SGN-12006 Basic Course in Image and Video Processing

EXERCISE 3

14.09.2015 - 16.09.2015

This exercise consists of both lab exercises and homework. Complete the lab exercises and present your results for the TA. Prerequisite for submitting the homework is attendance in an exercise session. Homework should be submitted only online using Moodle2.

Follow the naming format 'ExN_surname_ID.pdf' (N is the number of exercise). Also please clearly write down your full name and student number in the document. The homework report should be no more than 1 page long and it should be done individually (no pairs allowed). Questions on this exercise should be addressed to TA's email address: (firstname.surname@tut.fi).

Lab exercise

1. Pixel operation. (3 Points)

(a) Load the 'wom1.png' image. Construct your own histogram with 256 bins, and then show it in a figure. Please avoid using imhist, hist or other built-in Matlab functions dealing with image histograms. (You are allowed to use for loop).

(b) Create a new function called ContrastStretch to perform contrast stretching on the 'wom1.png' image, so as to expand its range to [0 255]. Avoid using imshow(I, [0 255]). (Hint: take notice of uint8, double of data type and check the lecture 3 pp 10-13 for more details).

(c) Now perform log transform on 'man8.png' and use the new ContrastStretch function to enhance the image. Show the resultant image and its histogram. Discuss the difference with the original ones.

2. Downsampling (5 Points)

(a) Divide the image *mbaboon.bmp* into blocks of 4×4 pixels. Replace each block by the intensity of the (2,2) pixel within the block. The resulting image will have the size four times smaller than the original one. Display the downsampled image.

(b) Repeat (a) but replace with the pixel (1,1) instead.

(c) Repeat (a) but replace with the average intensity over the original block.

Compare the obtained results (check also the Fourier domain) and discuss what have you learned about sampling from this exercise. To view a Fourier magnitude, use a command such as imagesc(log(abs(fftshift(fft2(IMAGE)))+0.0001)). The small constant is there in case any of the Fourier components are nearly zero. Note that the origin is in the middle of the image in this display method. What you are viewing here is one period of the periodic frequency spectrum of the discrete image.

Homework

1- Visual Perception (1 Point)

When you enter a dark theater on a bright day, it takes an appreciable interval of time before you can see well enough to find an empty seat. Which visual process is at play in this situation?

2- Histogram (1 Point)

Suppose we have an image $f(x, y)$ and its histogram is hf .

(a) If $f(x, y) \times c$, and we ensure the maximum pixel value will not exceed 255, how would hf become?

(b) If $f(x, y) + c$, and we ensure the maximum pixel value will not exceed 255, how would hf become?

(c) If we rotate the image $f(x, y)$ by 90^o clockwise, how would hf become?