TEL411 – Digital Image Processing

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Assignment 4

Due date: Sunday, November 1, 2020

Exercise 1

Create a function Compute_Median() that takes as an input an image I and a kernel K. The output of this function should be an image $\tilde{I}$ (of the same size as I) which shows the impact of the median filter. This function should work as follows:

1. Compute the size $n \times n$ of the kernel K.
2. Compute the size $m \times m$ of the input image I.
3. Add zeros around your image using padarray(). The size of the new image I' should be $(m + 2\lfloor n/2 \rfloor, m + 2\lfloor n/2 \rfloor)$.
4. With respect to the size of kernel n you should extract a small patch P (of size $n \times n$) of your image centered on the $I'(i + n/2, j + n/2)$ where $i, j = 1, \dots, m$.
5. Sort the coefficients of the $n \times n$ patch using the function sort().
6. Find the median value (You are allowed to use the default function median() but it would be appreciated more if you compute it manually).
7. Repeat the steps 4-6 for each pixel.

Test your code for 3 different kernel sizes 3x3, 5x5 and 9x9 using the 2 noisy images that have been shared on eclass at the following directory Labs/Lab4. Illustrate you results.

Exercise 2

Do all the necessary modifications in order to create 2 different functions that compute the max filter (Compute_Max()) and the min filter (Compute_Min()), respectively.

Test your code for 3 different kernel sizes 3x3, 5x5 and 9x9 using the 2 noisy images that have been shared on eclass at the following directory Labs/Lab4. Illustrate you results.

What to turn in

You should turn in both your code and a report. For every different case (18 in total = 3 median * 2 images + 3 max * 2 images + 3 min * 2 images) you should provide the filtered images and a short discussion.

Bonus Exercise

1. Construct the differential filter F = [-1 0 1].
2. Read the image ”peppers_gray.tif”
3. Convolve the image I with the filter F.

Hint: You should first apply the filter to the rows and then do a $90°$ rotation and apply the filter to the columns of your input image. The finally result is the summation of the two convolutions. (See the 4th Lecture).