AN ANALYTICAL SOLUTION OF OVER-ENHANCEMENT PROBLEM IN MIX CLAHE

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ABSTRACT

*In this paper a new algorithm has been designed to remove the problem of over-enhancement found in Mix CLAHE especially for underwater images. The underwater image suffers from low contrast and resolution due to dispossessed visibility circumstances, hence an object identification become typical task. The processing of underwater image captured is necessary because the quality of underwater images distress and these images leads some serious problems when compared to images from a clearer environment. This paper has proposed a hybrid approach which has integrated the MIX-CLAHE with the L*A*B based fuzzy enhancement. The experimental results have shown that the proposed technique outperforms over the available methods.*

Keywords: Fuzzy logic, Mix CLAHE, L*A*B, Underwater images.

I INTRODUCTION

Deprived imaging condition, bad influence of light absorption and dispersal by water molecule, underwater images usually have lower contrast and stronger noise, this is a major problem for many applications of computer vision in underwater images. Underwater image enhancement techniques provided a object detection of the object which is before not exactly visible to reorganization. underwater environment(deep seas and oceans) images get blurred due to deprived visibility conditions and effects “absorption of light”, “reflection of light”, “bending of light, “denser medium of water”, and “scattering of light” etc. These are the important factor which causes the deprived visible condition of underwater images.

Other reason for deprivation of underwater images is light. When ray light go through from air to denser medium water which is 800 times denser the air , its intensity partly reflect back in the air and partly enters in the water . So the partly light which enter the water slowly get start dropping at different distance under the water. E.g. at the beginning the red color starts depart at the depth of 3 m , after that orange color going to be disappear and in this way the rest of all color will gradually going to be depart at particular depth of the water.

II LITERATURE SURVEY

Zhiyuan et al. (2009) [1] has discussed images degraded by fog suffer from poor contrast. In order to remove fog effect, a Contrast Limited Adaptive Histogram Equalization (CLAHE)-based method has been presented.

This method established a maximum value to clip the histogram and redistributes the clipped pixels equally to each gray-level. It can limit the noise while enhancing the image contrast. In this method, firstly, the original image was converted from RGB to HSI. Secondly, the intensity component of the HSI image was processed by CLAHE. Finally, the HSI image was converted back to RGB image. To evaluate the effectiveness of the proposed method, the experiment with a color image degraded by fog and applied the edge detection to the image. The results showed that this method was effective in comparison with traditional methods. Setiawan et al. (2010) [2] proposed new enhancement method using CLAHE in G channel to improve the color retinal image quality. The enhancement process conduct in G channel was appropriate to enhance the color retinal image quality. Yisu et al. (2010) [3] presented a novel method combing Contrast-limited Adaptive Histogram Equalization (CLAHE) and multi-step integral projection. First, after real-time detecting face images, a sigma filter was used to remove the noise in images. Sigma filtering was chosen in this research because of its validity in noise removal. It has the advantages of providing a good noise removal result, not blurring the image and fast performance. Second, since it was important to extract facial features as accurately and clearly as possible, CLAHE was then applied on images for enhancing the facial features. This step was done after the sigma filter in order not to amplify the noise in images. Third, after enhancing these features, multi-step integral projection was proposed to detect the useful facial features regions automatically. Finally, the detected facial feature region was then extracted by Gabor transformation and the final facial expression recognition is classified by SVMs. They tested their system on the JAFFE database and achieved a high recognition rate of 95.318% on trained data. Sundarram et al. (2011) [4] has proposed the Histogram Modified Contrast Limited Adaptive Histogram Equalization (HM- CLAHE) to adjust the level of contrast enhancement, which in turn gave the resultant image a strong contrast and brought the local details for more relevant interpretation. It incorporated both histogram modifications as an optimization technique and Contrast Limited Adaptive Histogram Equalization. This method was tested for Mias mammogram images. The performance of this method was determined using the parameter like Enhancement Measure (EME). From the subjective and quantitative measures it wa interesting that this proposed technique provided better contrast enhancement with preserving the local information of the mammogram images. Hillers et al. (2012) [5] discussed a new method for enhancing the local contrast of high dynamical range images on conventional low dynamical range displays. Here they used the mean shift clustering algorithm to segment the image and enhanced that segmented image by using contrast limited adaptive histogram equalization (CLAHE) in combination with a new kernel based interpolation technique. Here their main application was the enhancement of welding image sequences, but they tested their method on a larger image database. Experiments demonstrated improvements over the traditional CLAHE based image enhancement. Kurt et al. (2012) [6] have proposed a strong hybrid algorithm which included mathematical morphology, anisotropic diffusion filter and contrast limited adaptive histogram equalization (CLAHE) and obtained successful results for much kind of medical images. The main purpose of image enhancement is to process an acquired image for better contrast and visibility of features of interest for visual examination as well as subsequent computer- aided analysis and diagnosis In the study, the authors have used top-hat transform, contrast limited histogram equalization (CLAHE) and anisotropic diffusion filter methods. The system results were satisfactory for many different medical images like lung, breast, brain, knee and etc. Suprijanto et al.

(2012) [7] have discussed the contrast quality of digital image that scanned using transmission and reflection mode was evaluated based on mean and standard deviation of the image. Furthermore, the quality of digital image was enhancement based on spatial technique using contrast stretching, histogram equalization (HE), adaptive histogram equalization (AHE), and contrast limited adaptive histogram equalization (CLAHE). Evaluation of the preference image quality was performed based on an objective criterion. The dental panoramic radiography is one of dental imaging that used to visualize the entirety of the maxilla and mandible jaws on the one image planes. Although the direct digital panoramic radiography has been available, however film- based panoramic radiography is still used on the mostly dental clinic and laboratory in Indonesia. The quality of film-based image has significant limitation due to chemical processing and image enhancement cannot be done if required. Therefore, digitized film-based image to digital image was required to allow image enhancements in order to improve the interpretability quality of information in the image. Digitized film-based image is performed using a flatbed scanner on transmission and reflection mode. Moreover in this paper, the contrast quality of digital image that scanned using both mode is evaluated based on statistic image characteristic. The results showed that the quality of digitized image using transmission mode is better than using reflection mode. However, if direct digital imaging is used as a gold standard, image enhancement on digitized image is still required. Four methods, i.e. contrast stretching, HE, AHE, and CLAHE are used to attempt improve the quality digitized image. Evaluation of the preference image quality was performed based on objective criterion. The preference image quality for digitized panoramic image can be obtained by using image enhancement based on CLAHE-Rayleigh method that indicated by the lowest value of mean, standard deviation, RMSE, and average difference and the higher value of NAE and SAE. Abhishek et al. (2012) [8] has described a novel and efficient fog removal algorithm. Fog formation is due to attenuation and airlight. Attenuation reduces the contrast and airlight increases the whiteness in the scene. Proposed algorithm used bilateral filter for the estimation of airlight and recover scene contrast. Qualitative and quantitative analysis demonstratesd that proposed algorithm performed well in comparison with prior state of the art algorithms. Proposed algorithm was independent of the density of fog and did not require user intervention. It can handle color as well as gray images. The algorithm has a wide application in tracking and navigation, consumer electronics and entertainment industries. Inhye et al. (2012)[9] has described consumer video surveillance systems often suffer from bad weather conditions, observed objects lose visibility and contrast due to the presence of atmospheric haze, fog, and smoke. In this paper, they presented an image defogging algorithm with color correction in the HSV color space for video processing. They first generated a modified transmission map of the image segmentation using multiphase level set formulation from the intensity (V) values. They also estimated atmospheric light in the intensity (V) values. The proposed method can significantly enhance the visibility of foggy video frames using the estimated atmospheric light and the modified transmission map. Another contribution of the proposed work was the compensation of color distortion between consecutive frames using the temporal difference ratio of HSV color channels. Experimental results showed that the proposed method couls be applied to consumer video surveillance systems for removing atmospheric artifacts without color distortion. Ullah et al. (2013) [10] has proposed environmental effects, mist, haze, fog, snow and rain considerably affect visibility and result in degradation of image quality. The poor quality weather-degraded images perpetually affect performance of automated surveillance and tracking systems. Water droplets presented in atmosphere cause mist, fog and haze effects due to scattering of light as it propagates through these particles. These chromatic effects of image scattering can be reversed for retrieval of image information. Scattering of light affects image contents in proportion to the depth of scene. The single image dehazing technique using dark channel prior has been further refined. The proposed model considered chromatic as well achromatic aspects of the image to define the Dark Channel. New definition of Dark Channel improves quality of restored haze free images. Contrast of the restored images has been considerably improved vis-a-vis color fidelity further refined. Major application areas of real time single image dehazing include surveillance and tracking system, consumer electronics and entertainment industry. Hitam et al. (2013) [11] has worked on Mixture contrast limited adaptive histogram equalization for underwater image enhancement. By improving the quality of an underwater image has received substantial attention due to rundown visibility of the image which is caused by physical properties of the water. Here they presented a new technique called hybrid Contrast Limited Adaptive Histogram Equalization (CLAHE) color spaces that specifically developed for underwater image improvement. The technique operated CLAHE on RGB and HSV color spaces and both results were joined together using Euclidean rule. Tentative results show that the future approach considerably improved the visual quality of underwater images by enhancing contrast, as well as dropping noise and artifacts. Sasi et al. (2013) [12] described the effective color model in this paper they work on an efficient color space for the contrast enhancement of myocardial perfusion images. In this, the effects of histogram equalization and contrast limited adaptive histogram equalization(CLAHE) were investigated and out of which one which gives good enhancement results is extended to the suitable color space model with a luminance(Y) and two chrominance components (cb,cr). The color space used either two of the enhancement techniques with which gives better results was chosen practically. Main features of this work was that contrast limited adaptive histogram equalization(CLAHE) technique was applied to the chrominance channels of the cardiac nuclear image, leaving the luminance channel unaffected which resulted in an enhanced image output in color space.

III PROPOSED ALGORITHM

Step 1: Select the image from computer memory in to computer program . Any given digital image is represented as an array size M*N pixels.

Step 2: Apply cubic root based method on given image which will reduce the number of bits in an image.

Step 3: Select the dimension size of an image in order to calculate the values of pixel in a current image which will also helps in obtaining end of file.

Step 4: Repeat the following steps until all the pixels of an image is not checked and end of file is not conquered.

Step 5: Collect all the pixels from mask following different size 3*3 , 5*5 , 7*7 in order to obtain pixels valued in selected mask

Step 6: Apply CLAHE to remove the haze from the images.

Step 7: Convert RGB to L*A*B color space

Step 8: Apply fuzzy based image enhancement on the L compponent of L*A*B color space to enhance the results further.

Step 9: Convert L*A*B to RGB color space

Step 10: Final image which has been visibly more stronger than the input image and the output of the available CLAHE results.

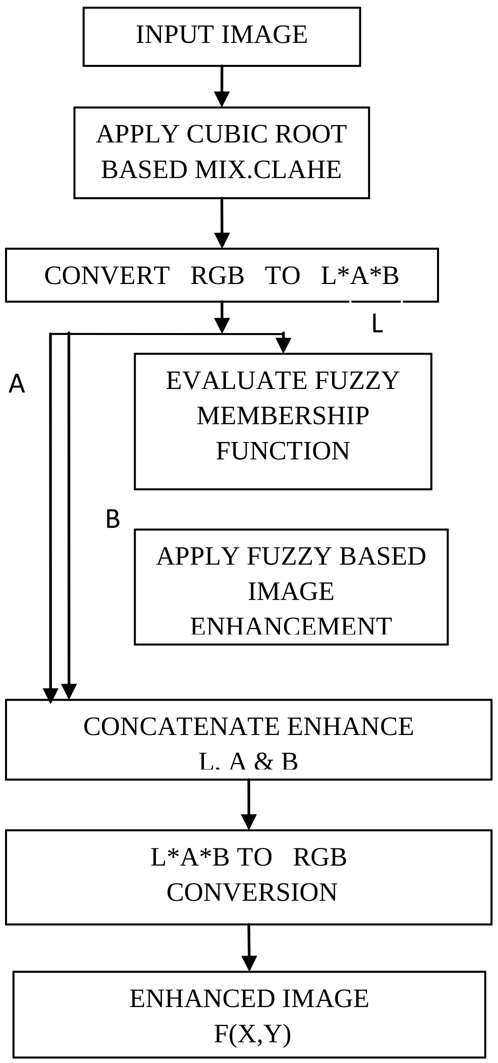

Figure 1: Proposed fuzzy based enhancement using L*a*b

IV RESULTS AND DISCUSSIONS

The proposed algorithm is tested on various images. The algorithm is applied using two performance indices Mean squared error (MSE) and peak signal to noise ratio (PSNR).

4.1 Experimental Set-Up

In order to implement the proposed algorithm, design and implementation has been done in MATLAB using image processing toolbox. Result showed that our proposed approach gives better results than the existing techniques.

Figure 2 has shown the input image which is passed to the simulation.

Figure 2: Input Image

Figure 3 has shown the output of previous filtering technique.

Figure 3: Filtered image

Figure 4: Proposed enhancement method.

After applying proposed enhancement technique Figure 4 has shown the output results are quite effective and has much more better results than the available methods. Thus the proposed algorithm has shown quite significant improvement over the available methods.

4.2 Performance Evaluation

This section contains the cross validation between existing and proposed techniques. Some well-known image performance parameters for digital images have been selected to prove that the performance of the proposed algorithm is quite better than the existing methods.

a) Peak Signal to Noise Ratio

Table 1 is showing the comparative analysis of the Peak Signal to Noise Ratio (PSNR). As PSNR need to be maximized; so the main goal is to increase the PSNR as much as possible.

Table 1: PSNR Evaluation

Images	Existing techniques	Proposed techniques
1	17.31	20.40
2	17.89	19.93
3	9.88	11.19
4	13.41	15.05
5	15.32	17.18
6	12.78	13.66
7	17.59	19.56
8	13.16	13.95
9	20.65	23.03
10	16.00	18.40
11	16.44	17.89

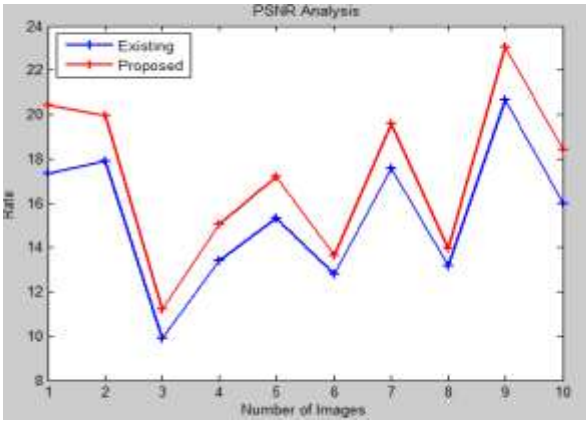

Figure 5: PSNR Analysis

Table 1 has clearly shown that the PSNR is maximum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods. Figure 5 has shown the quantized analysis of the peak signal to noise ratio of different images using fusion. It is very clear from the plot that there is increase in PSNR value of images with the use of proposed method over other methods. This increase represents improvement in the objective quality of the image

b) Mean Square Error

Table 2 is showing the quantized analysis of the mean square error. As mean square error need to be reduced therefore the proposed algorithm is showing the better results than the available methods as mean square error is less in every case.

Table 2: MSE Evaluation

Images	Existing techniques	Proposed techniques
1	1206.39	592.61
2	1054.78	660.20
3	6682.81	4933.47
4	2962.15	2030.38
5	1909.48	1243.70
6	3423.18	2793.16
7	1130.26	718.58
8	3139.90	2614.42
9	559.81	323.42
10	1631.23	938.53
11	1474.59	1056.29

Figure 6 has shown the quantized analysis of the mean square error of different images.

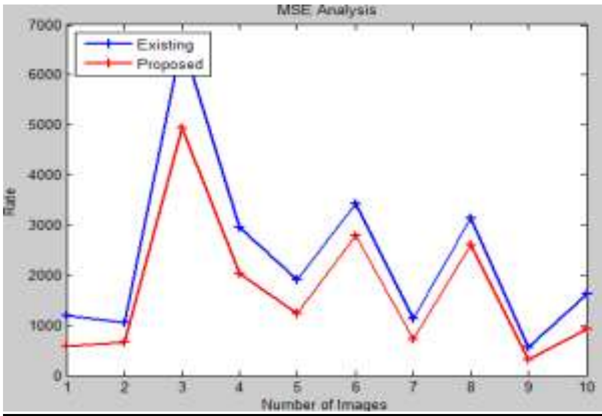

Figure 6: MSE Analysis

It is very clear from the plot that there is decrease in MSE value of images with the use of proposed method over other methods. This decrease represents improvement in the objective quality of the image.

V CONCLUSION AND FUTURE SCOPE

This paper has proposed a new algorithm which has removed the problem of over-enhancement found in Mix CLAHE especially for underwater images. The review analysis has shown that the underwater image suffers from low contrast and resolution due to dispossessed visibility circumstances, hence an object identification become typical task. This paper has offered an hybrid approach which has integrated the MIX-CLAHE with the L*A*B based fuzzy enhancement. The proposed technique has been designed and implemented in the MATLAB using image processing toolbox. The experimental results has shown that the proposed technique outperforms over the available methods. However this work has not considered much quality assessment metrics, so in near future we will use some more quality metrics to evaluate the effectiveness of the proposed technique.

REFERENCES

[1] Xu, Zhiyuan, Xiaoming Liu, and Na Ji. "Fog removal from color images using contrast limited adaptive histogram equalization." In Image and Signal Processing, 2009. CISP'09. 2nd International Congress on, pp. 1-5. IEEE, 2009.

[2] Agung W. Setiawan, Tati R. Mengko, Oerip S. Santoso, “Color Retinal Image Enhancement using CLAHE ,”

[3] Zhao, Yisu, Nicolas D. Georganas, and Emil M. Petriu. "Applying contrast-limited adaptive histogram equalization and integral projection for facial feature enhancement and detection." In Instrumentation and Measurement Technology Conference (I2MTC), 2010 IEEE, pp. 861-866. IEEE, 2010.

[4] Sundaram, M., K. Ramar, N. Arumugam, and G. Prabin. "Histogram based contrast enhancement for mammogram images." In Signal Processing, Communication, Computing and Networking Technologies (ICSCCN), 2011 International Conference on, pp. 842-846. IEEE, 2011.

[5] Hillers, Bernd, Vasile Gui, and Axel Graeser. "Contrast enhancement in video sequences using variable block shape adaptive histogram equalization." In Electronics and Telecommunications (ISETC), 2012 10th International Symposium on, pp. 239-242. IEEE, 2012.

[6] Kurt, B., V. V. Nabiyev, and K. Turhan. "Medical images enhancement by using anisotropic filter and CLAHE." In Innovations in Intelligent Systems and Applications (INISTA), 2012 International Symposium on, pp. 1-4. IEEE, 2012.

[7] Juliastuti, E., and L. Epsilawati. "Image contrast enhancement for film-based dental panoramic radiography." In System Engineering and Technology (ICSET), 2012 International Conference on, pp. 1-5. IEEE, 2012.

[8] Tripathi, A. K., and S. Mukhopadhyay. "Single image fog removal using bilateral filter." In Signal Processing, Computing and Control (ISPCC), 2012 IEEE International Conference on, pp. 1-6. IEEE, 2012.

[9] Yoon, Inhye, Seonyung Kim, Donggyun Kim, Monson H. Hayes, and Joonki Paik. "Adaptive defogging with color correction in the HSV color space for consumer surveillance system." Consumer Electronics, IEEE Transactions on 58, no. 1 (2012): 111-116.

[10] Ullah, E., R. Nawaz, and J. Iqbal. "Single image haze removal using improved dark channel prior." In Modelling, Identification & Control (ICMIC), 2013 Proceedings of International Conference on, pp. 245-248. IEEE, 2013.

[11] Hitam, M. S., W. N. J. H. W. Yussof, E. A. Awalludin, and Z. Bachok. "Mixture contrast limited adaptive histogram equalization for underwater image enhancement." In Computer Applications Technology (ICCAT), 2013 International Conference on, pp. 1-5. IEEE, 2013.

[12] Sasi, Neethu M., and V. K. Jayasree. "Contrast Limited Adaptive Histogram Equalization for Qualitative Enhancement of Myocardial Perfusion Images." Engineering 5 (2013): 326.