Practical work N°4

Objectives:

1. Histogram analysis
2. Apply arithmetic and logical operations between images

Commands

- **J = imnoise(I,'gaussian',M,V)** : add Gaussian noise with mean M and variance V.
- By default M=0 and V=0.01
- **J = imnoise(I,'salt & pepper',D):** add impulse noise, where D is the rate (%) of the pixels
- affected. Default D=0.05 (5%)
- **H = fspecial(type ,N) :** create a filter mask of size NxN with several type values: 'average', 'gaussian',
- 'laplacian', 'log'….
- **medfilt2 (A,[N N])** : returns the image denoised by a median filter of size NxN (3x3 by default)
- **B=imfilter(A,H) :** filtering of image A by mask H
- **B=filter2(H,A) :** returns the image filtered by H % B and A are of type double
- **B=conv2(A,H) :** convolution de A et H (see option) % B and A are of type double
- **edge(I, method, options) :** detect edges in an image (the result is a BW image).
  Method can be **:** 'Sobel' , 'Prewitt', 'Roberts', 'log', 'zerocross', 'Canny' et 'approxcanny'. If ***method*** is not specified, the **Sobel** filter is applied by default.

Exercise 1

Write a script that allows to:

1. Load image **cameraman.tif**
2. Create images affected by Gaussian noise with M=0 and V=0.01 , V=0.1, V=0.3
3. Show all noised images on the same figure
4. Create images affected by impulse noise with D= 0.05, D= 0.2 and D= 0.5
5. Show all noised images on the same figure

Exercise 2

Write an Octave script to:

1. Read image **eight.tif**
2. Add Gaussian noise with variance =0.02
3. Compare in the same figure the filtered images (3x3 and 9x9 averaging filter) and (3x3 9x9 Gaussian filter)
4. Repeat the same work for a color image **Madagascar.jpg**

Exercise 3

Write a script that allows to:

1. Read the image **eight.tif**
2. Add 4% salt & pepper noise
3. Display in the same figure the filtered (3x3 average filter) and (3x3 median filter) images, then compare PSNR.
4. Repeat the 3 question with a kernel 7x7

Exercise 4 *(at home)*

Program in Octave the non-linear filtering algorithms (KNN) k-nearest neighbors, SNN (symmetric nearest neighbors), Sigma, Min/Max

Exercise 5

Write an Octave script to:

1. Read the image **cameraman.tif**
2. Add 2% Gaussian noise to the original image
3. Compare the Roberts, Prewitt, Sobel and Canny filters in a single figure

Exercise 6

Write a script that allows to:

1. Read an image A **cameraman.tif**
2. Display on the same figure the contours of A with the following (Laplacian) masks:

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix} \qquad \begin{bmatrix} 1 & 1 & 1 \\ 1 & -8 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Help: use **imfilter** command for convolution

Exercise 7

Write an Octave script to:

1. Read the image **objects.jpg**
2. Add 2% impulse noise
3. Compare on the same figure the results of contour detection by the Laplacian and Laplacian of Gaussian(log) filters.

Exercise 8

Write a script that allows to:

1. Read the image **circuit.tif**
2. Add 5% impulse noise
3. Apply sobel filter after 3x3 and 9x9 averaging filters and display results
4. Compare the previous results with median filtering

Exercise 9

1. Write an Octave script where you show that the Laplacian filter is an isotropic filter (invariant to rotation) unlike the filters: Roberts, Sobel……
2. Test on **objects.jpg** image with an angle of 45 degrees