

People's democratic republic of Algeria  
Ministry of higher education and scientific research



Faculty of technology  
Electronics department



Medical image processing  
M1-S2 Biomedical engineering

**Practical *work* N°1**

# **Basic operations for medical image processing**

Prepared by:

Med BHAZ

## Aim

The present practical work is an introduction to medical image processing. It consists of becoming familiar with various basic operations on the image such as reading, writing, viewing, conversion etc.

## Work to do

### Activity 0, home preparation

A report of an individual home preparation is requested from the student before starting the practical work, failing which the student will be immediately excluded from the session. The preparation report will, of course, be corrected and noted.

### Activity 00, order

- 1- In Matlab interface, please display only the command window and the workspace window.
- 2- In command window, use the help to understand different Matlab functions.
- 3- During the practical work, it is recommended that the students follow the notations as well as the steps in the manuscript.
- 4- In this practical work, it is possible that the proposed pre-processing tool is not effective, it is therefore demanded to choose the appropriate one or to change the image to be processed.
- 5- In the case of a monochromatic and multi-channel image, read only the first channel.

### Activity 1, *imread.m* Matlab function

1. Read the provided monochromatic image '**leukemia1.bmp**'<sup>(\*)</sup> using *imread.m*, the Matlab function.  
example: `I1 = imread('leukemia1.bmp')`
2. Look at the workspace window and say if you notice a reading of the matrix I1.

### Activity 1. 1

1. Repeat activity 1 for the second monochromatic medical image '**shoulder.jpg**' (I2).
2. Repeat activity 1 for the color medical image '**leukemia2.bmp**' (I3).

### Activity 2, *imshow.m* Matlab function

1. Display in a figure the monochromatic image '**leukemia1.bmp**' using *imshow.m*, the Matlab function. Title the image using the Matlab function *title.m*.
2. Display in a same figure the monochromatic '**shoulder.jpg**' image and its three components using *imshow.m* and *subplot.m* the Matlab functions. Title the images.
3. Display in a same figure the color '**medications.jpeg**' image and its three components using *imshow.m* and *subplot.m* the Matlab functions. Title the images. What are these components called?

### Activity 3, reading and displaying a part of an image

1. Read and display in figure(31) the image 'baby.jpg'.
2. Display in figure(32) its first, second, third and fourth quarter using *subplot.m*.

### Activity 4, sampling, axial resolution & lateral resolution

Sampling an image consists of taking pixels from it. If we take a pixel between two in the two directions, the number of rows and columns will be halved and the image size will be divided by four.

1. Read the first channel of the provided image 'skull.jpg'.
2. Verify if the above sentence is correct.
3. Jump four, eight and sixteen pixel between two adjacent pixels in the two directions, see the result in the workspace window and in a figure, use *subplot.m* the Matlab function.
4. Repeat 2 for the image 'abdomen.jpg'.
5. Comment.

### Activity 5, formation of a synthetic image

1. Form and display a 256 by 256 pixel binary synthetic image which represents a black square centered in a white background.
2. Move the square to the extreme south east of the white background.
3. Repeat for a grayscale square.

### Activity 6, color to grayscale or binary transformation

1. Read and transform into a grayscale image the color image 'covid1.jpg' using *rgb2gray.m*, the Matlab function. Display and title the images.
2. Read and transform into a binary image the color image 'covid1.jpg' using *rgb2bw.m*, the Matlab function. Display and title the images.
3. Use *imcomplement.m* the Matlab function to display the compliment of the binary image found in 2.

### Activity 7, reconstruction of a color image by additive analysis

A color composite image is written as:

$$RGB = \alpha R + \beta G + \gamma B$$

$\alpha$ ,  $\beta$  and  $\gamma$  are the colors weighting coefficients of values between 0 and 1 such that:

$$\alpha + \beta + \gamma = 1$$

1. Use the color image 'leukemia2.bmp' to reconstruct three composite images of your choice, favoring one color each time.
2. Display each reconstruction.

## Activity 8, lesion detection

1. Read the two provided images '[mammothray1.jpg](#)' and '[mammothray2.jpg](#)'.
2. Use `imsubtract.m` Matlab function to detect novel lesion. Display in a same figure the images before lesion, after lesion and, lesion.

## Report:

An individual report must be submitted in the session after and must include:

- 1- A theoretical understanding.
- 2- Simulation results and interpretation.
- 3- General conclusion.

<sup>(1)</sup>Leukemia (*leucémie in french*) is a group of blood cancers that usually begins in the bone marrow and result in high numbers of abnormal blood cells. These blood cells are not fully developed and are called blasts or leukemia cells. There are several broad categories of blood cells, including red blood cells (RBCs), white blood cells (WBCs), and platelets. Generally, leukemia refers to cancers of the WBCs. Symptoms may include bleeding and bruising (blue like hematoma), fatigue, fever, and an increased risk of infections. A combination of genetic and environmental factors is believed the cause. Risk factors include smoking, ionizing radiation, some chemicals such as benzene.

<sup>(2)</sup>La leucémie est un groupe de cancers du sang qui commence généralement dans la moelle osseuse et entraîne un nombre élevé de cellules sanguines anormales. Ces cellules sanguines ne sont pas complètement développées et sont appelées blastes ou cellules leucémiques. Il existe plusieurs grandes catégories de globules sanguins, notamment les globules rouges (GR), les globules blancs (GB) et les plaquettes. Généralement, la leucémie fait référence aux cancers des globules blancs. Les symptômes peuvent inclure des saignements et des ecchymoses (hématome bleu), de la fatigue, de la fièvre et un risque accru d'infections. On pense qu'une combinaison de facteurs génétiques et environnementaux en est la cause. Les facteurs de risque comprennent le tabagisme, les rayonnements ionisants, certains produits chimiques comme le benzène.