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BLG 453E – Computer Vision: Homework 1

Introduction:

In this homework, we have executed a series of operation on image data, in order to get used to fundamental operations of computer vision. Those operations act on the intensity values of the image data. Overall goal was apply histogram match operation to the different part of the image(s). To accomplish this task; Firstly, we learned to operate on different part of the image by using masks. We got this masks from the segmentation map which provided by dataset's itself. Then, we applied histogram matching algorithm to the full image. And finally, we brought those two parts together and apply histogram matching algorithm for different parts/segments of the image separately.

Function Explanations:

get_LUT(cdf_img, cdf_target): This function creates a Look-Up Table for an image according to a target image. It basically takes CDF (cumulative distribution function) of an image and map it to a target image's CDF, so whenever we want to change color palette of an image according to another image, we can create a Look-Up Table and map the image with it. It returns a vector with size of 256, in range [0, 255].

get_hist(patch, dim): This function counts occurrence of an element in a patch(part of an image) for intensity values between [0, 255]. Since a patch can have multiple channels, channel that be worked on must be indicated via <dim> variable. It returns a vector with size of 256, each element indicates occurrence of its index.

hist_match(image, target): This function alter image color palette according to a target image by the help of Look-Up Table. In the function, histograms (both image and target image) are calculated via calling get_hist( ) function. Then turn it to PDF and calculate CDF in single line.

Part1:

In this part, we altered the segmented region in the original image to blue. In order to accomplish that, we used segmented images as a kind of mask, and cancelled out the Green and Red channels where grayscale value of the segmented image equals to the 38.

Note: Although, example in the PDF, decreases Green and Red channel by %75 to make specified region blue. I chose to just cancel out Red and Green channels.

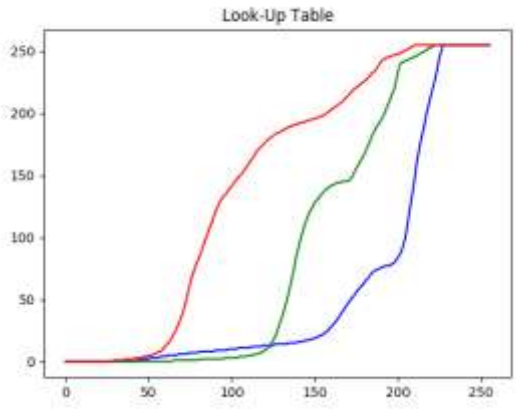
Video link: https://www.dropbox.com/sh/x2krk4ewzjso0fd/AADU1Zd_9z_HTkd6VlMxScfja?dl=0

Part2:

In this part, we applied histogram matching algorithm to the whole image. Histogram marching process has done by hist_match( ) function which I explained earlier. To summarize, this function gets histograms for both image and the target image for each channel and then create a Look-Up Table via get_LUT( ) function. Then we use LUT to map each pixel of the image.

Note: Although, it proposed to calculate LUT by using a concatenated image histogram. I was thought that this implementation wouldn't be organic and cannot be applied to a stream of image. Thus make it more intuitional, I decided to map every single image in the sequence separately.

Video link: https://www.dropbox.com/sh/z8ncq3hrhk8nklw/AAAOv9mKB1-ZXy1knIkdIRuXa?dl=0



As It shown in the look-up table we expect to see domination of the red channel and suppression in the green and blue channels. And the result is as expected.

Images	**Targets**
Boat	target/Sarap.png
Bus	target/Avokado.png
Classic-car	Target/Avokado.png
Shooting	Target/Avokado.png

Part3:

In this part, we applied histogram matching algorithm to the different segments by using segment map of the image and different target images for each segment. I randomly assigned a target image for each segmented region. Then, masked each segment and map those pixels separately by using different Look-Up Tables for each segment with different target images.

Note: As I mentioned in the part2, i decided to map every single image in the sequence separately.

Video link: https://www.dropbox.com/sh/sqyoviqoko0bwca/AAAd9M-Amfnw69GsAGuVSu1_a?dl=0

Images	**Targets**
Train	0: target/Bulut1.png; 14: target/Dalgalar.png; 38: target/Bulut2.png; 75: target/Gunbatimi2.png; 113: target/Doga1.png
Pigs	0: target/Ada.png; 38: target/Bulut.png; 75:

	target/Gunbatimi2.png; 113: Doga1.png
Shooting	0: target/Avokado.png; 38: target/Bulut2.png; 75: target/Dalgalar.png; 113: target/Sarap.png
Tuk-tuk	0: target2/Avatar2.png; 38: target2/GrandBudapestHotel.png; 75: target2/Matrix.png; 113: target2/WarHorse.png

Conclusion:

In this homework we acted on the range (intensity values) of the image data. First we basically set 0 to certain channels. Then map each pixel values with histogram matching algorithm. This type of operations can be used for manipulate an image intensity distribution to a desired distribution. Such as adjust contrast, make it more pastel, etc.