Intensity Adjustment Analysis of Underwater Images

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ABSTRACT- **This paper focuses on the subjective area of image enhancement techniques by modifying the colours and intensities. Image enhancement makes image more visually appealing. The underwater imaging tends to become bluish as the photographing activities go down deeper and deeper into the ocean. It is due to light absorption and diffusion effects of light. The images mentioned is taken from digital camera which has low resolution. The images undergo intensity adjustment methods as well as the colour map to seek for the correct colour of the images. It is found that both intensity adjustment whether adjusting the intensity values to a specific range or by histogram equalization illustrates better histogram as compared to the original images. The colour adjustment also demonstrates a good result by adjusting iteratively the red, green and blue panels. It is hoped that the study will benefit users with low resolution digital cameras to have better viewing as well as enjoying better quality of the images.**

Keywords: Image Processing, 2D Image, Image Enhancement, Histogram Equalization, Resolution, Quality Images, knowledge.

1.0 Introduction

Coastal Malaysia is an attraction for scuba divers from around the world. Destruction of marine habitats caused by inexperienced divers, earth natural disaster unwittingly crash into corals that took years to grow as these novices have to yet to master techniques for maintaining buoyancy. Before the habitat lost its shapes and actual structure, there is a need to preserve at least the images.

Underwater imaging is quite a challenging in the area of photography. The importance of underwater activities to scientists for discovering, recognizing underwater imaging brings new challenges and enforce significant problems due to light absorption and diffusion effects of the light [1]. This is because the images tend to become bluish as they go down deeper into the ocean to take photos. An image processing is a technique in which the data from an image are digitized in order to create an enhanced image that can be stored for future references study and human observer [13].

Thereby, this research is an attempt to enhance the image visualization of underwater images. Specifically, the research objective is to investigate the performance of an image enhancement algorithm towards underwater images by using MATLAB.

At the end of the experiment, it is expected that the performance of the algorithm will improve the visualization of underwater images in the coastal area of Malaysia [5]. In addition, the ultimate aim is to produce maximum percentage of image enhancement (colour and shape) to non divers by redistributing intensity to meet the satisfactory level of user acceptance.

2.0 Literature Review

Many related studies have been done in order to improve images. To digitally process an image, it is first necessary to reduce the image to a series of numbers that can be manipulated by the computer [7]. Each number representing the

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An image is enhanced when it is modified so that the information it contains is more clearly evident, but enhancement can also include making the image more visually appealing. An example is noise smoothing [8]. To smooth a noisy image, median filtering can be applied.

Underwater activities are gaining importance to scientists nowadays. They are keen to explore, understand and investigate the activities through underwater images [1]. Existing research shows that underwater images brings new challenges and enforce significant problems due to light absorption and diffusion effects of the light [2]. Characteristic of low end digital camera is that they suffer from many types of distortions such as poor contrast, noise, motion blur and colour casts [3].

Most of the previous research in image processing concentrates on ordinary types of images, for example personal photos as well as scenery and buildings [4]. Therefore, it is important to have techniques to visualize the underwater habitat for those who are not ready physically and mentally to go down deep into the ocean.

The study related to digital signal and image processing has become an establish practice in the educational programs in most worldwide technical universities [5]. The basic issues studies problems related to visual perception, sampling, and quantization of visual data, image restoration and enhancement, image segmentation, and image recognition, as well as image transmission and storage [9]

3.0 Methodology

In order to enhance the images, few stages must be taken into consideration.

The first method in enhancing the images is by using intensity adjustment. In intensity adjustment, two approaches are used to seek the performance of image enhancement. They are the adjusting the intensity values to a specific range and adjusting intensity values based on histogram equalization [10] [11].

The second method is by colourmap where image intensity of the original images needs to be adjusting iteratively to get the

correct colour of the images [5]. Following is the flowchart of the process.

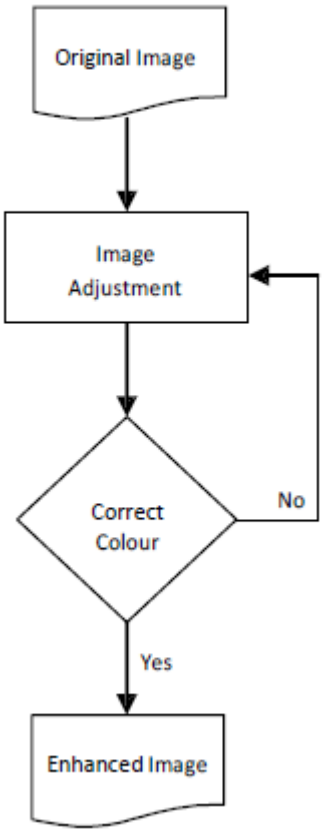

Figure 1 Process of Image Enhancement [5] The colour mapping is based only on the red, green, and blue components (RGB). Unique mappings for each colour component are possible when low_in and high_in are both 1-by-3 vectors. low_out and high_out are both 1-by-3 vectors, or gamma is a 1-by-3 vector. The input image is classified as uint8.

The third method is analyzing the texture of an image. Texture analysis attempts to quantify intuitive qualities described by terms such as rough, smooth, silky, or bumpy as a function of the spatial variation in pixel intensities [14]. A statistical method of examining texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image.

4.0 Analysis and Result

Intensity adjustment is an image enhancement technique that maps an image's intensity values to a new range. To illustrate, this figure shows a low-contrast image with its histogram.

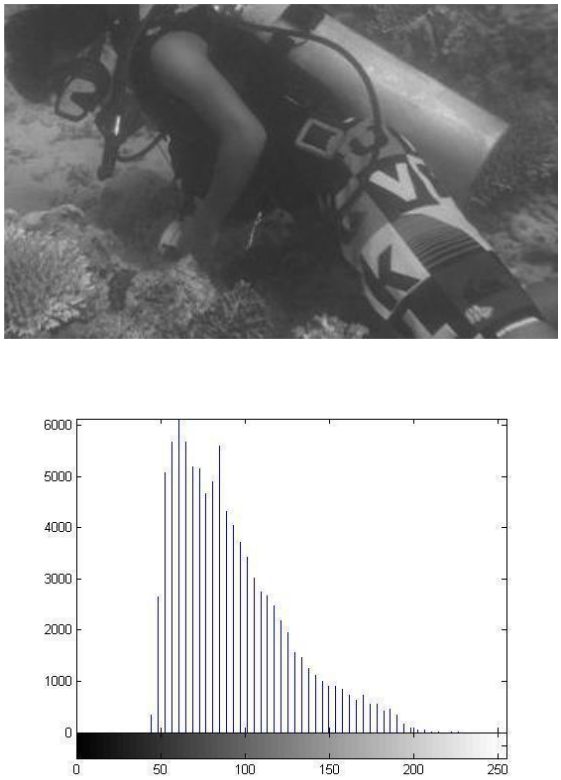

Figure 3 After Adjustment

Figure 3 displays the adjusted image and its histogram. Notice the increased contrast in the image, and that the histogram now fills the entire range.

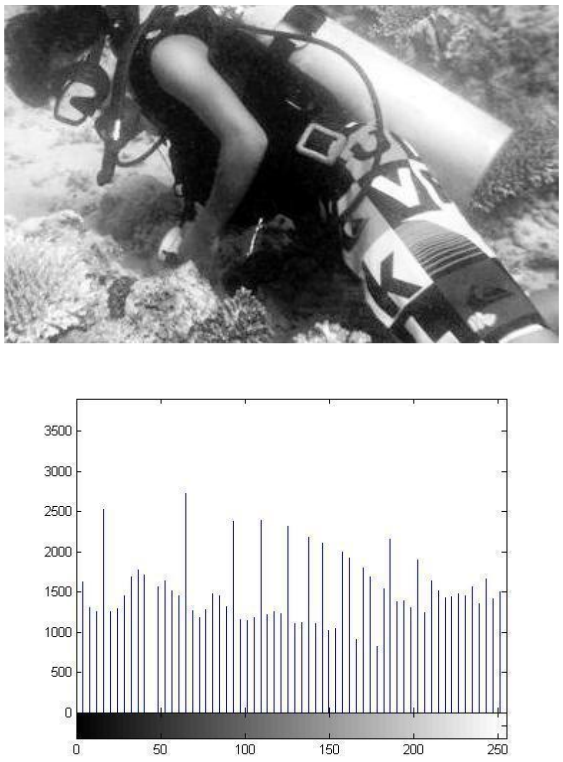

Figure 4 After Histogram Equalization

The original image (Figure 2) has low contrast, with most values in the middle of the intensity range. Histogram Equalization produces an output image having values evenly distributed throughout the range as in Figure 4.

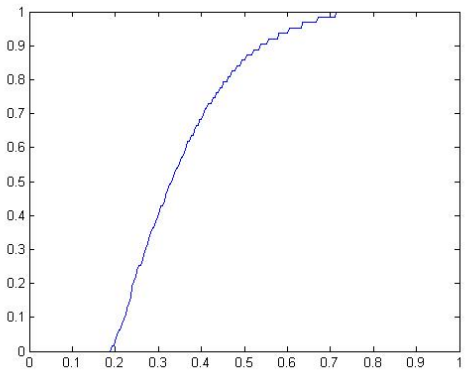

Figure 5 Transformation Curve

Figure 5 shows how this curve reflects the histograms in the previous figure, with the input values mostly between 0.2 and 0.7, while the output values are distributed evenly between 0 and 1.

The colour adjustment is based only on the red, green, and blue components (RGB). The following is the final syntax in adjusting the intensity of the colour

```
RGB1 = imread('head.jpg');
RGB2 = imadjust(RGB1,[.1 .4 0; .6 .8 1],[ ]);
```

The following are the selected images before and after image enhancement.

Figure 6 Before and After Colour Adjustment

The texture analysis is used to quantify the quality in pixels intensities. The relationship of pixels is illustrated in the following plot

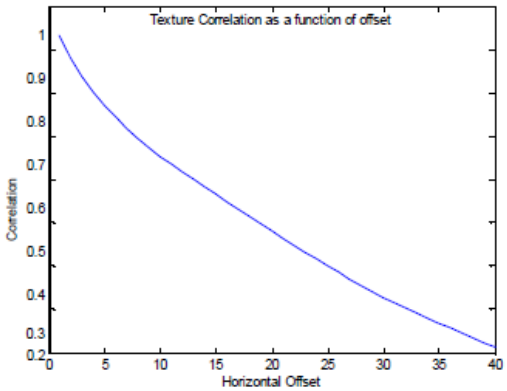

Figure 7 Texture Correlation

The plot in Figure 7 did not show any peaks at any offset. This means that the texture analysis is not appropriate in order to seek for periodic pattern in underwater images.

5.0 Conclusion

Image enhancement techniques are used to improve an image, where "improve" is sometimes defined objectively such as increase the signal-to-noise ratio, and sometimes subjectively such as make certain features easier to see by modifying the colours or intensities [12].

This study focuses on the subjective area of image enhancement techniques by modifying the colours and intensities. The intensity adjustments apply primarily to greyscale images and colour adjustment is used based on RGB components only.

The result shows very promising outcome whereby both intensity adjustment illustrates better histogram as compared to the original images. The colour adjustment also demonstrate a good result by adjust iteratively the red, green and blue panels.

The texture correlations somehow did not show any periodic patterns that relates the quality in pixels intensities. Further analysis should be done to identify why is the plot did not show any patterns.

It is hope that this study will benefit those who are involved in image processing technology. The enhancement of the still photos, videos, and library documents is important nowadays to improve the viewing of those images as evidences in any areas and situations.

6.0 Future Works

Further analysis should be carried out on texture analysis perhaps with another sample. Another interesting analysis is Decorrelation Analysis. The analysis enhances the colour separation of an image with significant band-to-band correlation. The exaggerated colours improve visual interpretation and make feature discrimination easier.

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