

112-1 MATLAB Midterm Exam

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Please follow the instructions and upload **three m-files**, including **midterm_1.m**, **midterm_2.m**, **midterm_3.m**, to the **Midterm** folder in the E3 system. Please have a copy of all files and bring them to the classroom next week for correction.

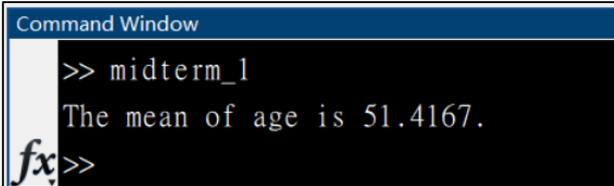
1. Program Debug (25 points)

Note: Please open the **Debug.m** file in the **MImaterials_midterm** directory and follow the steps below to debug the script. Please save the debugged file as **midterm_1.m**.

Steps:

- (1) Please correct one error of **xlsread** OUTPUTS on Line 3. (5 points)
- (2) Please correct one error of **xlsread** INPUTS on Line 3. (5 points)
- (3) Please correct one error on Line 7 to find the index of Age column. (5 points)
- (4) Please correct one error on Line 12 to find subjects with age within the age_range. (5 points)
- (5) Please correct one error on Line 17. (5 points)

Once all the errors are corrected, you should be able to see the output message in the Command Window, as shown in **Figure 1**.



```
Command Window
>> midterm_1
The mean of age is 51.4167.
fx>>
```

Figure 1

2. Fill in Program – Maximum intensity projection (MIP) (35 points)

Note: Perform maximum intensity projection (MIP) in contrast-enhanced magnetic resonance angiography to visualize the vessel structures. Please open the **Fillin.m** file in the **MImaterials_midterm** directory, and follow the steps below to fill in programs. Please save the script as **midterm_2.m**.

Steps:

- (1) Please assign the path of **MImaterials_midterm\data2** to a variable, **dirname**. (5 points)
- (2) Please remove the elements within **dirinfo** that are not DICOM files. (5 points)
- (3) Please create a for-loop to import all the DICOM files and save them as a 3D variable, **img**. (5 points)
- (4) Please use **montage** function to display all image slices in one figure (as shown in **Figure 2**). Please set up the 'Displayrange' between 0 and 500 and 'ThumbnailSize' as 512-by-416. (10 points)

HINT: help **montage** % for further information

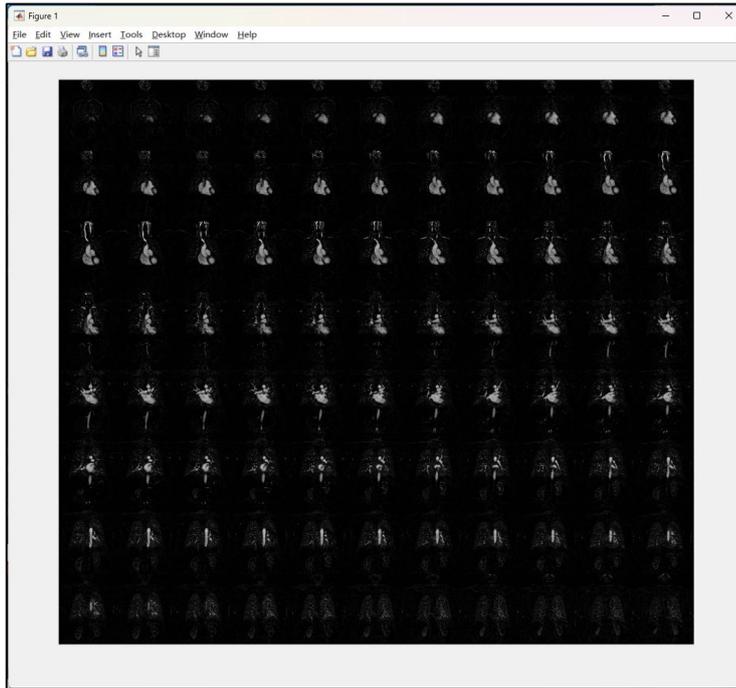


Figure 2

(5) Please follow the instructions below. (5 points)

- ✓ Please perform MIP along the third dimension.
- ✓ Please use **subplot** to locate the image at the first position.
- ✓ Please use **imshow** with display range between 30 and 400 to plot image.
- ✓ Please give a **title** to the image: [Anterior-posterior view](#).

(6) Please follow the instructions below. (5 points)

- ✓ Please perform MIP along the second dimension.
- ✓ Please use **subplot** to locate the image at the second position.
- ✓ Please use **imshow** with display range between 30 and 400 to plot image.
- ✓ Please give a **title** to the image: [Lateral view](#).

Once everything is done, you should be able to see the MIP images, as shown in **Figure 3**.

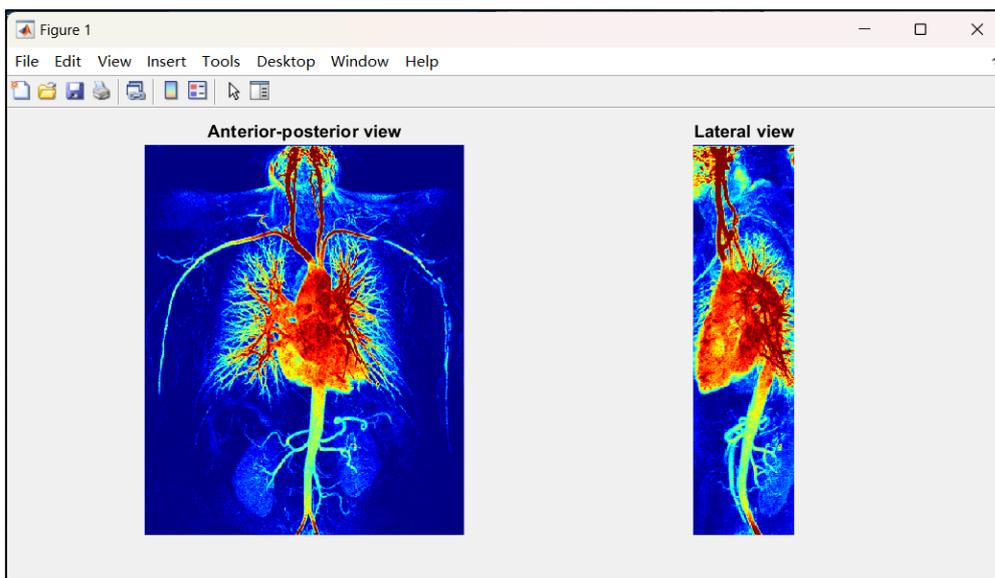


Figure 3

3. Image zoom-in, ROI, and thresholding (40 points)

Note: To assess a lesion, it is common to zoom in on images, draw region of interest (ROI), and perform thresholding. In this topic, please follow the steps below to accomplish the process and calculate the area of lesions. Please save the script as **midterm_3.m**.

Steps:

- (1) Please use **dicominfo** and for-loop to extract the series descriptions of DICOM header (**info**) from all the 200 files within the **MImaterials_midterm\data3** folder and save them within a cell array, **SeriesDescrip** (200 x 1 cell). (5 points)

HINT: **info.SeriesDescription**

- (2) Please use **dicomread** and for-loop to read 164 DICOM images with a series description of **'LUNG'** and save them within a 3D variable, **img** (512 x 512 x 164 double). (5 points)

- (3) Please convert the values of each DICOM image stored in **img** to Hounsfield Unit (HU). (5 points)

HINT: Please use **info.RescaleSlope** as the slope and **info.RescaleIntercept** as the intercept.

- (4) Please display the 120th slice of **img** using the window center of -500 and the window width of 1400. (5 points)

HINT: Please set up the display range with proper values in **imshow**.

- (5) Please use **drawrectangle** function to select the region of the right lung (**Figure 4**) and create a new figure to display the selected region with the same display window (**Figure 5**). (10 points)

HINT1: help **drawrectangle** % for further information

HINT2: **roi = drawrectangle;**

HINT3: The field 'Position' of **roi** is an array of the form [xmin, ymin, width, height], storing the location of ROI.

- (6) Please use **roipoly** function to contour the right lung as shown in **Figure 6** (5 points), and display a binary mask of the right lung using an intensity threshold of -200 (**Figure 7**). (5 points)

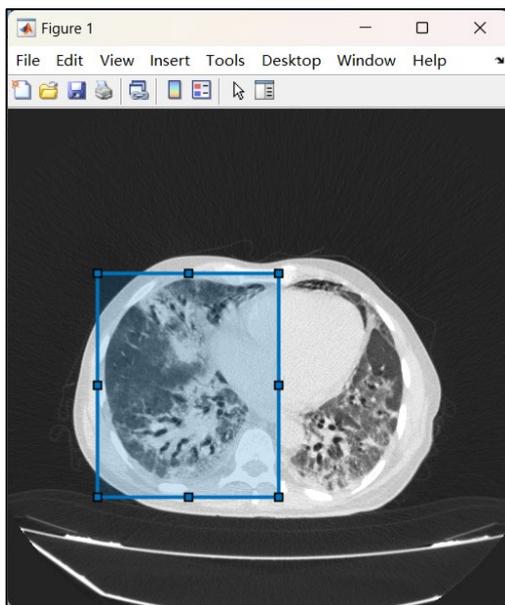


Figure 4

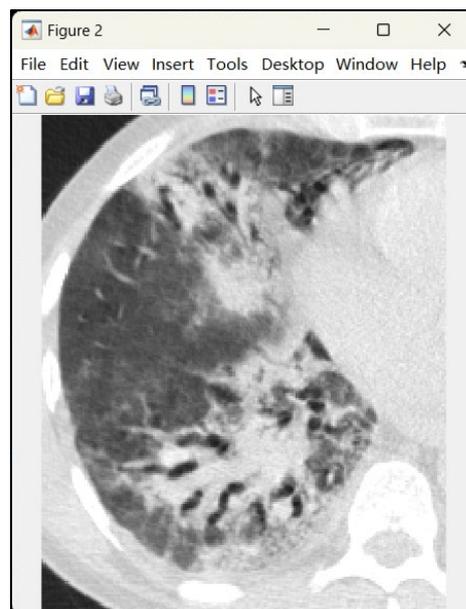


Figure 5

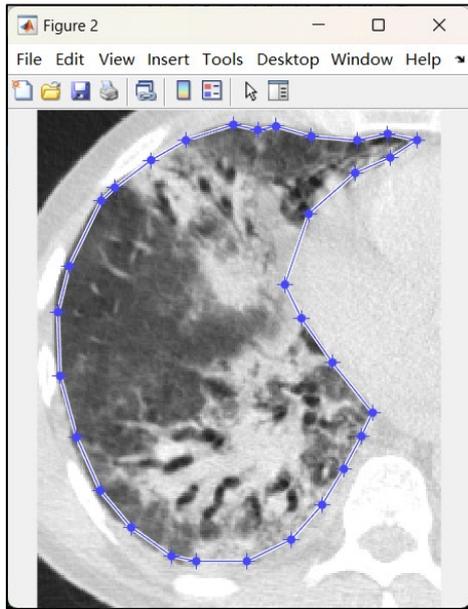


Figure 6

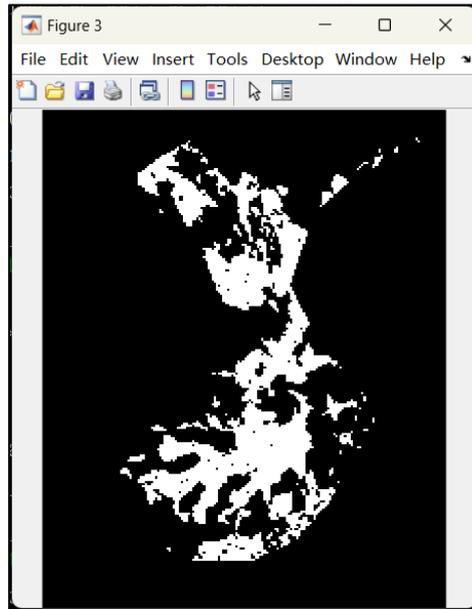


Figure 7