

Laboratorio di Elaborazione di Bioimmagini

Homework 2 – 26 November 2023

To upload the files in the proper folder in WeBeep (“cartella di consegna”) by **Friday December 15th 2023 at 23:59**. Please post in the Forum discussion for doubts or comments.

I remind you that the solution is expected to be personal. If you discuss with a particular colleague in general term how to solve the problem is fine, but you need to declare it in the report.

In case of problems with upload, send an email to enrico.caiani@polimi.it

Exercise 1

The image contained in the file “hand.mat” needs to be segmented in order to obtain the contours of the bones in the fingers. You need to first enhance the edges in the original image, and then apply:

- 1) the edge detection using compass masks of Robinson
- 2) the edge detection by the gradient computation using an operator of your choice

Morphological operators could also be applied to improve the final results, if needed.

For each method, in separate figures with relevant titles, plot the contour resulting from the segmentation as red dots overimposed to the original image.

Return the code and a short report, explaining your main methodological choices.

Exercise 2

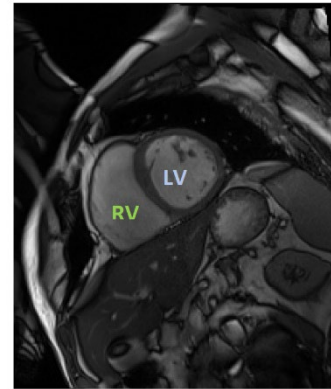
Dr. Wise wants you to automatically analyze pictures from pill blisters to understand how many have been used. One pic (“blister.jpg”) is given to you as a sample to be analyzed, with the following incrementally difficult aims:

- 1) detect the external contours of the blister and compute its aspect ratio
- 2) remove the different illumination effect
- 3) detect the pills still in the blister and the missing ones

You need to provide a report, indicating your methodological choices and corresponding results, and the matlab code.

Exercise 3

Given the file `loopMRI.mat`, containing the variable `slice6`, representing the series of 25 images (uint16) acquired during a cardiac beat for a short-axis section in a patient, **write the code** (and a relevant **report** to explain and justify the choices made) that, **in the most automated way** (i.e., minimizing the user interaction), attempts to perform the segmentation of the endocardium of the left ventricle (LV) for each frame.



The papillary muscles, if present, should result included in the LV cavity, and not as part of the LV contour.

The coordinates of the LV contour for each frame have to be extracted in counterclockwise direction, saved as a variable in a `.mat` file, and uploaded together with the code and the report.

At the end of the segmentation, the code should visualize:

- the plot of the LV area over time for the analyzed slice, **computed in ml** (use variables `xres`, `yres` e `zres` containing resolution in ml)
- the plot of the eccentricity over time
- for each frame, the endocardial contours overlapped in red on the original image, showed in a loop with a pause between two consecutive frames.

Prof. EG Caiani