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True Color Reconstruction of Underwater Object Using Macbeth Chart

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ABSTRACT
The underwater image processing is receiving considerable attention over the last decades, with important achievements. In this paper we are discussing some of the most recent methods that have been developed for the underwater environment. These techniques are capable for range of underwater imaging, improving image contrast and resolution. Considering the basic physics of the light propagation in the water medium, we are3 using the different algorithms available. The conditions for which each of them has been originally developed are highlighted as well as the quality assessment methods used to evaluate their performance that is in our paper is the performance analysis with various metrics to be taken into account.
Keywords
Macbeth Chart, Underwater Object, Underwater Macbeth Chart, Binary Segmentation, LAB color transition algorithm, Color Spaces, Color Image Segmentation.

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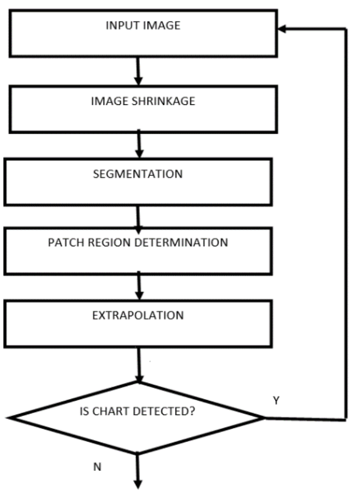
I. PROPOSEDSYSTEM

Macbeth chart:

The Macbeth Chart, is commonly used as a reference target for photographic and video **production** work. This chart consists of 24 color patches formulated to emulate common colors like skin color, sky and many other.



II. SEGMENTATION

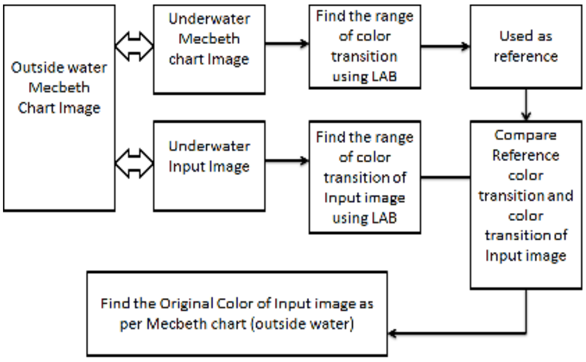
Image segmentation is a technique of dividing a digital **image** into multiple segments so as to simplify an **image**. This simplification helps in a study of **image**s for further analysis. Since the entire process is digital, a representation of the analog image in the form of pixels is available, making the task of forming segments equivalent to that of grouping pixels, Image segmentation is an extension of image classification where, in addition to classification, we perform localization. Image segmentation thus is a superset of image classification with the model pinpointing where a corresponding object is present by outlining the object's boundary. Semantic segmentation segments out a broad boundary of objects belonging to a particular class, instance segmentation provides a segment map for each object it views in the image, without any idea of the class the object belongs to besides that Panoptic segmentation is by far the most informative, being the conjugation of instance and semantic segmentation tasks, Panoptic segmentation gives us the segment maps of all the objects of any particular class present in the image.

III. COLOR SPACES

The color spaces in image processing facilitates the specifications of colors in some standard way. Types of color spaces are used in multiple fields like in hardware, in multiple applications of creating animation, etc.The color model facilitates the specifications of colors in standard way. Types of color models are used in multiple fields like in hardware, in multiple applications of creating animation, etc. The hardware-oriented models that are commonly used are the RGB model for printers and color monitors.

IV. LAB COLOR SPACE

The following figure clearly illustrates the coordinate system of l*a*b* color space.
Methodology:



Lab color space is a 3-axis color system with dimension L for lightness and a and b for the color dimensions.

The Lab color space is the most exact means of representing color and is device-independent. This accuracy and portability make it suitable in several different industries such as printing, automotive, textiles, and plastics.

V. OTSU METHOD:

This algorithm takes the maximum inter-class variance between the background and the target image as the threshold selection rule. From the principle of the OTSU method, the maximum between-class variance method is also its aliasOtsu's method instinctively performs clustering-based image thresholding. The algorithm considers that the image contains two classes of pixels backing bi-modal histogram (Foreground pixels and background pixels); it then enumerates the optimum threshold.

An image can be described as a two-dimensional function i:e f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of „f" at any pair of coordinates (x, y) is called the intensity or grey level of the image at that point. Each element of the array is called pixel or pel. The Pixels are stored as Integers. The integers can be of 8-bit, 24-bit or 32-bit depending on the type of image. The grayscale images are 8 bit images whereas 32-bit images have an additional transparency channel. The Grayscale image consists of average of R-G-B at each pixel. It is a myth amongst people that grayscale converts coloured

$$N = \sum_{k=0}^{L-1} n_k = n_0 + n_1 + \cdots + n_{L-1}$$

VI. PERFORMANCE ANALYSIS

A Binary Segmentation Algorithm is used for computer-aided segmentation of underwater images.

Performance evaluation is performed to validate the capability of the proposed segmentation algorithm and it is applied on various underwater images. Performance metrics such as segmentation accuracy, sensitivity, specificity used for performance evaluation and comparison of images.

Much better segmentation results than the existing common methods are obtained for the proposed algorithm than the available above existing algorithms.

For underwater images from the database a segmentation accuracy, sensitivity, specificity 98.43%, 90.57%, 98.18 respectively is achieved using the segmentation algorithm and much better than the existing algorithms.

The segmentation results are evaluated in a MATLAB environment.

$$\textbf{Sensitivity} = \frac{TP}{TP + FN} \times 100$$

$$\textbf{Specificity} = \frac{TN}{TN + FP} \times 100$$

$$\textbf{Accuracy} = \frac{TP + TN}{TP + FP + TN + FN}$$

$$\textbf{PPV} = \frac{TP}{TP + FP}$$

$$\textbf{NPV} = \frac{TN}{TN + FN}$$

$$\textbf{MCC} = \frac{(TP * TN) - (FN * FP)}{\sqrt{(TP + FN) * (TN + FP) * (TP + FP) * (TN + FN)}}$$

VII. RESULT

Original Macbeth Chart

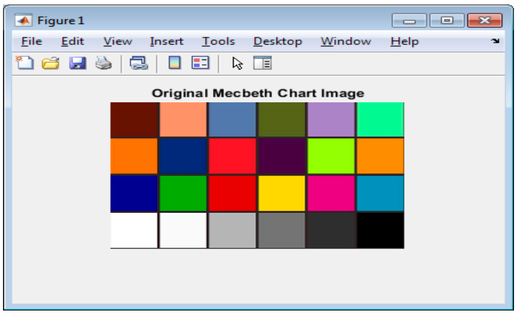


Fig 1. Macbeth Chart

The Color Checker Chart is a chart containing 24 colored patches arranged in a 6 by 4 array. It measures approximately 280 mm by 216 mm.

Underwater Macbeth Chart

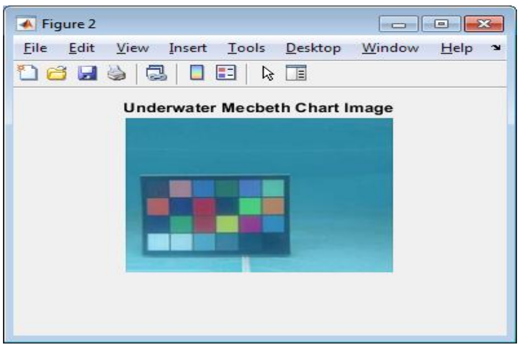


Fig.2 Underwater Macbeth Chart

Figure shows underwater Macbeth chart.The color differs from Macbeth chart of outside water.

Input:

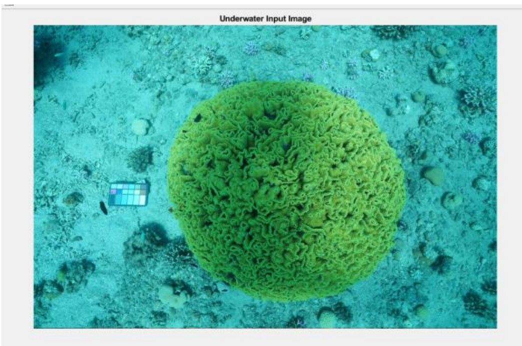
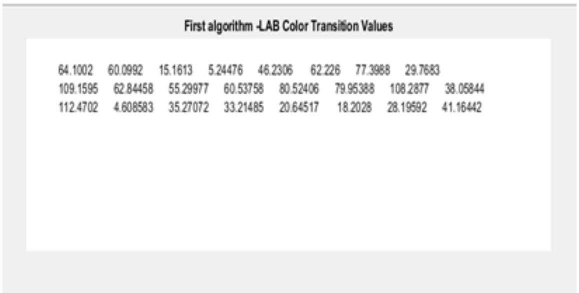


Fig 3. Underwater Input Image

First Algorithm



First algorithm -LAB Color Transition Values

64.1002	60.0992	15.1613	5.24476	46.2306	62.226	77.3988	29.7683
109.1595	62.84458	55.29977	60.53758	80.52406	79.95388	108.2877	38.05844
112.4702	4.608583	35.27072	33.21485	20.64517	18.2028	28.19592	41.16442

Fig 4. First algorithm LAB colour Transition Values

Second Algorithm

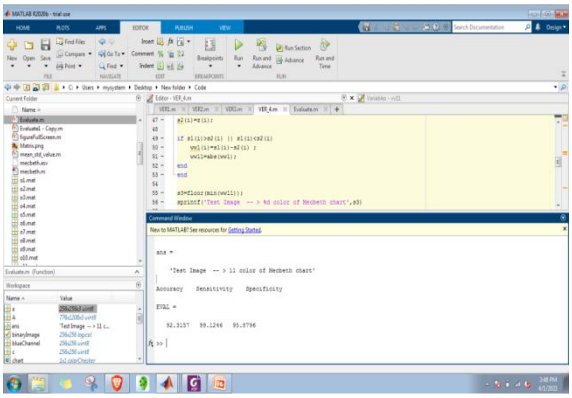


Fig 5. To find the matched colour value

Binary Segmentation

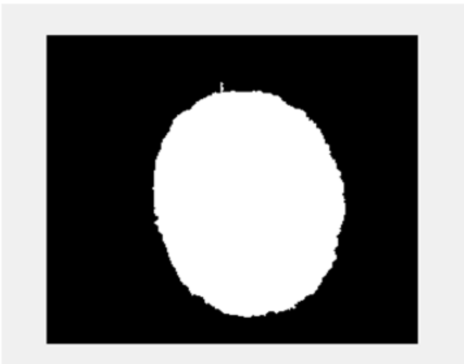


Fig 6. Binary Segmentation

OTSU method (OTSU) is a global adaptive binarization threshold image segmentation algorithm, it is put forward by Japanese scholars OTSU in 1979. This algorithm takes the maximum inter class variance between the background and the target image as the threshold selection rule.

Third Algorithm

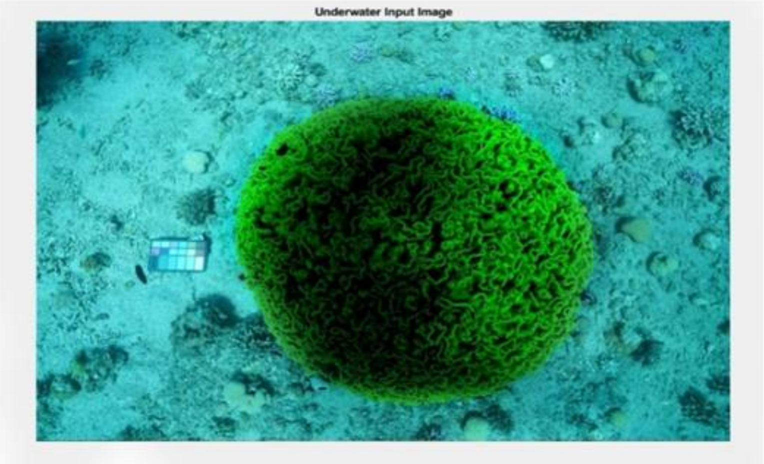


Fig 7. To Fill the predicted colour

Masking an area of image protects that area from being altered by changes made to the rest of the image.

Performance

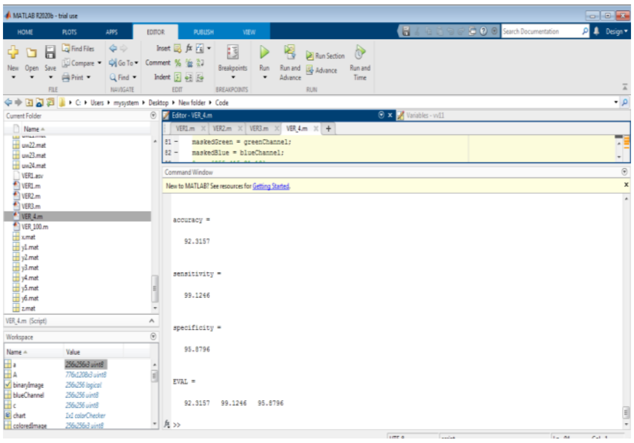


Fig 8. Performance Metrics

The accuracy can be defined as the percentage of correctly classified instances (TP + TN)/(TP + TN + FP + FN). where TP, FN, FP and TN represent the number of true positives, false negatives, false positives and true negatives, respectively.

VIII. Conclusion and Future Work

To deal with the difficulty of underwater target detection and 3D reconstruction in the optical image, a binocular vision-based underwater target detection, and 3D reconstruction system is proposed in this paper. The left and right views of the valid target area are obtained by image pre-processing technologies, such as image denoising, color restoration, salient region segmentation, and so on, which will help to reduce mismatch caused by noise and distortion. Based on the improved semi-global matching algorithm and the least-squares plane fitting method, the accuracy of the three-dimensional reconstruction of the targets is effectively improved, which is good for practical engineering applications. However, due to the pinhole model adopted for camera calibration in our research, the current system can only work well within a 2 m distance. Therefore, it is necessary to do more research on the pinax model, which is more accurate and apply it to our system in future work. Moreover, for the convenience of the experiments and the validation, the current work is carried out only in a reasonably clear water pool, its robustness in more turbid water needs to be verified in future research.

FUTURE SCOPE

- We can use the result for Archeological Researches.
- Underwater Object identification and classification.
- Underwater Image 3D Printing.

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