**COMPUTER VISION**

**ASSIGNMENT 2**

**From the given set of images, we first calculated the normalized values of R,G and B components using the following code:**

R = Image[ : , : , 0 ] / 255

G = Image[ : , : , 1 ] / 255

B = Image[ : , : , 2 ] / 255

**Let us try to understand all three cases for all images.**

**Case 1: The image is multiplied by a positive value p such that 0 < p < 1 .**

𝑰′ (𝑥, 𝑦) = 𝑰(𝑥, 𝑦) × 𝑝, 0 < 𝑝 < 1

**And we have to ignore all the pixels of I(x,y) where**

𝑅(𝑥, 𝑦) = 𝐺(𝑥, 𝑦) = 𝐵(𝑥, 𝑦)

**In this case , the intensity of image is scaled down by a factor of p. So only the intensity value of image should change in this case and hue and saturation must remain same.**

**The value of p is selected randomly in the code, so no two csv files guarantee to match exactly for the first case. Code can easily be modified to assign the fixed value of p.**

**For the first image (1.tiff), when p = 0.93, hue remains around 198.0624 degrees for the original image as well as modified image. We can make other similar observations from csv file but I think due to some discrepancy in the data, hue is varying by a very small amount.**

**Saturation remains around 83.669 % for both the original image and the modified image.**

**But the intensity in this case is decreased.**

**When p = 0.93, the original average intensity 30.995 comes down to 28.826 for the modified image.**

**When p = 0.35, the original average intensity 30.995 comes down to 10.8477 for the modified image.**

**Similar observation can be made by looking into the data obtained after running the code. Two such csv files are attached along-with this file.**

**Case 2: In this case, the modified image is calculated as follows,**

𝑰′ (𝑥, 𝑦) = 𝑰(𝑥, 𝑦) + [𝐺(𝑥, 𝑦) − 𝑅(𝑥, 𝑦), 𝐵(𝑥, 𝑦) − 𝐺(𝑥, 𝑦), 𝑅(𝑥, 𝑦) − 𝐵(𝑥, 𝑦)]

Again we ignore all pixels of I(x,y) where

𝑅(𝑥, 𝑦) = 𝐺(𝑥, 𝑦) = 𝐵(𝑥, 𝑦)

**In this case, the saturation and intensity of image will remain constant and hue will vary.**

**For the first image (1.tiff) , Intensity for the original image and modified image will be same i.e. 30.996 . Reason for this constancy is that we are not scaling the image by any value.**

**For the first image (1.tiff) , saturation will also remain same even after modification. Saturation for original image was 83.669 % and it can be observed from the data that modified image has same saturation.**

**Hue will vary in this case. The hue for original image (1.tiff) was 198.062 degrees and for the modified image it is 108.119 degrees .**

**Similar observation can be made for other images as well by looking into the data obtained after running the code.**

**Case 3: In this case, we apply Automatic White Balance Algorithm that corrects an image taken under an unknown light source so that it appears to be taken under a canonical light source.**

AWB through Gray world Assumption:

𝑅′ (𝑥, 𝑦) = 𝑅(𝑥, 𝑦) × 𝑚 Avg𝑥,𝑦𝑅(𝑥, 𝑦) ,

𝐺′ (𝑥, 𝑦) = 𝐺(𝑥, 𝑦) × 𝑚 Avg𝑥,𝑦𝐺(𝑥, 𝑦),

𝐵′ (𝑥, 𝑦) = 𝐵(𝑥, 𝑦) × 𝑚 Avg𝑥,𝑦𝐵(𝑥, 𝑦) ,

m = min( Avg𝑥,𝑦𝑅(𝑥, 𝑦) , Avg𝑥,𝑦𝐺(𝑥, 𝑦), Avg𝑥,𝑦𝐵(𝑥, 𝑦) )

Modified image in this case will be given by,

𝑰′ (𝑥, 𝑦) = [𝑅′(𝑥, 𝑦), 𝐺′(𝑥, 𝑦), 𝐵′(𝑥, 𝑦)]

Again we ignore all pixels of I(x,y) where

𝑅(𝑥, 𝑦) = 𝐺(𝑥, 𝑦) = 𝐵(𝑥, 𝑦)

In this case all the three parameters Hue , Saturation and Intensity will vary by some amount.

Considering the first image 1.tiff , we found that its average hue was 198.062 degrees originally and when we modified it by applying this algorithm, its average hue became 150.771 degrees.

Average saturation for 1.tiff was 83.669 % originally and for the modified image it became 99.726 % .

Average intensity for 1.tiff was 30.996 originally and it became 27.539 after modification.

When we consider the other images, similar observations can be made by looking into the csv file obtained after running this code.

**Submitted By**

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