# NL1 project
## DICOM Visualizer

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# 1 Introduction

Creating an app that allows the user to visualize DICOM images is the main topic of the NL1 chosen project.
The first step is showing the model, starting from sequences of DICOM images; then the only limits are your imagination and your skills, certainly improvable. Several things can be done with the model: segmenting it in three axes is helpful to see every single frame and to find diseases at a glance; highlighting bones and organs is useful to check one to one each part and, finally, viewing only some sections instead of the full-body lets you focus on the one part. These are just some features of the DICOM visualizer as DICOM images have different uses in all medical fields.

# 2 Related works

To the extent of my knowledge, I had made some searches focused on which types of DICOM visualizer had been created yet. Showing medical exams' results is the most common feature developed for doctors and looking to a 3D reconstruction is used by medical students.
Afterwards, I had to choose how to develop the app; from many programs available, MatLab is the one chosen for this project. MatLab, for DICOM images, is extremely useful since it has a specific toolbox, called *image processing toolbox*, and all commands are listed on a web page[1].

# 3 Script

The topic gives you a lot of freedom, so the challenge is to choose the features of the app, analyse which ones are truly viable, according to your capabilities, and respecting the deadline of the project.
The next passage is breaking the realisation of the app down into steps since creating an app out of nothing can be very difficult. The main steps are two: the first one is writing the code to see the volume and its features and the last one is creating the interface in which the user can choose the single image to view. Both of the steps can be made with MatLab, in particular the second part is done with the *Design App* section.

[1] Different functions for 3-D Volumetric Image Processing in references number 2

## Image reading and segmentation code

Being able to see the model is one of the essential features to include in the interface because reading a DICOM image is very complex. As a matter of fact, managing to read some of these frames can give a lot of insight about the health of the patient. Secondly, one of the features developed in the app is the segmentation of the full-body, thus the model is a good starting point. On MatLab's web page an example can be found, a short video[2] which explains how to view a 3D volume in the right proportions, starting from a sequence of DICOM images.

```
path=uigetdir('SEO');
[V,spatial,dim]=dicomreadVolume(fullfile(path));
V=squeeze(V);
```

The code sequence reported above makes up for just a small part of the whole script, but it is one of great significance in that it includes the *uigetdir* command. This makes it possible to load different sequences of images from distinct patients, the only characteristic to check is the size of them, it must be 512*512, since different sizes must be proportionate with different values written in the script (figure 1.a). Changing the isosurface's value will show the bones, isolated from the rest of the body: this is due to the fact that bones have different contrast values compared to other organs(figure 1.b).
For the segmentation, the chosen axes, that better show the model in its main planes, are three: top to bottom, front to back and lateral view. One of the DICOM images axes is displayed together in a grid, although, unfortunately, zooming in on each one isn't possible.

[2]Volume data structure in references number 1

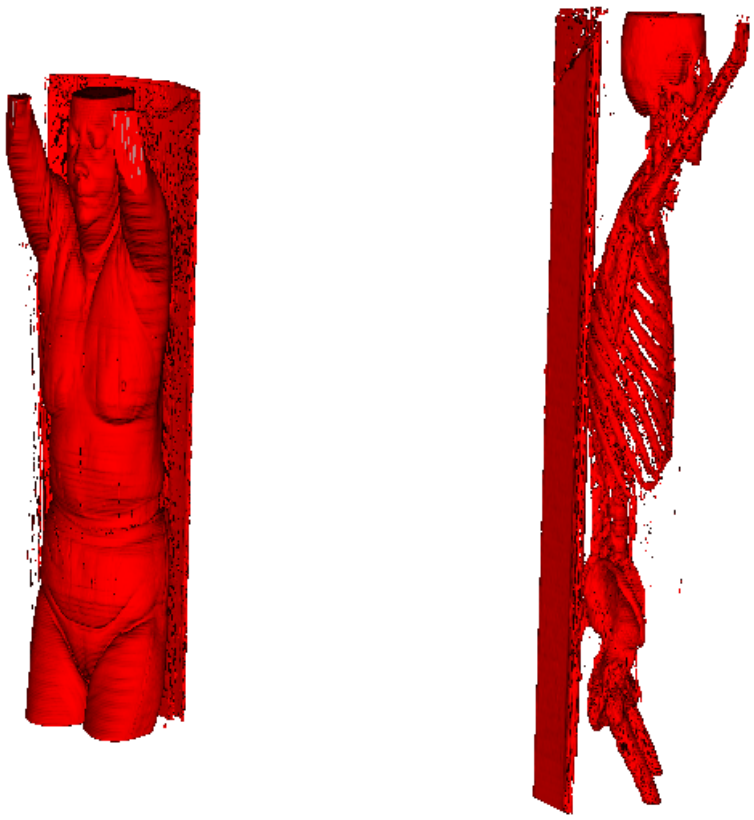

Figure 1: (a) Model view, (b) Bones view

## Interface

Design app[3] is the MatLab's section that can be used to project an interface. The process is very simple since the program creates the code automatically, based on the input from the design view: at this point, the only operation you have to do is filling the created sections with the attached code. The design app shows the interface seen by the user and this is very useful because you can see the final product while working on it. The app can be saved as a MatLab app and opened in the apps section; the first time you will need to launch the app for it to show in the section. The interface (figure 2) is structured as follows: on the left there are bottoms to select the image to visualise; at the end of this column there is the plot bottom to run the selected program; on the right there is a picture referring to the project's name. When the program is launched the user has to select the folder that contains DICOM images.

[3]App design in references number 3

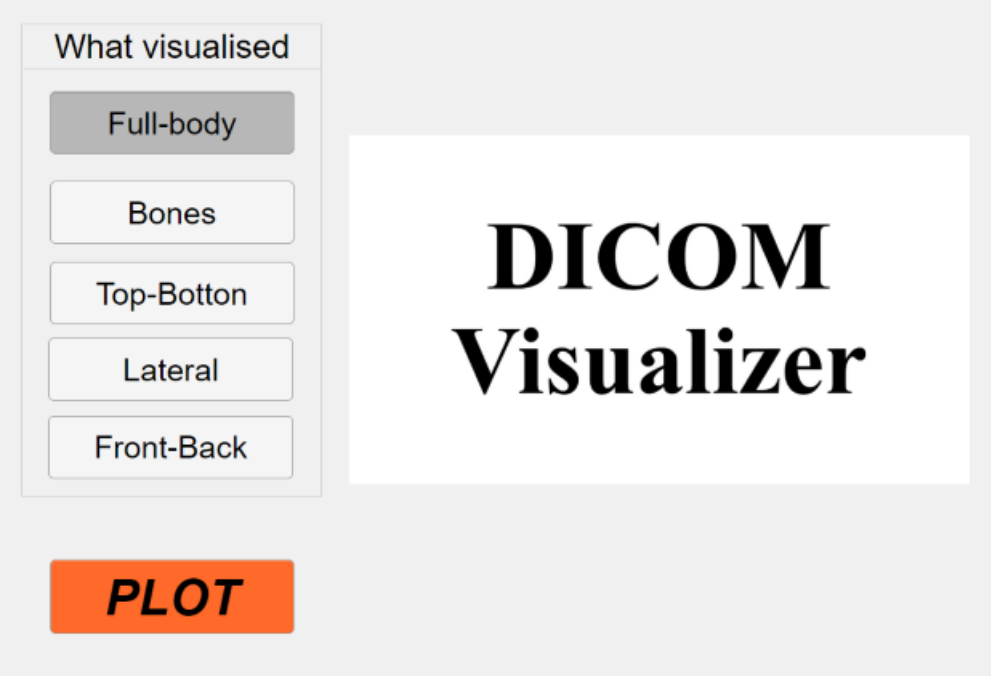


Figure 2: Interface view

# 4 Conclusions

In conclusion, this app allows to do the essential operations given a DICOM images sequence. The app is very user-friendly thanks to the simple interface and the intuitive steps to follow. The first one is the selection of what pictures to visualize in the table, located on the left part of the interface, then the user needs to plot it by pressing the button below and finally choosing the desired DICOM images' sequences from the computer. After a few minutes, the result appears on the screen. The possibility to choose which DICOM images visualised is the real benefit of the app since comparing different patients can be useful both in medical and academic fields.

# 5 Future works

An additional feature that should be added to the next app's version is the possibility to select which organ to see. Unfortunately, this cannot be done due to a lack of time and skills. In particular, there would be a function to do that, given any DICOM images sequence, highlights if certain organs are torn or unhealthy in any way.

# References

[1] Volume data structure

[2] Different functions for 3-D Volumetric Image Processing

[3] App design