University of Tehran

School of Electrical and Computer Engineering

Digital Image Processing

Instructor: Hamid Soltanian-Zadeh

Assignment 5

Chapter 6 – Digital Image Fundamentals

Due Date: 4th of Ordibehesht 1401

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Problem 1

In this problem, you are going to become familiar with the RGB color cube. First make G channel image like figure (1). Pixels values at left side of G channel are 0, 1 at the right side and pixels values increase linearly from left to right. B channel is like G channel but pixels values are 0 at down, 1 at top and increase linearly from down to top of image. Image size should be 250*250 for all RGB channels.

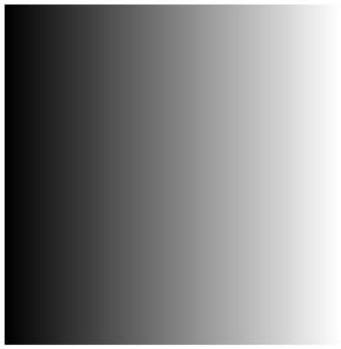

Figure (1): G channel

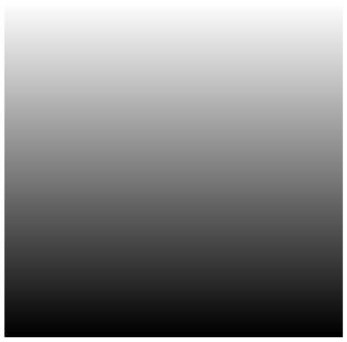

Figure (2): B channel

Do the following:

a. Make R channel image with pixels values all 0, now combine R, G, B channels to make a color image. Display R, G, B images and final color image. See section 6.2.1 of the textbook.

b. Make R channel pixels values all 0.5 and 1. Now display the new R, G, B channels and the color images. Compare the results of part a and b, discuss where these color images are according to the color cube.

Note: You **cannot use** MATLAB built-in functions.

Problem 2:

Load the image "fruit.png" which is a noisy color image and display R, G, and B images separately (RGB channels). Identify type of noise in every R, G, B channels and try to filter it and display filtered channels and final denoised color image. Which filter do you use for each channel? Explain whether filtering in frequency domain or spatial domain is effective to reduce each kind of noise, why?

Figure (3): Denoised image

Note: To see DFT magnitude you need to normalize it and then use "log" transform. Don't forget to centralize the DFT. You are allowed to use MATLAB built in functions for calculating FFT2 in all problems but designing the filter and filtering must be done by your own code.

Note: The final denoised image should be like Figure (3).

Problem 3:

Load the "friends.jpg" image and then do as follows:

a. Write your own functions to convert RGB format to HSI and CMY formats. Display the results and discuss briefly what information each H, S, I image gives us.

b. Convert format using MATLAB built-in functions and compare the results with those of part a.

Problem 4:

Segmentation is a process that partitions an image into regions. In this problem, you will try to segment the faces in “friends.jpg” using HIS color space. First display H, S, I images separately and do as follows:

a. Segment the faces using thresholding on HIS images. Explain which image or images (H, S, I) are useful for this task in this problem. Report the results. For segmentation, you need to make a mask that is a matrix with same size as the original image and every pixel that is related to a face, the pixel value is 1 and otherwise it's 0, see Figure (4). After that, you just need to multiply the mask and the original image and result should be like Figure (5).

Figure (4): the mask

Figure (5): final image

b. Now load "godfather.png" image and try to segment the face same as part a. Compare and discuss the results.

Note: You **cannot use** MATLAB built-in functions except for Convert RGB format to HSI.

Problem 5:

In Problem 4, you tried to segment using HIS images, now you will try RGB channels. See section 6.7.2 of the textbook.

Load the "godfather.png" image and then do as follows:

a. Do the same using the RGB vector space. Here, you should apply a rectangular region that contains colors we wish to segment out of the color image, e.g., red. You should use all three types of **box**, **elliptical**, and **spherical** enclosures to segment the face in the image.
b. Which enclosure type yields a better result? box, elliptical, or spherical?
c. Do you obtain better results working in RGB space or HSI?

Note: You **cannot use** MATLAB built-in functions.

Descriptive Assignments

Please solve the following questions of the 6th Chapter of the textbook: 4, 10, 12, 16, 23.

Notes:

1. Put written codes for each problem in one m-file, and for each section, intercept them by %%.
2. Analytical problems can be solved on papers, and there is no need to type the answers. The only thing that matters is the quality of your pictures. Scanning your answer sheets is recommended. If you are using your smartphones, you may use apps such as CamScanner or Google Drive Application.
3. Simulation problems need report as well as source code and results. This report must be prepared as a standard scientific report.
4. Your report is particularly important in the correction process. Please mention all the notes and assumptions you made for solving problems in your report.
5. You have to prepare your final report, including the analytical problems answer sheets and your simulation report in a single pdf file.
6. Finalized report and your source codes must be uploaded to the course page as a ".zip" or ".rar" file with the file name format as: Fullname_StudentNumber_HW#.rar.
7. Plagiarisms will be strictly penalized.
8. You may ask your questions from the corresponding TA of each assignment.

Good Luck!