CS3570 Introduction to Multimedia

Homework #1

Due: 11:59pm, March 27, 2014

1. Photo enhancement: implement the following steps to correct the image "ChangKungLake". (You cannot use Matlab built-in functions like rgb2ntsc, ntsc2rgb)
   (a) Convert the RGB color space to YIQ, and show the image histogram of Y channel.
   (b) Apply gamma transform to Y channel with a suitable gamma value.
   (c) Convert the transformed image from YIQ color space back to RGB to show the result with the best gamma value. Also show the histogram of Y channel for the transformed image.
   (d) Compare the image and histogram before and after your enhancement. Discuss what you observed.

2. Image filter and convolution masks
   Create 3 kinds of convolution masks of size 3x3 and perform convolution with these masks on the following gray-scale images and show the results after applying the following three image filters. Discuss what you observe. (Implement 2D convolution by yourself. You should not use the matlab built-in functions, such as conv2, imfilter, filter2 … etc.)
   (a) Gaussian blur mask(also repeat with 5x5 kernel, compare their result) "thinker_gray_noised.jpg"
   (b) Edge detection mask (both x and y directions are needed) "bellTower_gray.jpg"
   (c) Unsharp masking "garden_gray.jpg"

$$\begin{bmatrix} \frac{1}{16} & \frac{2}{16} & \frac{1}{16} \\ \frac{2}{16} & \frac{4}{16} & \frac{2}{16} \\ \frac{1}{16} & \frac{2}{16} & \frac{1}{16} \end{bmatrix} = \begin{bmatrix} \frac{1}{4} \\ \frac{2}{4} \\ \frac{1}{4} \end{bmatrix} \cdot \begin{bmatrix} \frac{1}{4} & \frac{2}{4} & \frac{1}{4} \end{bmatrix}$$

3x3 Gaussian kernel

$$\frac{1}{256} \cdot \begin{bmatrix} 1 & 4 & 6 & 4 & 1 \\ 4 & 16 & 24 & 16 & 4 \\ 6 & 24 & 36 & 24 & 6 \\ 4 & 16 & 24 & 16 & 4 \\ 1 & 4 & 6 & 4 & 1 \end{bmatrix} = \frac{1}{256} \cdot \begin{bmatrix} 1 \\ 4 \\ 6 \\ 4 \\ 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 4 & 6 & 4 & 1 \end{bmatrix}$$

5x5 Gaussian kernel

3. Write the image interpolation function to upsample image "panda_gray" to 4 times the original width and height. Implement the following two different interpolation methods and show the 4X (both x and y directions) upsampled image. (You should not use Matlab built-in functions imresize)
   (a) Nearest-neighbor (NN) interpolation
   (b) Bilinear interpolation
   (c) Compare results from (a)&(b). Discuss what you observe.