Ceng466 - Fundamentals of Image Processing
Spring 2017-2018
Assignment 3

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***Index Terms*—rgb image, hsv image, morphological filters, histogram equalization, lab color space**

I. Introduction

This report aims to analyze implemented *hsv2rgb* function which transforms a distorted image on HSV mode to its RGB mode and morphological filter that used to repair ruptures on the retrieved image and come to a conclusion by a comparision.

II. Used Technologies

- Python3.6
- OpenCV

III. Implementation

Images on figure 1 were used as source images.

(a) Original Image

(b) Distorted Image

Fig. 1: Source Images

Distorted image was converted to the original image by fixing its channels first, after all possible patterns had been tried.

In order to get the original image from the distorted one, steps below were followed.

1) Permuted channels were observed and (h,s,v) values were gotten as (s,h,v).
2) HSV values were converted to its corresponding RGB values. In order to do so, available formulas were used. [1]
3) Channels of the converted RGB image were fixed as BRG.
4) Retrieved image had ruptures on it. It almost fixed by using morphological filters.

IV. Results

Fig. 2: Converted RGB Image

Needless to say, the ruptures on the Figure 2 are not originated from the implementation since the source image *(distorted.png)* which was used to transform to the original RGB image has the same ruptures on the boat.

Those gaps on the boat were almost repaired by using morphological filter. Since the aim was to fill the gaps, erosion was chosen as the morphological filter. However, it blurred the image, which can be considered as an undesirable effect. By doing experiments, erosion and opening were applied.

A. Parameter Comparison

Applied erosion with different parameters can be seen on the Figure 3.

(a) Erosion with 2x2 kernel size, 1 iteration

(b) Erosion with 4x4 kernel size, 1 iteration

(c) Erosion with 2x2 kernel size, 2 iteration

Fig. 3: Erosion on the Ruptured Image with Different Parameters

(a) Opening with 2x2 kernel size, 1 iteration

(b) Opening with 4x4 kernel size, 1 iteration

(c) Opening with 2x2 kernel size, 2 iteration

Fig. 4: Opening on the Ruptured Image with Different Parameters

Larger kernel size and more iteration fixed the ruptures on the boat effectively, yet it, especially larger kernel size, blurred the image more.

B. Performance

After erosion had been applied, blurring were tried to be fixed with dilation *(opening)*.

Since erosion with small size (figure 3) could not fill all the gaps on retrieved image, applying dilation on it enhanced the gaps.

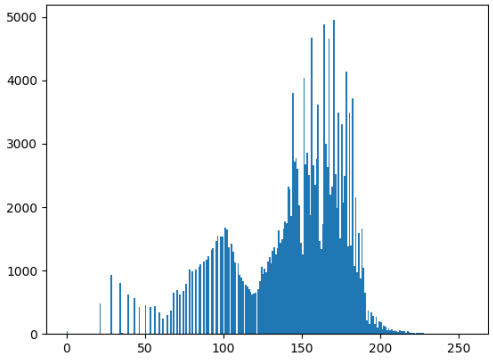
However, opening worked pretty well as can be seen on Figure 4b-4c. It almost fixed the dark areas and converged to the original image, yet the images are still blurry.

From those experiments, in order to get the closest result to the original image, I would choose to apply erosion on Figure 3a since blurring makes an image more different than the ruptures do, I believe.

C. Image Operations

Histogram equalization to its gray-scale image was applied and it increased the contrast of image, as the figures demonstrate.

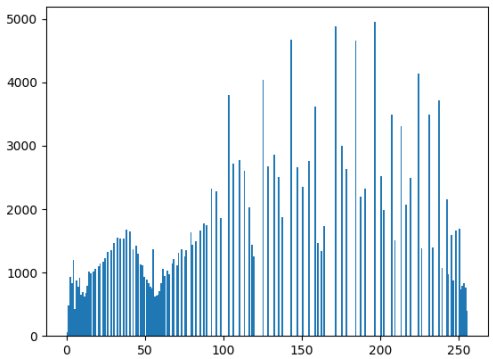
(a) Gray Scaled Image



(b) Histogram

Fig. 5: Original Image

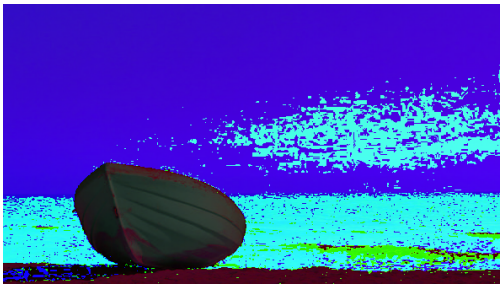
(a) Equalized Image



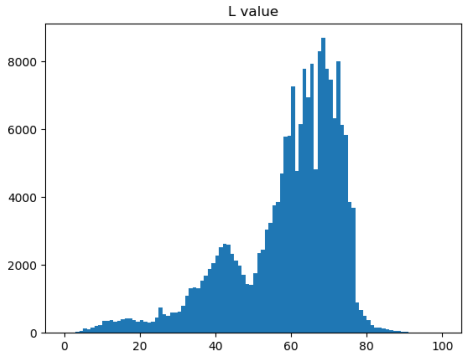
(b) Histogram

Fig. 6: Histogram Equalization

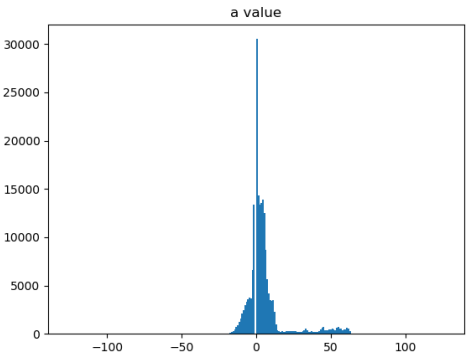
D. RGB to LAB



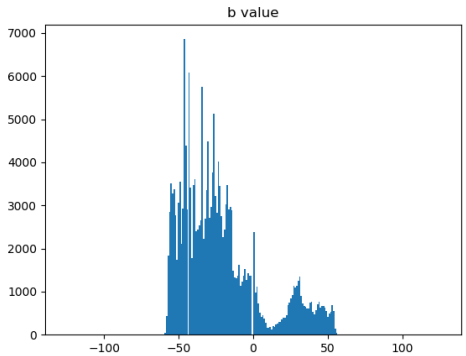
(a) Resulted Image



(b) L value

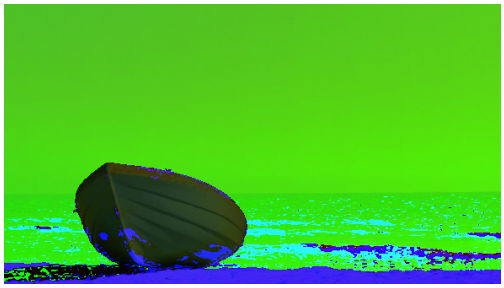


(c) a value

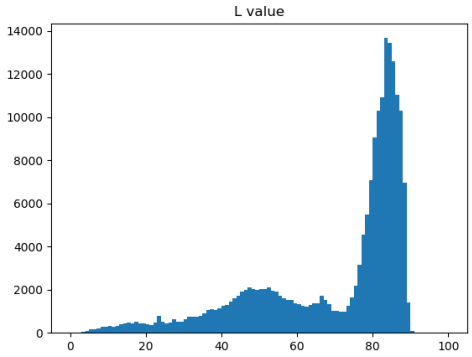


(d) b value

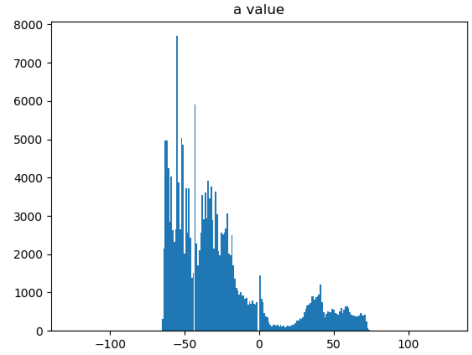
Fig. 7: RGB to LAB



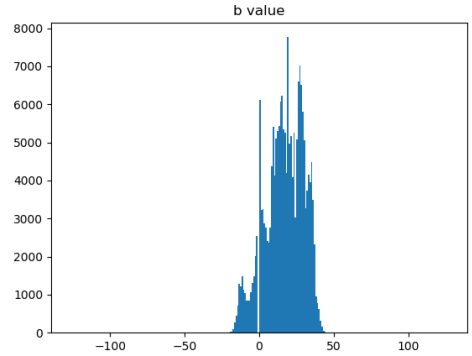
(a) Resulted Image



(b) L value



(c) a value



(d) b value

Fig. 8: RGB to LAB

Figure 7 shows fixed channels and its histogram while figure 8 demonstrates *Lab to Lba* channels.

In Lab Color Space, L represent the lightness and negative a values indicate green while negative b values indicate blue.

As we can interpret this easily, figure 8 is brighter than the other while looking at its L values. Also, that is why number of negative a values for the green image (figure 8) is greater than this for figure 7 while number of negative b values for the blue image (figure 7) is greater than this for figure 8.

V. Notes

Image operations that had been done on the previous assignments (median filtering, averaging, adding noise) were also applied, yet were excluded from this report. Corresponding results can be obtained from the based implementation.

References

[1] HSV to RGB color conversion. (n.d.). Retrieved May 22, 2018, from https://www.rapidtables.com/convert/color/hsv-to-rgb.html