Research Paper on Underwater image enhancement using super resolution technique

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Abstract - The use of digital images is increasing because of the advantages possessed by digital images, among others, in the picture, reproduce images, image processing and others. But not all digital images have a visual appearance that satisfies the human eye. Dissatisfaction can arise due to noise, lack of illumination quality in the images where it either too dark or too bright. So we need methods to enhance the quality of digital images. To enhance the image quality from the red color side we can give care to the histogram. The treatment referred to in this article is an image equalization histogram at the gray level (grayscale). A good picture histogram when it involves all possible levels or levels on a gray level. Of course the goal to be able to display the detail on the image for easy observation. One method to improve digital images is to use the equalization of histogram method, where the level or gray in the image can the spread evenly across all levels of gray**.** Histogram Equalization is a contrast enhancement technique in the image processing which uses the histogram of image. However histogram equalization is not the best method for contrast enhancement because the mean brightness of the output image is significantly different from the input image. There are several extensions of histogram equalization has been proposed to overcome the brightness preservation challenge. Contrast enhancement using brightness preserving bi-histogram equalization (BBHE) and Dualistic sub image histogram equalization (DSIHE) which divides the image histogram into two parts based on the input mean and median respectively then equalizes each sub histogram independently. This paper provides review of different popular histogram equalization techniques and experimental study based on the absolute mean brightness error (AMBE), peak signal to noise ratio (PSNR), Structure similarity index (SSI) and Entropy.

Keywords - image processing, histogram equalization, digital image Histogram Equalization, Contrast Enhancement, Brightness Preservation, Absolute Mean Brightness Error, Peak Signal to Noise Ratio, Structure Similarity Index.

I. INTRODUCTION

Histogram equalization applications are commonly implemented for image processing in medical use, voice recognition, synthesizing textures and more. Recently, the implementation of the histogram equalization method to enhance image has been an interesting topic. A technique that has been develop where images manipulated from its pixel intensity to create an image that visually greater, called Image enhancement [1]. The purpose are to enhance images for human visually by improving the interpretation of information contained in it, or also the result can be used as a high quality input for more image processing use. From many proposed image enhancement method over years, equalization of histogram has become the most popular image enhancement used. The method mostly implemented in image enhancement process because of its ease of use, a higher performance and output with almost all kind of image. With the manipulation the level of gray based on the distribution probability, an image can be improved. That changes and improve the level of contrast of the images by manipulating dynamic range from the histogram, where its stretches and flatten based on the method [1]. The equalization of histogram (HE) has become the common used technique in image contrast enhancement [2]. And also become the most popular process because of its ease of use and higher quality output and performance. Histogram equalization method is by recapping image's level of gray according to the input gray level probability distribution [2].

However, it is well known that traditional HE methods suffer of the following deficiencies [3]:

1) Has no mechanism that adjusts the rate of improvement and sometimes it can't reach a balance on many aspect of the image, for example, the balance between image detail and the background.

2) Sometimes causing an increasing level of noise, undesirable visual artifacts like clipping or level saturation, over enhancement, and imbalance between many aspects.

3) May changes a lot of things, and can dramatically affect the image, like different average of illumination from the image with the result.

Due to the side effect pointed above, equalization of histogram become rarely implemented on its normal form. Since then, years and years improvement, manipulation, development and changes result in new type of HE methods that have been proposed. Image contrast enhancement technique is popular method to use in image or video processing to gain a very dynamic and wider range. The most common algorithm which can be implemented to gain the most dynamic range is the Histogram based algorithm.

APPLICATIONS OF HISTOGRAM IN IMAGE ENHANCEMENT

- A popular tool for real-time processing: Histograms are simple to calculate in software and also lend themselves to economic hardware implementations –
- Histograms are used to analyze image: We can predict the properties of an image just by looking at the details of the histogram.
- Histograms are used for brightness purpose: We can adjust the brightness of an image by having the details of its histogram.
- Histograms are used to adjust the contrast of an image: The contrast of an image is adjusted accordingly required need by having the details of x-axisor gray level intensities of a histogram-Histograms are used for image equalization: The gray level intensities are expanded along the x-axis to produce a high contrast image.
- Histograms are also used in thresholding.
- Histograms improve the visual appearance of an image.
- By having the histograms of input and output image, we can easily determine that which type of transformation or enhancement algorithm is applied.
- Histogram of an image depicts the problems that originate during image acquisition such as dynamic range of pixels, contrast, etc.
- Histograms reflect a wide range of vulnerabilities such as saturation, spikes, and gaps, the impact of image compression.
- The shape of histogram predicts information about the possibility of contrast enhancement. Histograms are processed for these kind of applications. In histogram processing, the input image is enhanced by modifying or manipulating the histogram of image.

II. REVIEW PAPER

Haidi I, NSP Kong : This paper discusses BPDHE as a continuation of MPHEBP and DHE. Both MPHEBP and BPDHE can split the histogram and is almost identical in dynamic range intervals terms with DHE. The difference is, the use of a brightness normalization in order to maintain input intensity by BPDHE. Also, BPDHE advantages is the absence of parameters that need to be regulated. From experiments and results have been concluded that BPDHE can improve images without first knowing the unwanted artifacts. With this we can conclude that, BPDHE can be implemented in real system, easy to use and very effective.

MA Al-Wadud, MH Kabir, MAA Dewan, and O Chae : We have proposed a dynamic approach for contrast enhancement of low contrast images. DHE improves image without reducing image detail. However, if the user is not satisfied, he or she can control the upgrade rate (i.e., the amount of lost details he / she is ready to accept) by simply adjusting one parameter.

Q Wang, RK Ward : The experimental results show that the proposed WTHE is able to achieve a visually pleasing enhancement effect. That over-enhancement and saturation levels of artifacts are effectively avoided. Compared to many other global HEbased enhancement methods, enhanced images using the WTHE method show enhanced contrast and small artifacts, while looking natural. Importantly, the control mechanism in WTHE is convenient and smooth, especially adjusting the power factor r.

YEONG TM : This paper discusses the development of a contrast enhancement algorithm called dengahn BBHE. BBHE is a novel addition of a typical histogram equalization. BBHE uses more than two subimages obtained by reducing the input image with reference to the mean value. The purpose of BBHE is to improve and maintain the average brightness in the image.

M Kim and MG Chung : The problem with Histogram Equalization is the difference between the original and result images brightness which very visible. In this journal, there is a new method of histogram distribution method called RSWHE (Separate and Recursive Histogram Equation) to effectively solve the problem of average shift. The main reason for RSWHE made was just to enhance image contrast and keep the image bright.

H Yeganeh, A Ziaei, A Rezaie : This journal discuss the new technique that can be used to enhance contrast of images for better perception. The method that being suggested is based on the previous histogram processing before the histogram equalization implemented. The result has a better method efficiency than other ordinary methods for contrast enhancement

JH Han, S Yang, and BU Lee : In this paper discusses comparison of the performance of histogram color equalization method in gray. Because images contrast is worse after converting. So this paper suggests a 3 dimensional method of color that results in the same distribution on a gray scale histogram. The performance of Menotti algorithm also discusses on this paper, on its performance that depends on color component. With this, we have a conclusion that the

method presented improves the contrast of the lighting effectively by generating the same pdf on a gray scale.

D Menotti, L Najman, J Facon, and AA Araújo : MHE is the new test method which can enhance brightness and contrast for images, and also control that produces images with a natural look. From the experimental results obtained the conclusion that brightness of a picture being processed is better to be maintained with this method since it is providing output images with a very good view.

JY Kim, LS Kim, and SH Hwang : POSHE is a so-called new contrast enhancement algorithm is the main topic on this paper. It is more effective and much closer than local histogram equalization. POSHE has a very important feature that is the ow-pass mask-shaped filter gain function density probability sub-region which has the conclusion that the image size can vary. The global equity histogram method is not used because POSHE has an increase in brightness contrast to very large images and causes a preventive effect.

III. PROPOSED HISTOGRAM PROCESSING TECHNIQUES

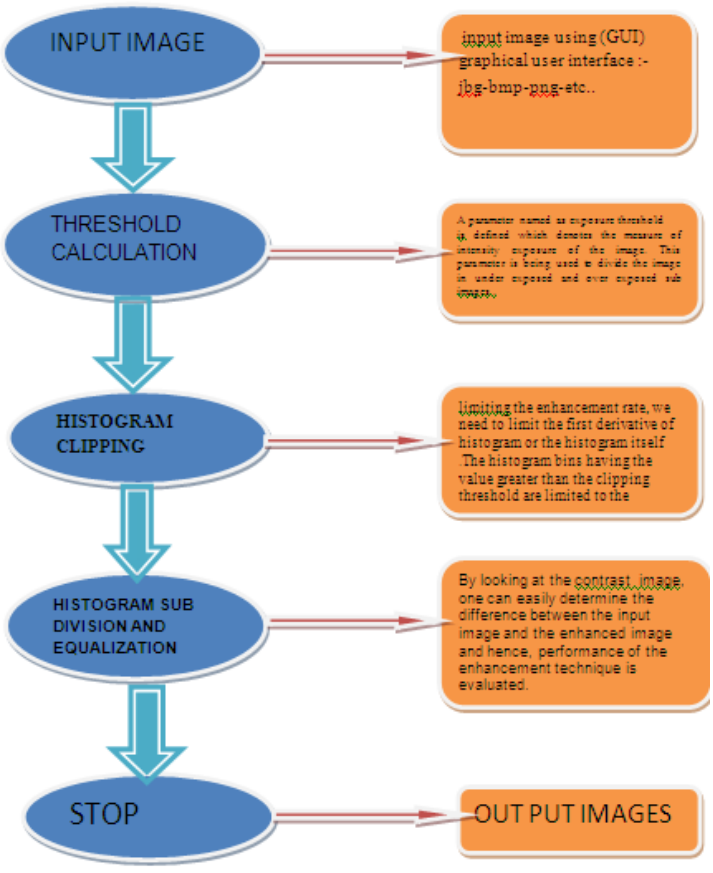

Fig. 1 flowchart of Our Proposed Methodology

3.1 THRESHOLD CALCULATION

The standardized scope of introduction esteem is 0–1. On the off chance that the estimation of introduction for a specific picture is more than 0.5 and inclines toward 1, it implies that the picture has lion's share of overexposed area and if this esteem is under 0.5 and inclining toward 0 then picture is containing larger part of under uncovered locales. In both cases picture contains poor differentiation and necessities differentiate improvement. Picture force presentation esteem can be ascertained as

(5.1) ----------

$$exposure = \frac{1}{L}\frac{\sum_{k=1}^{L} h(k)k}{\sum_{k=1}^{L} h(k)}$$

Where, h (k) is histogram of picture and L is adding up to number of dark levels. Another parameter Xa (as ascertained in Eq. identified with introduction is characterized, which gives the estimation of dim level limit that partitions the picture into under uncovered and over uncovered sub pictures.

(5.2) ----------

$$X_a = L(1 - exposure)$$

This parameter achieves an estimation of more noteworthy or lesser than L/2 (dark level) for introduction esteem lesser or more prominent than 0.5 separately for a picture having a dynamic range 0 to L.

3.2 HISTOGRAM CLIPPING

For restricting the improvement rate, we have to restrain the primary subordinate of histogram or the histogram itself. The histogram containers having the esteem more prominent than the section edge are restricted to the edge. The cut-out limit is figured as a normal number of dim level events

(5.3) ----------

$$T_c = \frac{1}{L}\sum_{k=1}^{L} h(k)$$

$$h_c(k) = T_c \quad \text{for } h(k) \geqslant T_c$$

Where, h(k) and hc(k) are the first and cut histogram separately. This technique for histogram section is computationally proficient and devours lesser time.

3.3 HISTOGRAM SUB DIVISION AND EQUALIZATION

The first histogram is first cut up in light of introduction limit esteem Xa as figured in. The Histogram Sub Division handle brings about two sub pictures IL and IU going from dim level 0 to Xa and Xa + 1 to L _ 1 and can be named as under uncovered and over uncovered sub pictures. PL (k) and PU (k) are comparing PDF of these sub pictures as characterized in

(5.4) ----------

$$P_L(k) = h_c(k)/N_L \quad \text{for } 0 \leqslant k \leqslant X_a$$

$$P_U(k) = h_c(k)/N_U \quad \text{for } X_a + 1 \leqslant k \leqslant L - 1$$

Where, NL and NU are added up to number of pixels in sub pictures IL and IU individually. CL (k) and CU (k) are comparing CDF of individual sub pictures and CDFs can be characterized.

The following stride of alter picture establishments is to even out all the four sub histograms exclusively. The exchange capacities for histogram leveling based. Can be characterized as

(5.5) ----------

$$F_L = X_a \times C_L$$

$$F_U = (X_a + 1) + (L - X_a + 1)C_U$$

FL and FU are the exchange capacities utilized for evening out the sub histograms exclusively. The last stride includes the combination of both sub pictures into one finish picture.

The target of the postulation work contains the accompanying strides as portrayed beneath:

1) To review the idea of improvement.

2) To investigation of different existed picture improvement systems by utilizing MATLAB.

3) Study of how to enhance picture improvement systems.

4) To propose a calculation to improve the low quality picture to great quality pictures by increment the limit.

5) Implement the idea in tangle lab code.

IV. RESULTS AND DISCUSSION

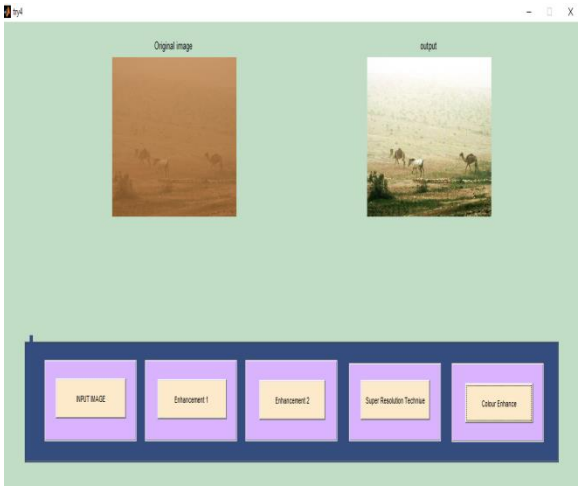

Fig.2 Experimental results of the proposed visibility enhancement technique.-Naturally degraded dusty image & Recovered image using the proposed technique with

From the obtained trial comes about, it can be seen that the proposed strategy performed well as far as hues recuperation and visual quality, as these angles enhanced enormously contrasted with the first perceptions. By looking at the histograms of the first and the prepared pictures, it can be seen that there is an immense contrast regarding hues conveyance. The histograms of the first pictures demonstrate an unsound conveyance, in which the hues are restricted in a specific range. Such surprising conveyance demonstrates that the visual nature of these pictures is seriously debased. In any case, the histograms of the handled pictures demonstrate a vital change in the allotment of hues, in which they turn out to be very much dispersed to the whole range. This is noteworthy in light of the fact that it shows that the recouped pictures have better shading quality. Subsequently, such agreeable outcomes are convenient for use with various genuine picture handling applications. Building up an assist technique that effectively recuperates clear outcomes and reveals enhanced picture subtle elements with adequate hues is basic. Such a task is unmistakably refined, in which they showed results are clearer and accordingly give a larger number of points of interest than their unique partners.

Fig.3 Experimental results of the proposed visibility enhancement technique. - Naturally degraded dusty image & Recovered image using the proposed technique.

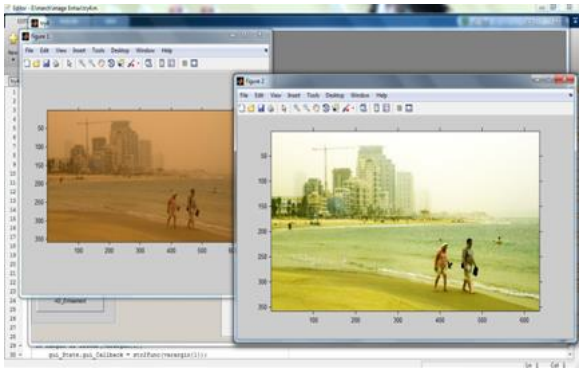

Fig.4 Experimental results of the proposed visibility enhancement technique. (a) Naturally degraded dusty image; (b) Recovered image using the proposed.

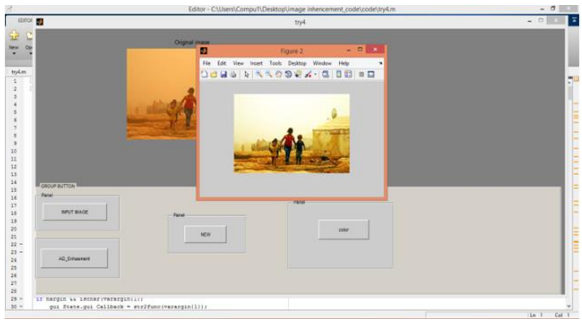

Fig.5 Experimental results of the proposed visibility enhancement technique. (a) Naturally degraded dusty image; (b) Recovered image using the proposed technique.

Fig.6 Input low regulation images

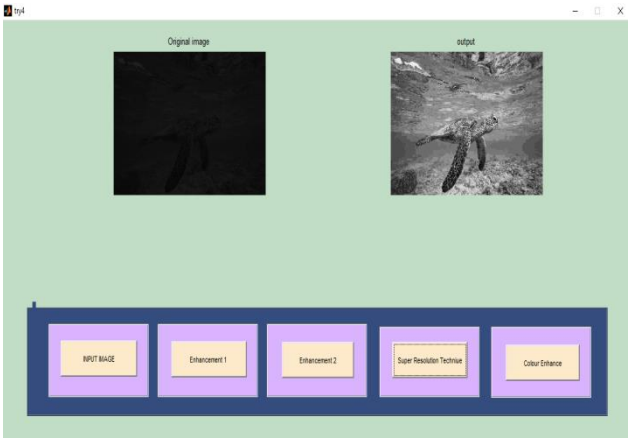

Fig.7 After Output Images

This mod-picture encasement method likewise utilized for picture demising process. Picture done sing is brought out through three vital strides. They are,

1) The pixels are ordered in surface and smooth districts of a picture.

2) Then the pixels are evaluated in smooth district for altering the heading of every pixel.

3) Finally, the cross breed change is utilized to diminish the commotion in locales. The mod-picture strategy is utilized to enhance the execution picture.

Fig.8 Low Regulation Fish Images

The original gray image (a), enhanced using global histogram equalization (b), enhanced using local histogram equalization (c) and enhanced using our method with $\tau = 1$. Note that global histogram equalization leads to oversaturation of parts of the image in (b). While local histogram equalization alleviates that problem, it ends up introducing noise in the background and changes the appearance of parts of the image in (c) like the shirt. Our method in (d) does not suffer from both of these and achieves an image which is closer to the original in its appearance.

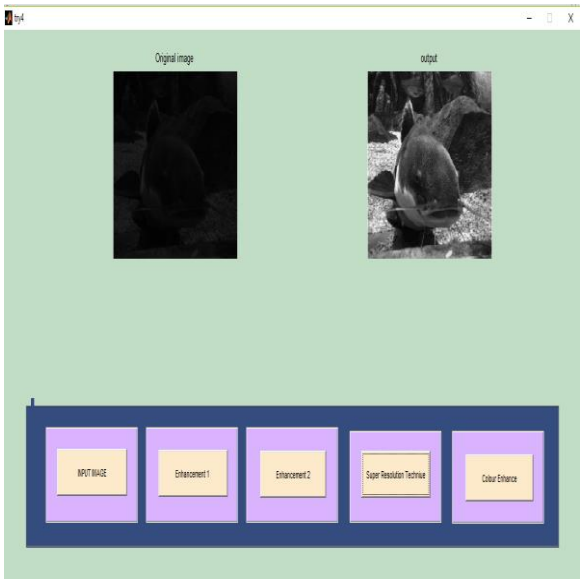

Fig.9 After Output Images

V. CONCLUSION

In this paper the different applications of histogram in image enhancement are discussed, there are a number of histogram processing techniques, to choose the appropriate technique for a particular application such as enhancement, compression etc. from a number of available techniques, we can simply select a particular technique by just having a look on the histogram of image. So, we can say that having a huge number of other applications, histograms also reduce the complexity of choosing a processing technique in order to process an image.

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