**Exercise 4 – Filters (27.November.2017 16h-17h)**

Filters

A small part of the image was selected and it is represented by the following matrix A:

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 1 | 5 | 6 |
| 2 | 3 | 5 | 7 |
| 4 | 5 | 7 | 1 |
| 8 | 5 | 1 | 2 |

1. Using a 3x3 kernel, represent the following filters (if possible) and show their results when applied to the above image:

1. Average Filter

|  |  |  |
| --- | --- | --- |
| 1/9 | 1/9 | 1/9 |
| 1/9 | 1/9 | 1/9 |
| 1/9 | 1/9 | 1/9 |

|  |  |  |  |
| --- | --- | --- | --- |
| 7/9 | 17/9 | 3 | 23/9 |
| 16/9 | 11/3 | 40/9 | 31/9 |
| 3 | 40/9 | 4 | 23/9 |
| 22/9 | 10/3 | 7/3 | 11/9 |

1. Median Filter

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 | 3 | 0 |
| 1 | 4 | 5 | 5 |
| 3 | 5 | 5 | 1 |
| 0 | 4 | 1 | 0 |

1. Sobel Filter (horizontal)

|  |  |  |
| --- | --- | --- |
| 1 | 2 | 1 |
| 0 | 0 | 0 |
| -1 | -2 | -1 |

|  |  |  |  |
| --- | --- | --- | --- |
| -7 | -13 | -20 | -19 |
| -10 | -13 | -3 | 8 |
| -14 | -6 | 11 | 14 |
| 13 | 21 | 20 | 9 |

1. Laplace Filter (without diagonals)

|  |  |  |
| --- | --- | --- |
| 0 | -1 | 0 |
| -1 | 4 | -1 |
| 0 | -1 | 0 |

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | -5 | 8 | 12 |
| 0 | -1 | -2 | 16 |
| 1 | 1 | 16 | -12 |
| 23 | 6 | -10 | 6 |

2. Apply a average filter h1=[1/3 1/3 1/3] followed by h2=[1/3 1/3 1/3]T. What is the resulting filter? How many operations did you perform for a given pixel?

3. Perform these operations in Matlab using the functions fspecial/imfilter, medfilt2 (if you have the image processing toolbox), otherwise apply using conv2(A,h1,’same’) and confirm the results with the ones obtained in the previous exercise.

1. Create matrix A

2. Create a 3x3 kernel representing the following filters:

1. h1 Average Filter
2. h2 Sobel Filter (horizontal)
3. h3 Laplace Filter (without diagonals)
4. h4=[1/3 1/3 1/3] followed by h5=[1/3 1/3 1/3]T

3. Load a gray scale image e.g. Rose.tiff and apply the filters above.