Lecture 3 exercise 1 - DICOM file reading and visualizing

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The objective is: 1) to read a DICOM folder that contains different series of 2D DICOM images 2) to read a DICOM folder that contains different 3D DICOM series 3) to display 2D axial, coronal and sagittal views of 3D volumes

Sample DICOM images are available at INFN Pandora or on drive Google drive folder

Choose for this exercise: the Breast_Mammography_Case2/ dataset to complete point 1), the Lung_CT_cd2/ dataset for points 2) and 3).

Complete the lines starting with %c

1) Read a DICOM folder that contains different series of 2D DICOM images

A preliminary exploration of the content of a directory containing dicom files can be done with the DICOM Browser app (check the MATLAB APP menu)

Clear the workspace, close all figures and clear the command window

```
%c ...
%c ...
%c ...
```

Define the path of the data folder dir (mammography example)

```
%c filedir= ...;
```

Use dicomCollection to gather details about the series included in DICOM folder

```
%c collection = ...;
```

Read the right (R) mediolateral oblique (MLO) view (to which series it corresponds?) using dicomread NB: dicomCollection returns a table, use the table element containing the filename of the image to read

```
%c R_MLO= ...;
```

Visualize the 2D image

```
%c figure; ...
```

Change the colormap to gray

```
%c ...
```

2) Read a DICOM folder that contains different 3D DICOM series

Define the path of the data folder dir (lung CT example)

```
%c filedir=...;
```

In that directory there is a file named dicomdir.

A DICOM directory file (DICOMDIR) is a special DICOM file that serves as a directory to a collection of DICOM files stored on removable media, such as CD/DVD ROMs. When devices write DICOM files to removable media, they typically write a DICOMDIR file on the disk to serve as a list of the disk contents.

Use dicomCollection to gather details about the series included in DICOM folder. You can pass to dicomCollection either the filedir or the dicomdir file name

```
%c collection = ...;
```

Use dicomreadVolume to read a series of DICOM files (high resolution CT volume). Open only the series of interest with dicomreadVolume

```
%c [V,spatial,dim] = ...;
```

Explore the dicomreadVolume output.

spatial and dim variables contain useful voxel size information: - spatial is a structure describing the location, resolution, and orientation of slices in the volume. - dim specifies which real-world dimension (X = 1, Y = 2, Z = 3) has the largest amount of offset from the previous slice.

Check the dimension of V

```
%c ...
```

The dimensions of V are [rows,columns,samples,slices] where samples is the number of color channels per voxel. For example, grayscale volumes have one sample, and RGB volumes have three samples. Use the squeeze function to remove any singleton dimensions

```
%c V_3D=...;
```

Display one axial slice of the volume V

```
%c figure; ...
```

3) Display 2D axial, coronal and sagittal views of 3D volumes

Display the axial, coronal and sagittal views of the 3D volume V_3D intersecting at a given point P(i,j,k), similarly to the Mango viewer default display. Let's stat from a central point P=[i,j,k]. Define the cordinates of a central point for the volume V_3D

```
%c P=...;
```

Display an axial slice passing by P (i.e. z is fixed)

```
%c Im_Ax=...;
%c figure; ...
```

It is not correctly oriented. To oriented it as in Mango's neurological coordinate system ("Left is left"), try to left-right flip with fliplr

```
%c figure; ...
```

Display a coronal slice passing by P (i.e. x is fixed) Tip: check for singleton dimensions

```
%c Im_Cor=...;
```

Display Im_Cor

```
%c figure; ...
```

It is not correctly oriented. To oriented it as in Mango's neurological coordinate system, try a 90degree rotation (rot90), then a left-right flip

```
%c figure; ...
```

Display a sagittal slice passing by P (i.e. y is fixed)

```
%c Im_Sag=...;
```

Display Im_Cor

```
%c figure; ...
```

It is not correctly oriented. To oriented it as in Mango's neurological coordinate system, try a 90degree rotation

```
%c figure; ...
```

Display the three views together, with a big axial on top and smaller coronal and sagittal in the second row.

```
%c figure;
%c subplot(2,2,1:2)
%c ...;
%c subplot...
%c ...;
%c subplot...
%c ...;
```

Display the views passing for a different point P (e.g. P=[300 70 100] corresponding to point (69,299,200) in Mango (which starts numbering from zero)

```
%c P=...
```

In R2019b the orthosliceViewer has been introduced in MATLAB. The orthosliceViewer object opens a viewer for exploring grayscale and RGB volumes. The viewer displays three orthogonal views of the volume: a view along the x, y, and z dimensions.

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