SGN-12006 Basic Course in Image and Video Processing
EXERCISE 5
28.09.2015 - 30.09.2015

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 exercises

1. Laplacian filter with high-boost filtering. (1 point)
Create a 3-dimensional Laplacian kernel with the center A = 8, 9, 9.7, and show your filtered results on cameraman.tif in a 2×2 subplot with the original one on the top left.

2. Directional filtering (5 points)

a. Load cameraman.tif and add random noise scaled by 10. Show the image in Figure 1.

b. Create a function called direct_filter in Matlab. The function gives a convolution kernel of user-defined dimension as an input parameter. Filter the image with your function in 4 directions, e.g. an output kernel of three dimensions would yield a convolution kernel of [0 0 0; 1 1 1; 0 0 0]/3 and [1 0 0; 0 1 0; 0 0 1]/3 plus two more kernels rotated 90 degrees from these. Filter the image with directional filters of dimension 3, 5, and 7. You should present your results in 3 2×2 subplots showing the filtered images in each direction. Discuss the effect of kernels with increasing sizes.

c. Form the output image as an average of the four filter images. Present your result in a 2×2 subplot with the noisy image on the top left and the filtered image with different dimensions in the following.

3. Threshold Median Filtering an Image (2 points)

a. Load the Miranda1.tif, and add some random white noise in the image center of 100×100 in size.

b. Load the threshold median filter file medfilt_th.m. Read the comments in the file and filter the scratched image with your adjusted parameter.

c. Construct your own median filter in 5×5 neighborhoods. (The matlab built-in function medfilt2 is not allowed to be used.)

d. Present the original image, your scratched image, smoothed image by threshold median filter and your own median filter in a 2×2 subplot.

Homework: (2 points)

1. Discuss the effect of repeatedly applying the following type of filters on the center of an image. Suppose the kernel will not reach the image boundaries and thus the effect on them is not considered.

   a. Mean filter,

   b. Median filter,

   c. Low-pass filter,

   d. High-pass filter.

2. Prove that by adding Gaussian noise to an image, the noise variance is reduced.