SGN-12006 Basic Course in Image and Video Processing
EXERCISE 4
21.09.2015 - 23.09.2015

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- Image Enhancement Intensity Transformations (2 points)

The focus of this part is to experiment with intensity transformations to enhance an image. Download the image *university.png* and enhance it using:

(a) the log transformation

$$s = c \log(1 + r),$$

where c is a constant and it is assumed that $r \geq 0$. We would use a transformation of this type to expand the values of dark pixels in an image while compressing the higher level values.

(b) a power-law transformation of the form

$$s = cr^{\gamma},$$

where c and γ are positive constants.

In (a) the only free parameter is c, but in (b) there are two parameters, c and γ for which values have to be selected. As in most enhancement tasks, experimentation is a must. The objective of this exercise is to obtain the best visual enhancement possible with the methods in (a) and (b).
Once (according to your judgment) you have the best visual result for each transformation, explain the reasons for the major differences between them.

2- Histogram Equalization (4 points)

a.) Implement your own histogram equalization function (histequal.m)**.** Perform histogram equalization on the images (*moon.png*, *house.png*, *spine.jpg, church.png*) by your OWN method. Compare the histograms and images before and after processing. (*for* loops are allowed. !Do not use MATLAB *histeq* function!). Compare outputs to the ContrastStretch results.

b.) Use the image *corel.png* to histogram equalize *church.png*.

c.) Can you think of another way (without *corel.png*) to improve the visual appearance of and *church.png* using histogram equalization? Show the result. What choice did you make and why?

3- Histogram Matching (2 points)

Implement a function that will apply histogram matching from image A to image B. You can use simple interpolation, if necessary. (see http://en.wikipedia.org/wiki/Histogram_matching)

Use *corel.png* as A and (*spine.jpg* or *church.png)* as image B. What can you observe?

Homework

1. Explain in your own words why applying histogram equalization multiple times will have no additional effect. (1 point)

2. For the case of the localized histogram equalization, how do you think the images *moon.png* and *spine.jpg* would look like after processing? Justify your answers. (1 point)