A Survey on Techniques for Deblurring Underwater Blur Images

Monali V. Kamdi, Surbhi S Nehare, Prof. A.D.Gotmare
Department of CE, BDCE Wardha MH India

Abstract- Underwater images are originally characterized by accomplished low visibility because light is growing contract as it tour in the water and the scenes result poorly mismatched. The blue color tours the enlarged in the water expected to its shortest observations, building the underwater pictures to be control originally by blue color. In brief, the pictures we are interested go through of one or more of the coming problems: made-drunk visibility, low contrast, non-homogeneous lighting, blurring, honest artifacts, color and noise. Image enhancement need subjective principle to harvest a more optically attractive pictures and they do not commit on any real model for the image architecture.

Keywords- underwater, filtering, enhancement, retinex, denoising

I. INTRODUCTION

Camera movements might result in motion blur in captured images. The blurred image is usually modeled as a convolution between the original image and a known point spread function (PSF). Image restoration techniques are used to remove or minimize known degradations in an image. There are several classical image restoration methods, such as the iterative Lucy–Richardson algorithm and the non-iterative Wiener algorithms [1–2]. Several complex methods such as the Bussgang algorithm [3] have also been proposed. In [4], an adaptive restoration method to adaptively correct retinal images is proposed. This is performed by using deconvolution to remove the residual wave-front aberrations and provide an improvement over the Wiener filter with respect to the quality of restoration. An efficient technique based on physical optics is presented in [5]. In this, space-variant blurs are restored by sectioning using modified Wiener filtering. In [6], an image reconstruction and restoration method using the simplified topological ε-algorithm is proposed. In [7], the generalized Hermitian and skew-Hermitian splitting (GHSS) iterative method is applied to the problem of image restoration.

This paper focuses its attention towards underwater image processing in order to improve the image quality. As most of the images of offshore installations, drinking water reservoir etc. are captured and inspected manually by divers. And manual intervention in this regard is dangerous, costly, time-consuming and yet does not often enable a full assessment. Hence camera based inspection is used to capture the images under water. Using cameras underwater poses major technological challenges. The objects in the underwater images are faint, difficult to view and analyze because the images of such environment loses the details of the object. The underwater images usually suffer from non-uniform lighting, low contrast, skew, blurs and diminished colors. And hence in this research work, a novel method has been proposed for handling underwater image skewing and blurring in case of unidirectional cyclic waves and circular ripples to enhance the visibility of underwater images. The geometric distortion such as skew is caused by the time variant refraction over the dynamic fluids. And this distortion is associated with motion blur depending on the exposure time of camera

II. LITERATURE SURVEY

Quality evaluation of underwater images is a key goal of underwater video image retrieval and intelligent processing. To date, no metric has been proposed for underwater color image quality evaluation (UCIQE). The special absorption and scattering characteristics of the water medium do not allow direct application of natural color image quality metrics especially to different underwater environments. Based on these, a new UCIQE metric, which is a linear combination of chroma, saturation, and contrast, is proposed to quantify the nonuniform color cast, blurring, and low-contrast that characterize underwater engineering and monitoring images. Importantly, UCIQE is a simple and fast solution for real-time underwater video processing. This approach[1] extracts the most relevant statistical features that are representative for underwater image degradations such as colour cast, blurring and noise caused by attenuation, floating particles and lighting. This approach uses the following methods (i) defogging based algorithms – to enhance visibility (ii). contrast stretching methods and the newest image fusion enhancement.

By adopting image blurriness with the image formation model (IFM) [2], there is a way to estimate the distance between scene points and the camera and thereby recover and enhance underwater images. This paper used image blurriness to estimate the depth map for underwater image enhancement. It is based on the observation that objects farther from the camera are more blurry for underwater images.

Blurring and low-contrast are the characteristics of underwater images, which are similar to haze images, is the main challenge in searching of fish from underwater images. To overcome the effects of blurring and low-contrast, apply the dark channel prior [3], which was proposed to remove haze from a single input image. Since the underwater images are similar with the haze images, this method mentioned can be also applied to underwater images. The dark channel prior is based on those most local patches in haze-free outdoor images containing some pixels, which have low intensities in at least one color channel. Using this prior with the hazeimaging model, a high quality haze-free image can be recovered. When the dark channel prior is applied to an underwater image, a clear image is generated.

Objects look very different in the underwater environment compared to their appearance in sunlight. High quality images with correct colouring simplify the detection of underwater objects and may allow the use of visual SLAM algorithms developed for land-based robots underwater. Hence, image processing is required to obtain images of high quality and correct colouring. Current algorithms focus on the colour reconstruction[4] of scenery at diving depth which has the advantage that a significant part of sunlight is still present and different colours can still be distinguished. At greater depth the filtering is much stronger such that this is no longer possible. In this study it is investigated whether machine learning can be used to transform image data. In order to obtain images under underwater lighting conditions in a controlled environment a special light source with a defined wavelength is used for illumination of test objects in a laboratory setup. The images are then fed through statistical learning algorithms with or without pre-filters. It is shown that k nearest neighbour and support vector machines are most suitable for the given task and yield excellent results.

Spatial and frequency domain filtering and linear filtering methods are conceptually pleasing and extremely useful in many applications [6]. The spatial filtering is used in spatial domain in the image plane by directly manipulating neighborhood pixels with the help of convolution kernels (Andrews, Hunt, 1987). In frequency domain filtering, if it neglects the presence of interference in the image and restoration is on the footing of the frequency response of correction filter, which was set up for the inverse of the frequency response [7]. This inverse filtering has developed in the frequency domain with the help of FFT. But image restoration by direct inversion was ill-posed owing to the presence of observation noise [8-9]. Direct inversion had caused oscillation due to noise amplification solution [10]. Stephen E. Reichenbach et al. has used corresponding spatial frequency-domain acquisition model. In this model they were designed, small convolution kernels for the restoration of Advanced Very High Resolution Radiometer (AVHRR) images. Small kernels were carried out efficiently by convolution which corrected the degradations and increased apparent resolution of the image. In this restoration, convolution kernels were maximized image fidelity subject to explicit constraints on the spatial support and resolution of the kernel. It was designed with greater resolution than the image to perform partial reconstruction for geometric correction and other remapping operations [11].

To overcome the problems of the inverse filtering Wiener filter is used. It requires extensive priori information i. e. spectra of the original image and the noise. [5]. In 1977, A.K.Jain had proposed that the Wiener filter equation, it can be numerically achieved via a fast sine-transform algorithm which is related to the fast-fourier transform (FFT) algorithm. The factorization provides a fast Wiener restoration scheme for large size images with narrow PSF. This approach has reduced the memory storage and computational requirement for overall restoration [6]. Then in 1982, Chellapa had presented Wiener restoration technique which did not require the availability of prototypes of the original image [7]. In 1986, M. S. Ahmed and K. K. Tahboub had proposed recursive Wiener filtering that exploits the band structure of the correlation matrices of a noisy image. The recursive Wiener filtering was computationally simpler than classical wiener filtering. The sharpness and contrast of restored image were improved with the assumed width of band of correlation matrices. But the computational requirement increase with the assumed width of the band [18]. In 1990, Allen D. Hillery and Chin have proposed iterative Wiener filter for number of degraded images and very high noise level images [9].

III. CONCLUSION

In this paper, an overview of different underwater superresolution techniques has been presented. Different techniques involve the use of various types of filtering, out of which, homomorphic filtering and bilateral filtering are the most important ones. Retinex theory, wavelet denoising and CLAHE are some other methods of underwater image enhancement techniques.

IV. REFERENCES

[1]. Ancuti, C., Ancuti, C. O., Haber, T., Bekaert, P. 2012. Enhancing underwater images and video by fusion. IEEE International Conference on Computer Vision and Pattern Recognition (CVPR). Providence, RI. 16-21 June 2012. pp. 81-88.

[2]. Anthoni, J. F. 2012. Water and Light in Underwater Photography. http://www.seafriends.org.nz/phgraph/water.htm, excessed on September 2012.

[3]. Arici, T., Dikbas, S., Altunbasak, Y. 2009. A Histogram Modification Framework and Its Application for Image Contrast Enhancement. IEEE Transactions on Image Processing, September 2009, 18(9), pp. 1921-1935.

[4]. Arnold-Bos, A., Malkasse, J. P., and Kerven, G. 2005a. A preprocessing framework for automatic underwater images denoising. Proceedings of the European Conference on Propagation and Systems.

[5]. Brest, France. March 2005. Arnold-Bos, A., Malkasset, J. P., Kervern, G. 2005b. Towards a model-free denoising of underwater optical images. Proceedings of the IEEE Europe Oceans Conference, Brest, France. June 2005. Vol. 1, pp. 527–532.

[6]. Bazeille, S., Quidu, I., Jaulin, L., Malkasse, J. P. 2006. Automatic underwater image preprocessing. Proceedings of the Caracterisation du Milieu Marin (CMM '06). Brest, France, 16-19 October 2006.

[7]. Foresti, G. L. 2001. Visual inspection of sea bottom structures by an autonomous underwater vehicle. IEEE Transaction on Systems, Man and Cybernetics, Part B, October 2001. 31(5), pp. 691-705.

[8]. Garg, R., Mittal, B., Garg, S. 2011. Histogram Equalization Techniques for Image Enhancement. International Journal of Electronics and Communication Technology, March 2011, 2(1), pp. 107–111.

[9]. Gasparini, F. and Schettini, R. 2003. Color Correction for Digital Photographs. IEEE 12th International Conference on Image Analysis and Processing (ICIAP 2003).

[10]. Mantova, Italy. 17-19 September 2003. pp. 646-651. Gonzalez, R. C. and Woods, R. E. 1992. Digital Image Processing, Addison-Wesley Pub (Sd), Reading, MA, March 1992, 3rd edition.

[11]. Gribbon, K. T. and Bailey, D. G. 2004. A Novel Approach to Real-time Bilinear Interpolation. Proceeding of IEEE International Conference on Field Programmable Technology. 28-30 January 2004, pp. 126-131.

[12]. Hitam, M. S., Yussof, W. N. J. W., Awalludin, E. A., Bachok, Z. 2013. Mixture Contrast Limited Adaptive Histogram Equalization for Underwater Image Enhancement. IEEE International Conference on Computer Applications Technology (ICCAT). Sousse, 20-22 January 2013, pp. 1-5.

[13]. Horváth, G. and Varjú, D. 1995. Underwater refraction-polarization patterns of skylight perceived by aquatic animals through Snell's window of the flat water surface. Journal of Vision Research, June 1995. 35(12), pp. 1651-1666.

[14]. Hsieh, C. H., Chen, B. C., Lin, C. M., Zhao, Q. 2010. Detail aware contrast enhancement with linear image fusion. IEEE International Symposium on Aware Computing (ISAC). Tainan. 1-4 November 2010. pp. 1-5.

[15]. Huai, X., Lee, K., Kim, C. 2010. Image noise reduction by dynamic thresholding of correlated wavelet intensity and anisotropy. International Conference on SoC Design (ISOCC). 22-23 November 2010. Seoul, pp. 28-33.