE value of images and blue line indicates the PSNR of the images. The position of lines changes according to the variation in the results.

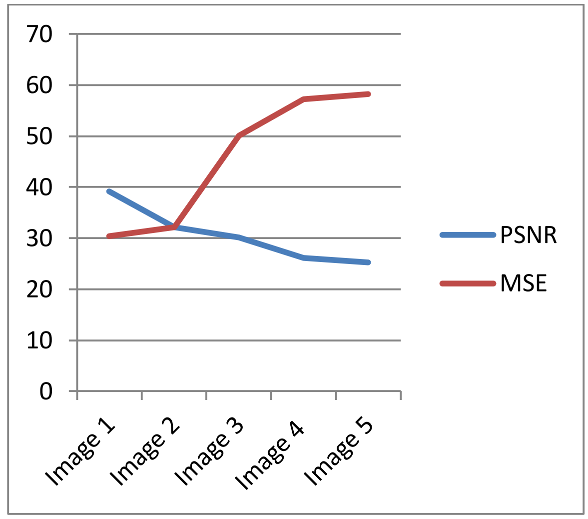


Figure 4.1 Graph of PSNR and MSE of proposed method

Figure 4.1 demonstrate the value of PSNR and MSE of five images in the proposed method. This graph shows two lines in which red line indicates the MSE value of images and blue line indicates the PSNR of the images. The position of lines changes according to the variation in the results.

V. CONCLUSION

This paper has presented a novel approach for stitching images acquired underwater which is able to tackle the problems that arise when using common image stitching methods on underwater images. In the first step, dehazing optimize by particle swarm optimization is used to improve the aesthetic quality of images as well as to improve data quality for the task of feature detection. Guided image filtering is used to speed up the process of dehazing the images. Then SIFT is used to find and match features between images and a single homography per image was used to perform alignment. In the next step, a graph cuts-based seam cutting method in the image gradient domain is used to find the optimal cut between two images in order to reduce visible seams in the overlapped regions. While producing an image with no overlaps using seam cutting, we use linear blending to reduce colour discontinuities that may still exist. A novel idea proposed in this method is to use colour normalization to transform images into the same colour space to make the stitching result even more “seamless”

VI. REFERENCES

[1]. Ancuti, Codruta O., et al. "Color balance and fusion for underwater image enhancement." *IEEE Transactions on Image Processing* 27.1 (2018): 379-393.

[2]. Huang, Dongmei, et al. "Shallow-Water Image Enhancement Using Relative Global Histogram Stretching Based on Adaptive Parameter Acquisition." *International Conference on Multimedia Modeling*.Springer, Cham, 2018.

[3]. Li, Chongyi, JichangGuo, and ChunleGuo. "Emerging from Water: Underwater Image Color Correction Based on Weakly Supervised Color Transfer." *IEEE Signal Processing Letters*(2018).

[4]. Hu, Haofeng, et al. "Underwater image recovery under the non-uniform optical field based on polarimetric imaging." *IEEE Photonics Journal* (2018).

[5]. Lu, Huimin, et al. "Underwater Light Field Depth Map Restoration Using Deep Convolutional Neural Fields." *Artificial Intelligence and Robotics*.Springer, Cham, 2018.305-312.

[6]. Ao, Jun, and Chunbo Ma. "Adaptive Stretching Method for Underwater Image Color Correction." *International Journal of Pattern Recognition and Artificial Intelligence* 32.02 (2018): 1854001.

[7]. Han, Min, et al. "A Review on Intelligence Dehazing and Color Restoration for Underwater Images." *IEEE Transactions on Systems, Man, and Cybernetics: Systems* (2018).

[8]. Jain, Rakshit, and NitinRakesh. "Robust and Efficient Routing in Three-Dimensional Underwater Sensor Network." *Proceedings of First International Conference on Smart System, Innovations and Computing*.Springer, Singapore, 2018.

[9]. Walter, Nishit, et al. "KRUSH-D approach for the solution to node mobility issue in Underwater sensor network (UWSN)." *Networking Communication and Data Knowledge Engineering*.Springer, Singapore, 2018.89-98.

[10]. Zhang, Shu, et al. "Underwater image enhancement via extended multi-scale Retinex." *Neurocomputing* 245 (2017): 1-9.

[11]. Chang, Cheng-Hao, et al. "Design and implementation of a low-cost guided image filter for underwater image enhancement." *Dependable and Secure Computing, 2017 IEEE Conference on*.IEEE, 2017.

[12]. Emberton, Simon, Lars Chittka, and Andrea Cavallaro. "Underwater image and video dehazing with pure haze region segmentation." *Computer Vision and Image Understanding*(2017).

[13]. Perez, Javier, et al. "A Deep Learning Approach for Underwater Image Enhancement." *International Work-Conference on the Interplay Between Natural and Artificial Computation*. Springer, Cham, 2017.

[14]. Wang, Yafei, et al. "Fusion-based underwater image enhancement by wavelet decomposition." *Industrial Technology (ICIT), 2017 IEEE International Conference on*.IEEE, 2017.

[15]. Thakare, Shiwam S., and Amit M. Sahu. "Comparative Analysis of Various Underwater Image De-Noising Methods." (2015).

[16]. Saggu, Manpreet Kaur, and Satbir Singh. "A review on various haze removal techniques for image processing." *International Journal of Current Engineering and Technology*. 5.3 (2015): 1500-1505.