School of Computing
National University of Singapore
CS4243 Computer Vision and Pattern Recognition
Semester 1, AY 2016/17

Lab 2 – Color
(for the week 5th – 9th Sep 2016)

Objective:

To understand the materials covered in the lecture through

- Implementing color conversion using python codes
- Performing histogram equalization on color images
- Understanding hue, saturation and value

Preparation:

- Download the file lab2_pictures.zip from IVLE into your working directory. Uncompress the file and you should find the following pictures: concert.jpg, sea1.jpg, sea2.jpg.

Introduction and Coding Instructions

This is an exercise to understand the concept of color, color conversion and histogram equalization on color images. You must write python code in this lab. Specific instructions are:

- You can only use OpenCV for the following, and only for the following:
  - cv2.imread
    - to read an image (eg. image = cv2.imread('filename.jpg'))
  - cv2.imwrite
    - to save an image (eg. cv2.imwrite('filename.jpg', image))
  - cv2.imshow
    - to display an image on screen (eg. cv2.imshow('title', image))
  - cv2.waitKey(*x*)
    - *x* is duration, if you set it to 0, it waits for your key press
  - cv2.destroyAllWindows()
    - to kill all windows created by cv2.imshow

- You are not allowed to use any other methods in OpenCV or any other packages other than python, its libraries numpy and math.

- You must implement color space conversion by writing the python codes yourself (i.e. you cannot get the codes from elsewhere). The formula for RGB to HSV conversion can be found in

http://www.rapidtables.com/convert/color/rgb-to-hsv.htm

and the formula for HSV to RGB conversion can be found in:

http://www.rapidtables.com/convert/color/hsv-to-rgb.htm

Requirements

1) Perform RGB to HSV conversions on the following images and store the output images:

   a) Input: concert.jpg
      Output: store the hue, saturation and value (i.e. brightness) images in concert_hue.jpg, concert_saturation.jpg and concert_brightness.jpg respectively.

   b) Input: sea1.jpg
      Output: store the hue, saturation and value (i.e. brightness) images in sea1_hue.jpg, sea1_saturation.jpg and sea1_brightness.jpg respectively.

   c) Input: sea2.jpg
      Output: store the hue, saturation and value (i.e. brightness) images in sea2_hue.jpg, sea2_saturation.jpg and sea2_brightness.jpg respectively.

2) Perform HSV to RGB conversions on the HSV images obtained in Step 1 above, and store the output images:

   a) Input: concert_hue.jpg, concert_saturation.jpg and concert_brightness.jpg
      Output: concert_hsv2rgb.jpg

   b) Input: sea1_hue.jpg, sea1_saturation.jpg and sea1_brightness.jpg
      Output: sea1_hsv2rgb.jpg

   c) Input: sea2_hue.jpg, sea2_saturation.jpg and sea2_brightness.jpg
      Output: sea2_hsv2rgb.jpg

3) Perform histogram equalizations on the value channels of the HSV images obtained in Step 1. Combine this histogram equalized value channel with the original hue and saturation, then convert the HSV images to RGB and save these RGB images.

   a) Input: concert_value.jpg
      Processing: histogram equalization on convert_value.jpg, then combine with the original hue and saturation images, and finally convert

the resultant HSV image to RGB.
Output RGB image: concert_histeq.jpg

b) Input: sea1_value.jpg
Processing: histogram equalization on sea1_value.jpg, then combine with the original hue and saturation images, and finally convert the resultant HSV image to RGB
Output RGB image: sea1_histeq.jpg

c) Input: sea2_value.jpg
Processing: histogram equalization on sea2_value.jpg, then combine with the original hue and saturation images, and finally convert the resultant HSV image to RGB
Output RGB image: sea2_histeq.jpg

4) Answer the following questions:

a) Comment on the histogram-equalized images of concert_histeq.jpg, sea1_histeq.jpg and sea2_histeq.jpg.
b) For sea2_hue.jpg, explain why the horizontal golden strip at the middle of the image appear as a dark strip.
c) For sea2_saturation.jpg, explain why the cloud appears dark.

Submission Instruction

Submit the following:

1. Print-out of your Python codes (do not print the images in hardcopy).

2. Put your answers to Q4 in a file *yourName*.pdf (do not print the hardcopy of this file).

3. Save your python code, *yourName*.pdf, and all the output images obtained in a folder and zip the folder.

4. Submit the softcopy of your zipped holder to IVLE.
   - Use the following convention to name your folder: *StudentNumber_yourName_Lab2*. For example, if your student number is A1234567B, and your name is Chow Yuen Fatt, for this lab, your file name should be *A1234567B_ChowYuenFatt_Lab2*

Please remember to write your name on the hardcopy print-out of your python code.