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COLOR ENHANCEMENT OF RGB IMAGES

In this project, we discuss some common methods used to enhance color(rgb) images or color in the images. We also talk about their advantages and disadvantages and general comparison.

METHOD 1)

It is a very trivial method. In this method we follow the following steps:

1) Separate out r,g,b components of the image.
2) Apply histogram equalization to all the three components.
3) Merge the histogram equalized components to get the final equalized image.

This is done in code extract_rgb.m
The r,b,g separated components are respectively stored in orig_red,orig_blue and orig_green jpg image files.
The combined result image is in rgb_result.jpg

Here we see that the image has the contrast at some points, but its thoroughly jumbled up at other points.What happens is separate histogram equalization for the three color channels will result in artificial color shift.

Limitations of this method-
The main disadvantage of the RGB space involving natural images is the high correlation between its components. The RGB space also suffers from non-uniformity, since it is impossible to evaluate the perceived differences between colors on the basis of distances, and psychological intuitiveness, since the visualization of a color based on R, G,B components is rather hard.

Using this method may yield dramatic changes in the image's color balance since the relative distributions of the color channels change as a result of applying this algorithm.

To reduce the effects of such abrupt changes, we use smoothing after equalizing. But, even after that the resultant image is not properly enhanced.

Smoothing can be done using function smooth.m (Uses gaussian filter).Advanced smoothing operations are discussed later.

METHOD 2)

HSV (Hue , Saturation ,Value) color space:

The problems faced in method 1 could be resolved using this method. can be applied to the luminance or value channel without resulting in changes to the hue and saturation of the image.
It separates the color information from its intensity information. Intensity is achromatic and describes the brightness of the scene, while hue and saturation are the chromatic components. More precisely, hue is an attribute associated with the dominant wavelength, and thus represents the dominant color perceived by an observer. Saturation corresponds to relative color purity, that is the amount of white light mixed with a hue.
By converting a RGB image to HSV, we can equalize the Value channel without altering the Hue or Saturation. After converting the result back to RGB, a properly equalized image is produced.

The code for the HSV equalization is extract_hsv.m
Resulting image is in hsv_final.jpg

Observations:
Image is clearer and has better enhancement than rgb component breaking one.

CONVERT AN RGB IMAGE TO GRAYSCALE KEEPING ONE COMPONENT:

This method can be used when there is prominently one color in your image.
One way is to convert to a different color space in order to more easily select your colors. In particular, the HSV color space defines pixel colors in terms of their hue (the color), saturation (the amount of color), and value (the brightness of the color).

Following are the steps:

1. Convert your RGB image to HSV space .
2. Set the saturation for the pixels which are to be converted to gray scale to 0 (so they are gray-scale)
3. Then convert the image back to RGB space.
4. Here the the hue space decides the limits for the range of color you choose. For example in the code, a histogram was plotted (color) in order to measure the range values for color red.

The code is enhance_red.m
The result image is in hsv_final.jpg

Observation:
The prominent color of the image(red) is enhanced and better than the previous two methods.

COMPARING GRAY-SCALE IMAGES:

An easier way to compare the above techniques could be comparing the gray-scale equalized versions of all the three image results. Greater the deviation(differences) from the original grayscale, greater are the inaccuracies.

This is done in the program grayscale_effect.m
The resulting images are in gray_orig,gray_rgb,gray_hsv.jpg
We see that the HSV files are closer to the original grayscaled version.