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Under Water and Underexposed Image Enhancement via Image Reduce Hazing Algorithm

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***Abstract* – Underwater and Underexposed image processing is an intelligence research field that has great potential to help developers better explores the underwater environment. Underwater image processing has been used in a good kind of fields, like underwater microscopic detection, terrain scanning, mine detection, telecommunication cables, and autonomous underwater vehicles. However, underwater imagery suffers from strong absorption, scattering, color distortion, and noise from the artificial light sources, causing image blur, haziness, and a bluish or greenish tone. The large quantities of suspended particles in atmosphere cause scattering of light before it reaches the camera which corrupts the outdoor image quality. It is an annoying problem to photographers as it changes the colors and reduces the contrast of daily photos. Therefore, the proposed system removes the haze and enhances the input image. The enhancement can be divided into 2 methods, underwater image de-hazing and underexposed image color restoration. This Project presents the reason for underexposed image degradation, surveys the state of the art intelligence algorithms like image reduce hazing algorithm. The proposed algorithm uses two different de-hazing Dark Channel Prior (DCP) methods, Simple DCP and Approx DCP to reduce haze in an image. The de-hazing algorithms in imreduce-haze estimates the atmospheric light using a dark channel prior, Estimates the transmission map, Refine the estimated map, Restore the image and Performs optimal contrast.**

***Keywords* – Image Processing, de-hazing, color restoration, imreduce-haze algorithm, Dark Channel Prior.**

I. INTRODUCTION

Digital image processing refers processing of the image in digital form. Modern cameras may directly take the image in digital form but generally images are originated in optical form. They are captured by video cameras and digitalized.

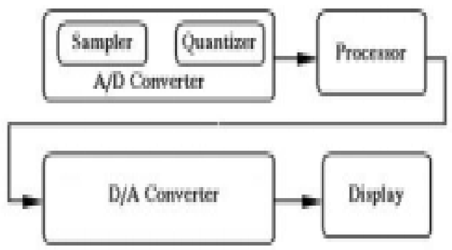


Fig .1. Digital Image processing.

An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image.

But images taken by ordinary digital cameras usually suffer from a lack of details in the under-exposed and over-exposed areas if the camera has a low or high exposure setting [1] [2].

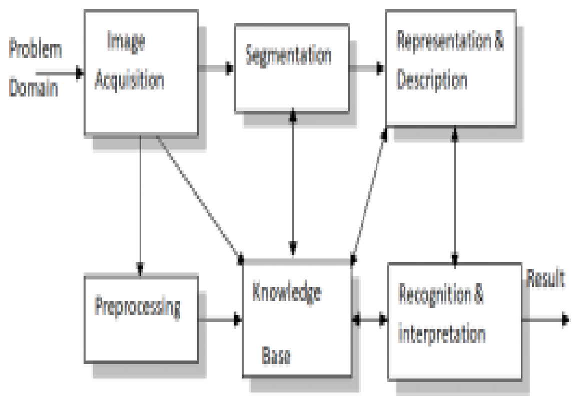


Fig.2.Fundamental sequence in an image processing system.

Bad weather conditions such as haziness, mist, foggy and smoky degradation in the quality of the outdoor scene [3]. It is an annoying problem to photographers as it changes the colors and reduces the contrast of daily photos, it diminishes the visibility of the scenes and it is a threat to the reliability of many applications [4] like outdoor surveillance, object detection, it also decreases the clarity of the satellite images and underwater images. So removing haze from images is an imperative and broadly demanded area in image processing. The procedure is developed mainly for enhancing images acquired under extremely low light situation where the features of images are nearly unseen.

There may be large quantities of suspended particles in atmosphere that can cause scattering of light before it reaches the camera which corrupts the outdoor image quality. Haze attenuates the reflected light from the scenes and blends it with additive light in atmosphere [4]. Haze removal techniques tend to improve this reflected light (i.e. scene colors) from mixed light. The constancy and strength of the visual system can also be improved by using this effective haze removal of image [3]. There are many methods available to remove haze from image like polarization independent component analysis and dark channel prior etc. Algorithm to refine the different kinds of an amorphous on the foggy image [5] after apply dark channel prior. The algorithm can be used for both underwater and under exposed images and the results showed that this method makes the de-hazing result more close to actual scene.

II. EXISTING SYSTEM

Intelligence de-hazing and color restoration methods for underwater images are novel research fields that have great potential to help developers better explore the underwater environment. These methods used to deal with the degradation like strong absorption, scattering, color distortion, and noise from the artificial light source to improve the visibility and color balance [8]. With the rapid development of image processing, underwater image processing opens up many new research directions.

Outline de-hazing and restoration algorithms for underwater images, which help scholars, better comprehend underwater image processing [9]. According to this paper, we envision the intelligence de-hazing and restoration methods like machine learning will be hot research topics in research of underwater image processing. Then, we review underwater image processing applications according to their use in underwater navigation and underwater target detection [10] [11].

Now, to building an effective and objective underwater degradation Image Quality Evaluation (IQE) metric, in order to enable processing, classification, and analysis of underwater images, especially in underwater environmental monitoring and target detection. The CLAHE is advancement on AHE. AHE has a drawback of over amplifying noise. CLAHE limits the amplification by clipping the histogram at a predefined value (called clip limit) before computing the CDF [12]. Contrast Limited AHE (CLAHE) [13] differs from ordinary adaptive histogram equalization in its contrast limiting. The only drawback is that the visual quality is lower when compared to the globally guided image filtering.

III. PROPOSED SYSTEM

Imreduce-haze uses two different de-hazing algorithms, Simple DCP and Approx DCP. These methods both rely on a Dark Channel Prior, which is based on the observation that un-hazy images of outdoor scenes usually contain some pixels that have low signal in one or more color channels. The methods differ in how they estimate the dark channel prior and atmospheric light. Both the methods use guided filter [14] to refine the transmission map [15].

The De-hazing algorithm in Imreduce-haze follows five steps:

1. Estimates the atmospheric light L using a dark channel prior.
2. Estimates the transmission map T.
3. Refines the estimated transmission map.
4. Restores the image.
5. Performs optional contrast enhancement.

The proposed algorithm is sharper than those de-hazed images by any algorithm.

IV. MODULE DESCRIPTION

1. Input Image Dataset:

A data set (or dataset) is a collection of data. In the case of tabular data, a data set corresponds to one or more database tables, where every column of a table represents a particular variable, and each row corresponds to a given record of the data set in question. The data set lists values for each of the variables, such as height and weight of an object, for each member of the data set. Each value is known as a datum. Data sets can also consist of a collection of documents or files.

(a) (b)

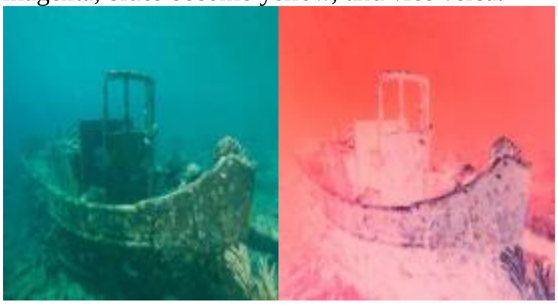
Fig. 3. (a)Under water image (b)Under exposed image

2. Pre-Processing:

Data sets can require preprocessing techniques to ensure accurate, efficient, or meaningful analysis. Data cleaning refers to methods for finding, removing, and replacing bad or missing data. Detecting local extreme and abrupt changes can help to identify significant data trends. Smoothing and detrending are processes for removing noise and linear trends from data, while scaling changes the bounds of the data. Grouping and binning methods are techniques that identify relationships among the data variables.

In this project we use image complement to complement the image. In the complement of a gray scale or color image, each pixel value is subtracted from the maximum pixel value supported by the class (or 1.0 for double-precision images). The difference is used as the pixel value in the output image. In the output image, dark areas become lighter and light areas become darker.

For color images, reds become cyan, greens become magenta, blues become yellow, and vice versa.

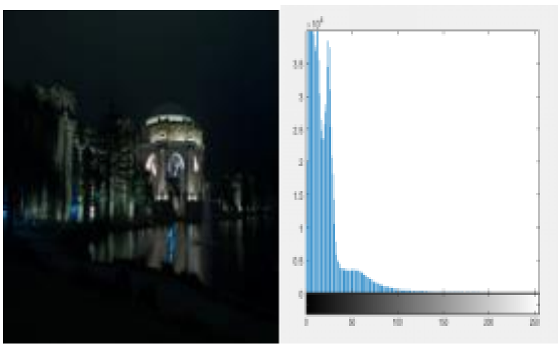


(a) (b)

Fig .4.(a)Sample image (b)Complement image

V. HISTOGRAM EQUALIZATION

Histogram Equalization is a computer image processing technique used to improve contrast in images [12]. It accomplishes this by effectively spreading out the most frequent intensity values that is stretching out the intensity range of the image. This method usually increases the global contrast of images when its usable data is represented by close contrast values [13]. This allows for areas of lower local contrast to gain a higher contrast.



(a) (b)

Fig. 5. (a)Sample image (b)Histogram image.

In the above figure 5(a) is the sample image and 5(b) is the histogram of the sample image where X-axis represents the tonal scale (black at the left and white at the right), and Y-axis represents the number of pixels in an image. Here, the histogram shows the number of pixels for each brightness level (from black to white), and when there are more pixels, the peak at the certain brightness level is higher.

VI. IMAGE REDUCE HAZE ALGORITHM

After using better and effective image defog algorithm to the inverted input image, the contrast get improved and the dark surface become bright when the intensity can be amplified.

1. **Amount:** Amount of haze to remove, specified as a number in the range [0,1]. When the value is 1, imreducehaze reduces the maximum amount of haze. When the value is 0, imreducehaze does not reduce haze and the input image is unchanged. Larger values can cause more severe color distortion.
2. **Name-Value Pair Arguments:** Specify optional comma-separated pairs of Name, Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1, Value1., NameN, ValueN.
3. **Method:** Technique used to reduce haze [16], specified as the comma-separated pair consisting of 'Method' and one of these values: 'simpledcp' — Simple dark channel prior method. This method uses a per-pixel dark channel to estimate haze and quad tree decomposition to estimate the atmospheric light. 'approxdcp' — Approximate dark channel prior method. This method uses both per-pixel and spatial blocks when computing the dark channel and does not use quad tree decomposition.
4. **Atmospheric Light:** Maximum value to be treated as haze, specified as the comma-separated pair consisting of 'Atmospheric Light' and a 1-by-3 numeric vector for RGB images or a numeric scalar for grayscale images. Values must be in the range [0, 1]. Atmospheric light values greater than 0.5 tend to give better results.
5. **Boost:** Amount of per-pixel gain to apply as postprocessing, specified as the comma-separated pair consisting of 'BoostAmount' and a number in the range [0, 1]. This argument is only supported if ContrastEnhancement is specified as 'boost'.

VII. EXPERIMENTAL RESULTS

The main motive of the proposed system is not to change the natural scene. Every system that works related to image enhancement or color restoration should make sure that they preserve the naturalness of the image [6][7]. The proposed method is given various input images that have different issues in it. The sample images taken are mostly under exposed and underwater images. For every input the system first takes output of the image from the existing system as input. It takes complement of the image and increases the color contrast by using methods

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[14] and also reduces the haze using imreduce haze algorithm [3].

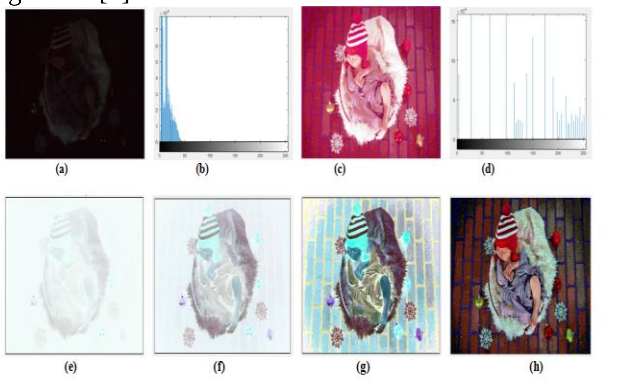

Fig .6. (a)Underexposed image, (b)Histogram graph of the previous image 6(a), (c)Output of Histogram Equalization, (d)Histogram graph of the previous image 6(c), (e)(f)(g) are compliment of the input image and histogram equalized image, (h)Output image of the imreduce haze algorithm.

In the above given example Fig. 6 the input image 6(a) is an underexposed image. From the input we attain the histogram equalization 6(c) which is better than the input image but the obtained output is not exactly the image that was expected, it has haze and noise in it so on further proceeding with proposed method the complement of the image is taken 6(e), 6(f), 6(g) more than one time and reduce haze algorithm is used. This step moves on by reducing haze in the image and a proper image with corrected color contrast is obtained as a result 6(h). Now when comparing the previous output of the histogram equalization [13] method with the output of the proposed method it is clear that the proposed method has produced an output which far better than the previous one.

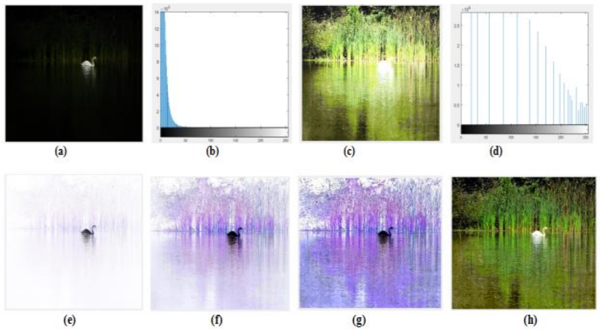

Fig. 7. (a)Underexposed image, (b)Histogram graph of the previous image 7(a), (c)Output of Histogram Equalization, (d)Histogram graph of the previous image 7(c), (e)(f)(g) are compliment of the input image and histogram equalized image, (h)Output image of the imreduce haze algorithm.

Once again in Fig. 7 consider an underexposed image 7(a) that has more green shade in it. Due to darkness and less atmospheric light [4] the input image suffers a lot. Now on applying Histogram Equalization [13] we obtain an image 7(c) which has more haze in it. The haze and ghostly [5] effect present in that image reduces the sharpness of the image. But after applying the proposed method and its algorithm we obtain a clear image 7(h) which gives a better image compared to the previous image 7(c). Here the haze is reduced and the image is so clear.

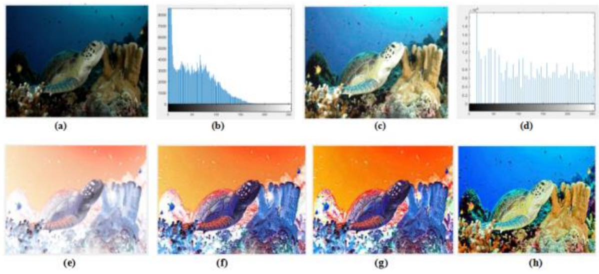

Fig.8. (a)Underwater image, (b)Histogram graph of the previous image 8(a), (c)Output of Histogram Equalization, (d)Histogram graph of the previous image 8(c), (e)(f)(g) are compliment of the input image and histogram equalized image, (h)Output image of the imreduce haze algorithm.

Now by considering Fig. 8 it is an underwater image. The input image 8(a) is an aquarium image that some portions as not clear so the has taken for histogram equalization [13]. The output of histogram 8(c) has produced a good image better than the given input image but to get a much better image the proposed method is applied for it. The final output 8(h) is obviously superior to the histogram output. Even very small particles are so clear in it [11].

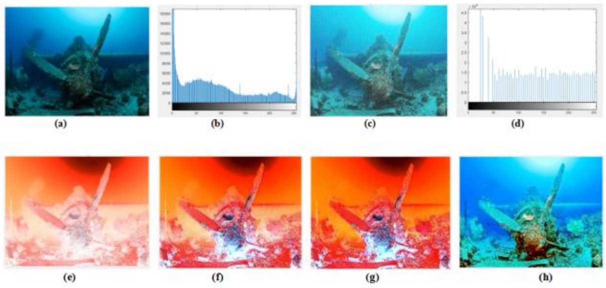

Fig .9. (a)Underexposed image, (b)Histogram graph of the previous image 9(a), (c)Output of Histogram Equalization, (d)Histogram graph of the previous image 9(c), (e)(f)(g) are compliment of the input image and histogram equalized image, (h)Output image of the imreduce haze algorithm.

On the other side an underwater image usually have blue haze [8] issues in it. The above given Fig. 9 input 9(a) also has the same issue. The input is processed by histogram. But the output 9(c) is not having the expected details in it so by the final output 9(h) increases color contrast [9] of the image for a better result.

The color contrast is increased only in the compliment of the histogram and reflected to the final output.

Considering the above figures it is obvious that the proposed method provides superior results compared to the approaches presented by using the Histogram Equalization [13].

VIII. CONCLUSION

The proposed method is a simple and efficient approach of removing haze from the given input dataset images i.e. the underexposed image. Conditions like haziness, mist, fog and smoke decreases the quality of the outdoor scene [3]. So removing haze from images is an imperative and broadly demanded area in image processing. Both underwater and under exposed images are tested and various results are analyzed. The suspended particles in atmosphere causes scattering of light and corrupt the outdoor image quality. This annoying problem can now be solved and the images can be prevented from getting changes in the colors and reduction in the contrast of daily photos. The results showed that the proposed method makes the de-hazing image more close to actual scene without changing its naturalness [7].

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