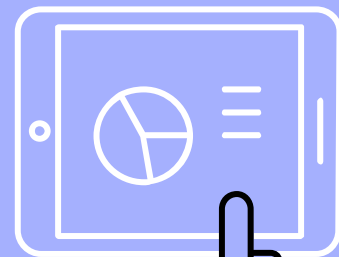
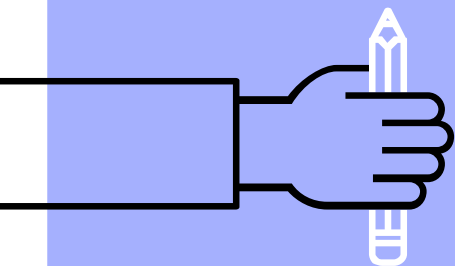


MATLAB程式語言

GUIDE介紹與實作

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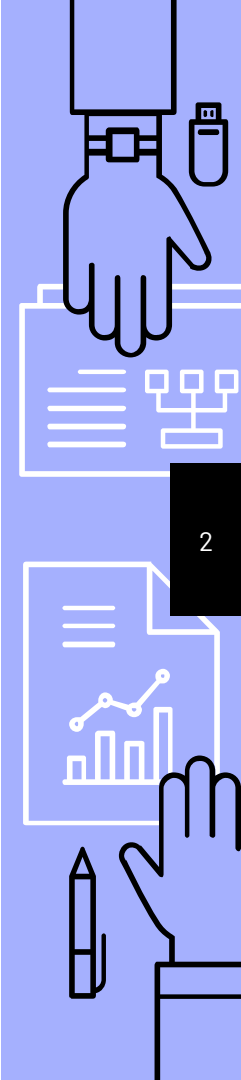


課程內容

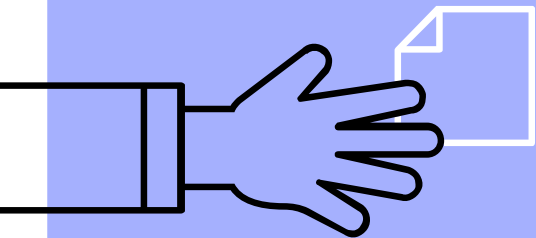
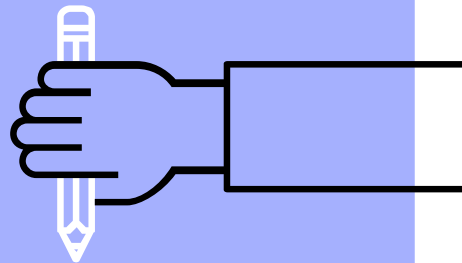
- ▷ 使用者圖形介面架構與GUIDE環境
- ▷ GUIDE影像處理介面實作

請自行至教學網頁下載本週課程資料

http://www.ym.edu.tw/~cflu/CFLu_course_matlabimage.html



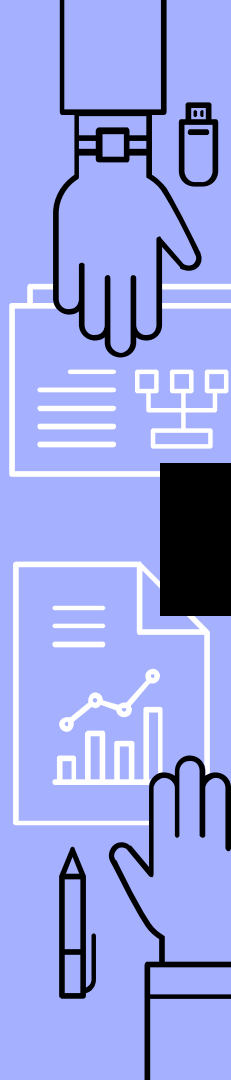
使用者圖形介面架構 與GUIDE環境



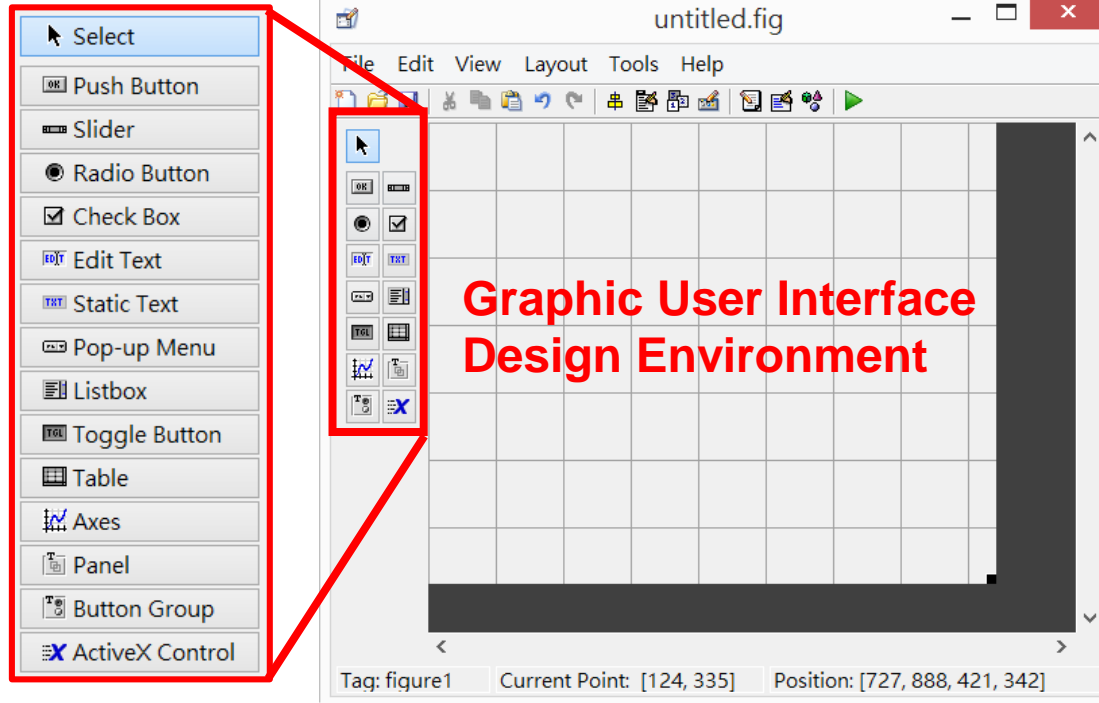
Graphic User Interface (interactable)



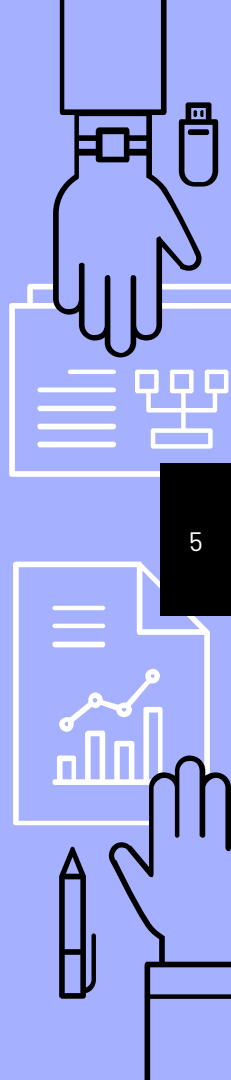
Please run `MImaterials_L15\guide_imgthres.m`



MATLAB guide (key in guide in command window)

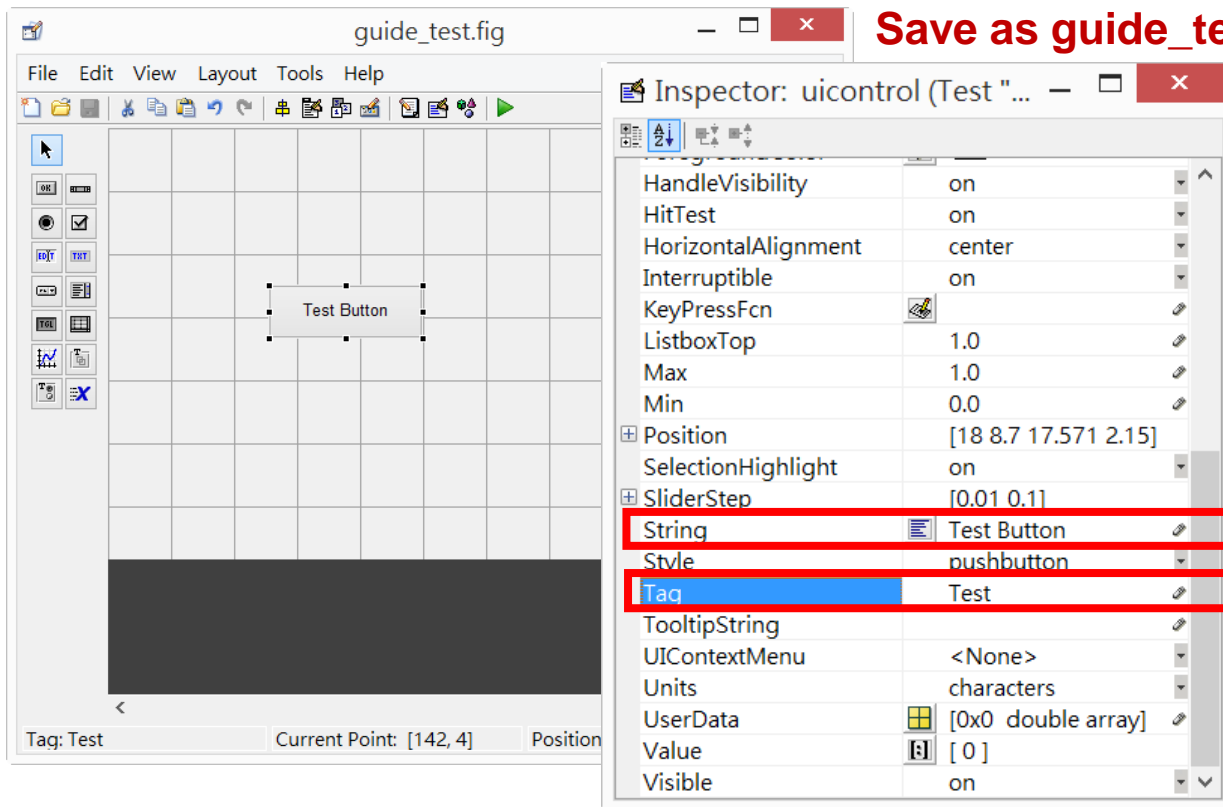


File → Preference → GUIDE → check Show names in component palette



Properties of an Object (double click on it)

Save as guide_test.fig



The image shows a MATLAB GUI editor window titled 'guide_test.fig'. In the center, there is a button labeled 'Test Button'. To the right, the 'Inspector: uicontrol (Test "...)' window is open, displaying the properties of the selected button. The properties are listed in a table:

HandleVisibility	on
HitTest	on
HorizontalAlignment	center
Interruptible	on
KeyPressFcn	
ListboxTop	1.0
Max	1.0
Min	0.0
Position	[18 8.7 17.571 2.15]
SelectionHighlight	on
SliderStep	[0.01 0.1]
String	Test Button
Style	pushbutton
Tag	Test
TooltipString	
UIContextMenu	<None>
Units	characters
UserData	[0x0 double array]
Value	[0]
Visible	on

The 'String' and 'Tag' properties are highlighted with red boxes. The 'Tag' property is also highlighted with a blue background.

handles.Test

guide Structure – initialize GUI

**Put *.m and *.fig
together or error!!**

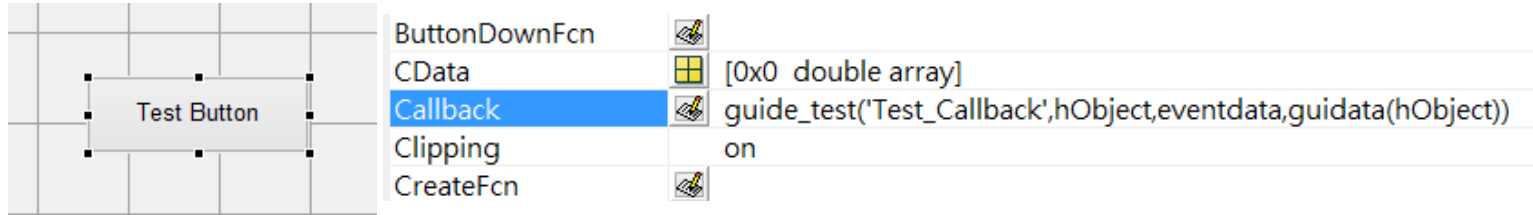
```
27 % Begin initialization code - DO NOT EDIT
28 - gui_Singleton = 1;
29 - gui_State = struct('gui_Name',    mfilename, ...
30                    'gui_Singleton', gui_Singleton, ...
31                    'gui_OpeningFcn', @guide_test_OpeningFcn, ...
32                    'gui_OutputFcn', @guide_test_OutputFcn, ...
33                    'gui_LayoutFcn', [], ...
34                    'gui_Callback', []);
35 - if nargin && ischar(varargin{1})
36 -     gui_State.gui_Callback = str2func(varargin{1});
37 - end
38
39 - if narginout
40 -     [varargout{1:narginout}] = gui_mainfcn(gui_State, varargin{:});
41 - else
42 -     gui_mainfcn(gui_State, varargin{:});
43 - end
44 % End initialization code - DO NOT EDIT
```





guide Structure – initialize GUI

```
47 % --- Executes just before guide_test is made visible.
48 function guide_test_OpeningFcn(hObject, eventdata, handles, varargin)
49 % This function has no output args, see OutputFcn.
50 % hObject handle to figure
51 % eventdata reserved - to be defined in a future version of MATLAB
52 % handles structure with handles and user data (see GUIDATA)
53 % varargin command line arguments to guide_test (see VARARGIN)
54
55 % Choose default command line output for guide_test
56 handles.output = hObject;
57
58 % Update handles structure
59 guidata(hObject, handles);
60
61 % UIWAIT makes guide_test wait for user response (see UIRESUME)
62 % uiwait(handles.figure1);
```

← Create other objects here!!

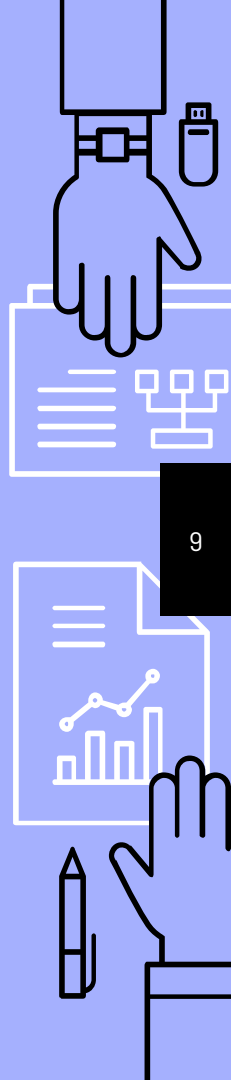
guide Structure – Callback



ButtonDownFcn		
CData		[0x0 double array]
Callback		guide_test('Test_Callback',hObject,eventdata,guidata(hObject))
Clipping		on
CreateFcn		

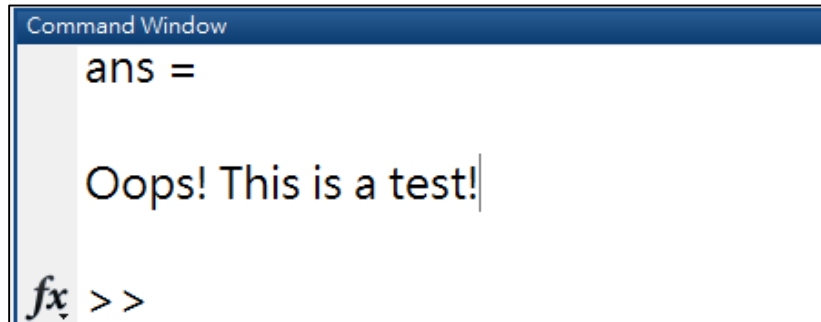
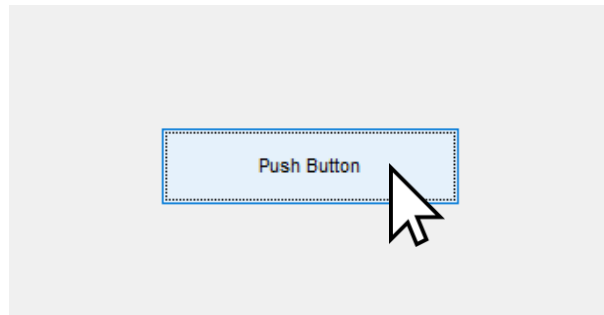
```
76 % --- Executes on button press in guide_test.  
77 function Test_Callback(hObject, eventdata, handles)  
78 % hObject handle to guide_test (see GCBO)  
79 % eventdata reserved - to be defined in a future version of MATLAB  
80 % handles structure with handles and user data (see GUIDATA)  
81  
82  
83
```

← Add commands here!!



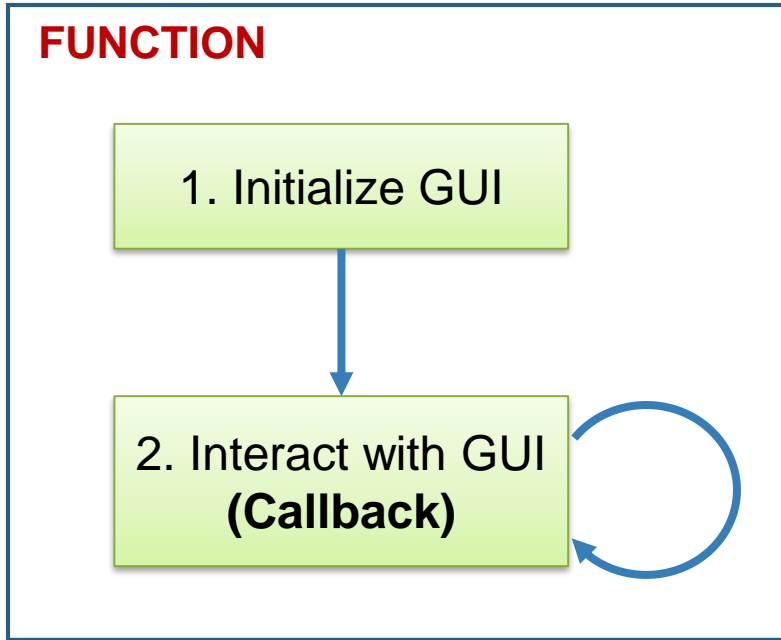
guide Structure – Callback

```
76 % --- Executes on button press in Test.  
77 function Test_Callback(hObject, eventdata, handles)  
78 % hObject handle to Test (see GCBO)  
79 % eventdata reserved - to be defined in a future version of MATLAB  
80 % handles structure with handles and user data (see GUIDATA)  
81 - fprintf('Oops! This is a test \n')
```



```
Command Window  
ans =  
  
Oops! This is a test!  
  
fx >>
```

guide Structure – Callback

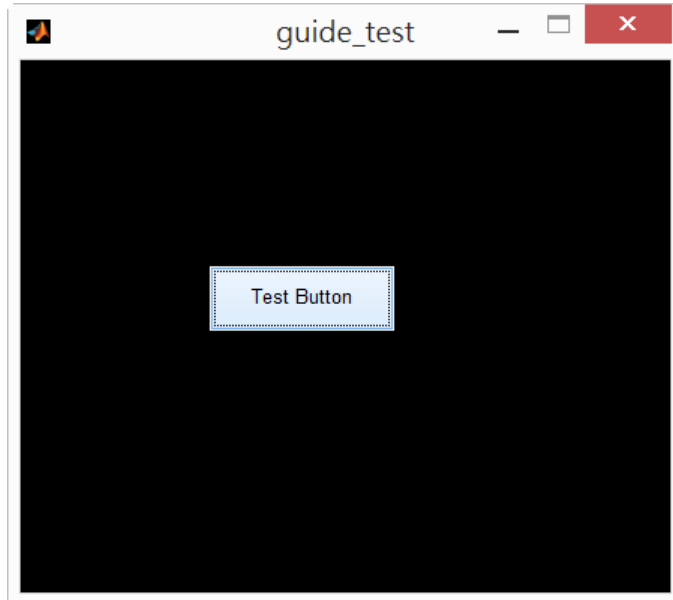
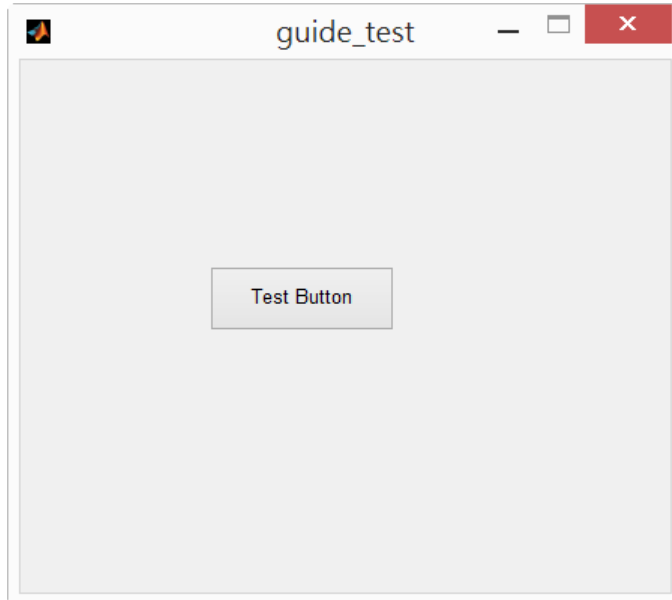


Learn how to deal with objects

- **handles**

Example – change figure color

- ▶ `set(gcf,'color',[0 0 0])`

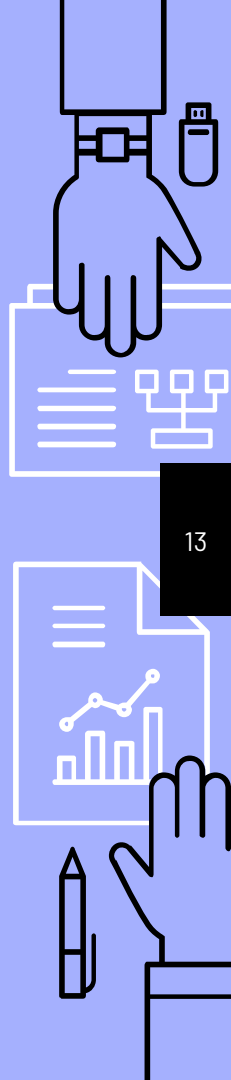




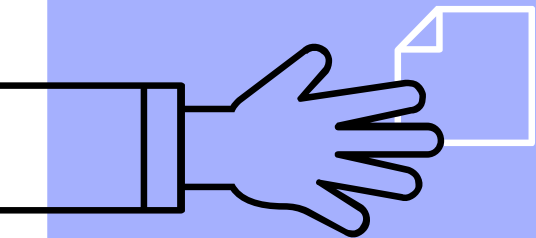
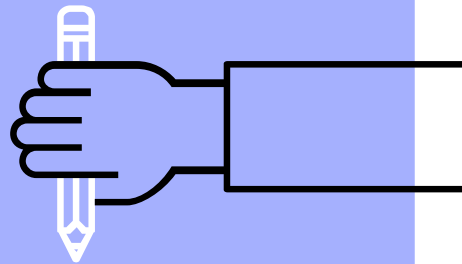
Handles of UI objects

- ▶ **gcf**: get handle of current figure
- ▶ **gca**: get handle of current axes
- ▶ **gco**: get handle of current object

- ▶ **gcbf**: get handle of callback figure
- ▶ **gcbo**: get handle of callback object

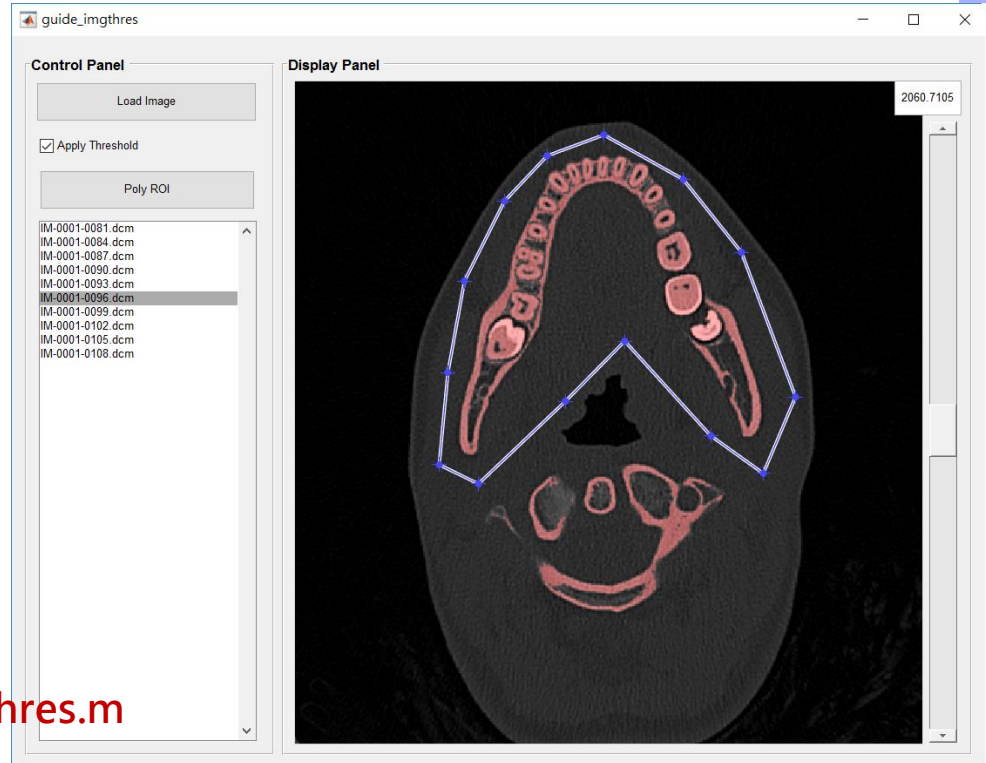


GUIDE影像處理 介面實作



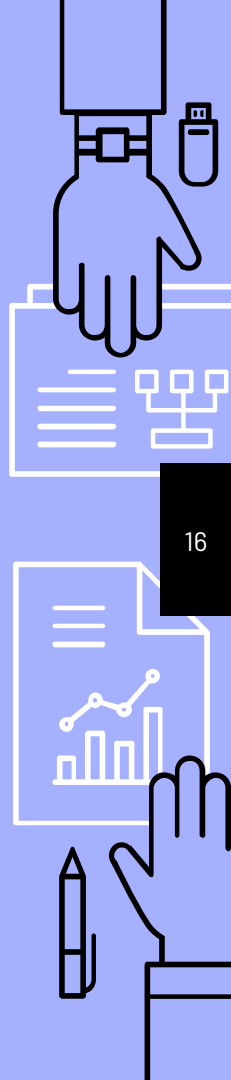
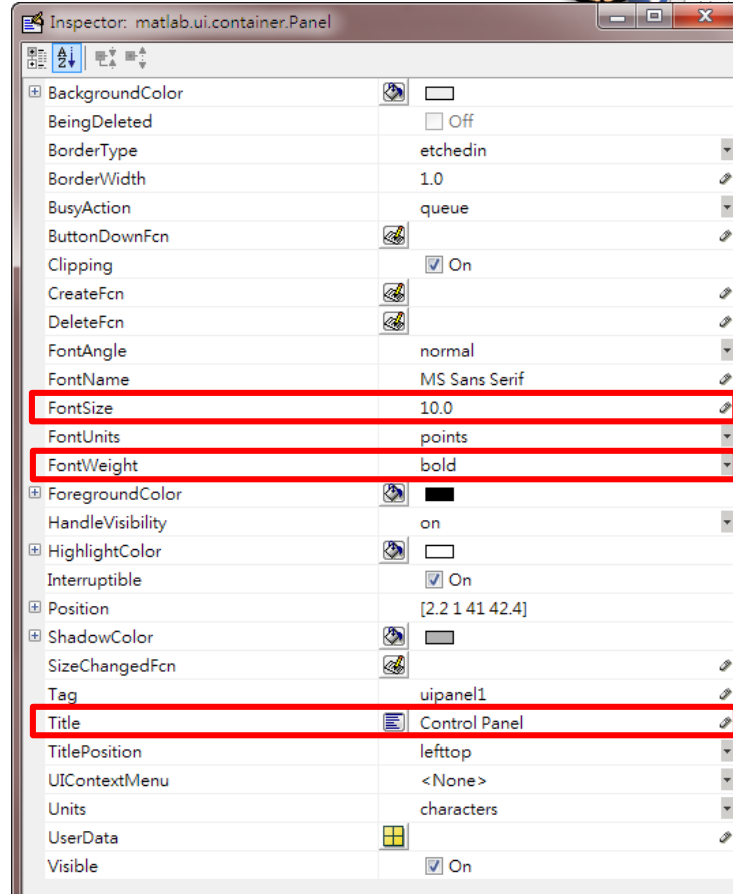
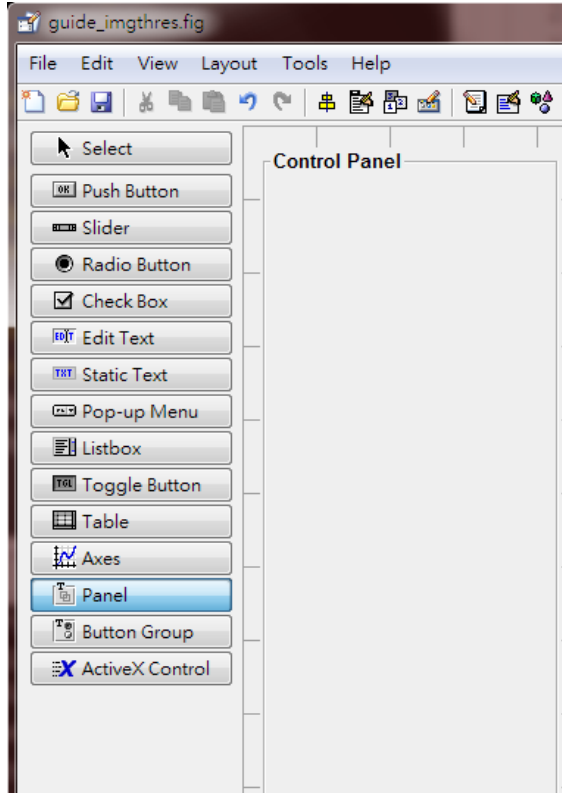
GUI of Image Processing

- ▶ Load and view image slices
- ▶ Interactively preview the image thresholding result
- ▶ Overlap thresholding masks with the manual ROI (roipoly)



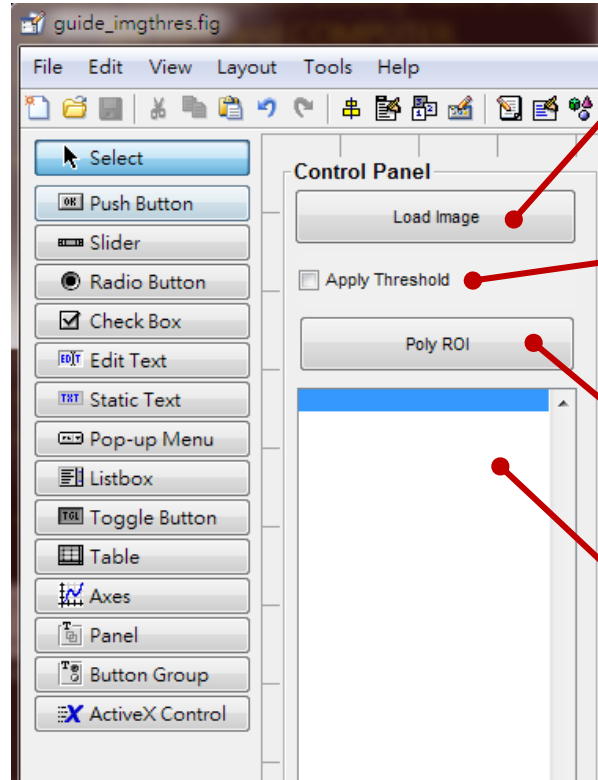
MImaterials_L15\guide_imgthres.m

UI panel



UI panel

UI objects within an UI panel will automatically form a group.



String: Load Image
Tag: **loadimage**

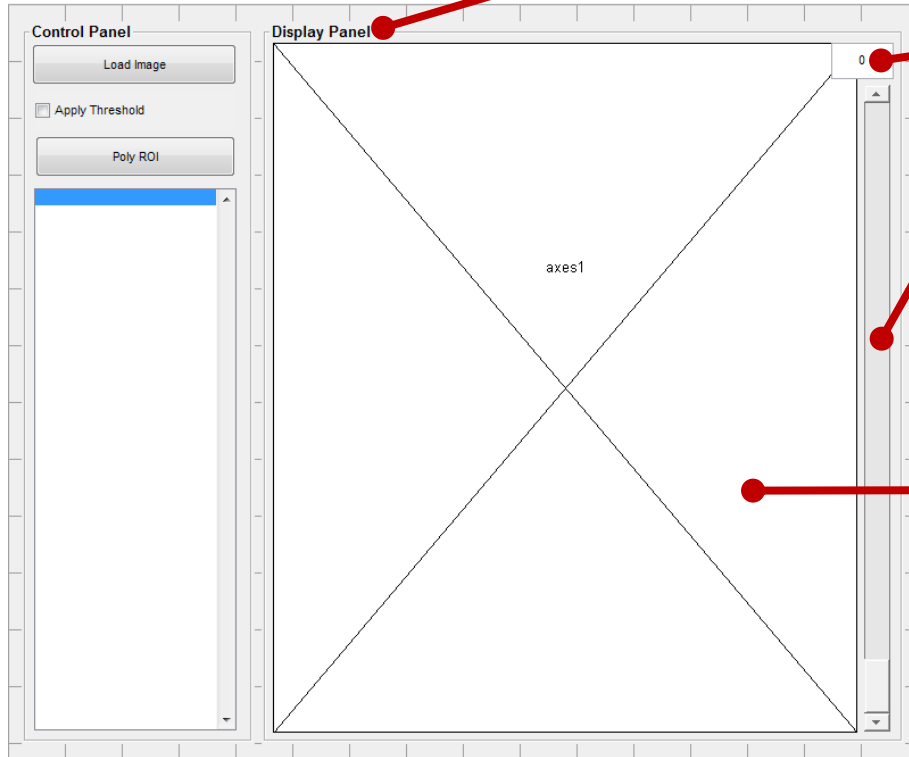
String: Apply Threshold
Tag: **applythres**

String: Poly ROI
Tag: **roipoly**

String:
Tag: **imglist**

Layout of GUI

Title: Display Panel
FontSize: 10, FontWeight: bold



String: 0
Tag: editthres

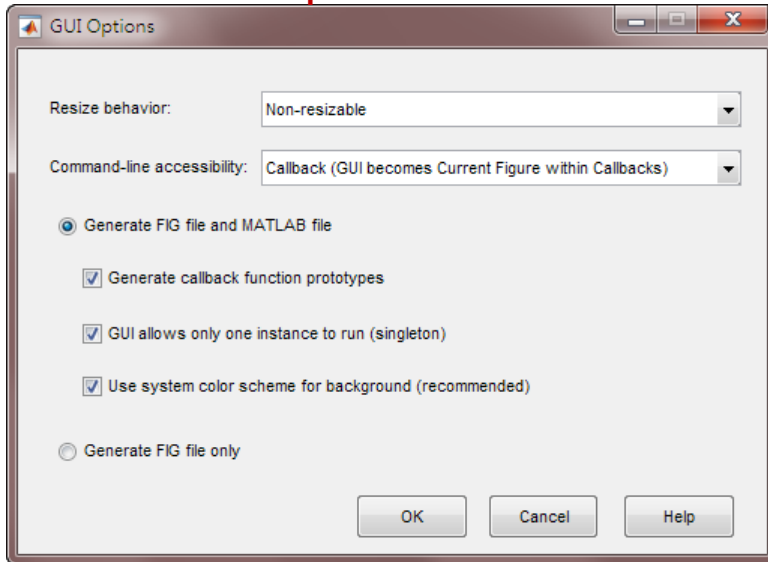
Tag: sliderthres

Visible: off

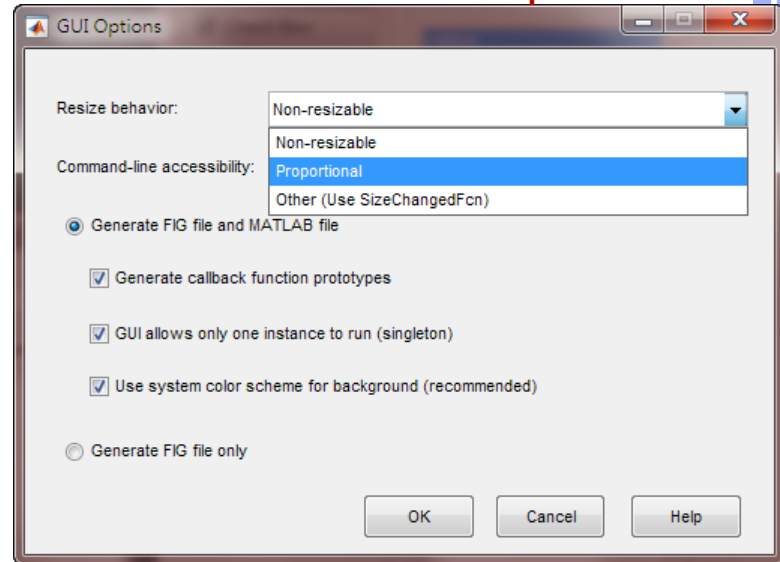
Please set up the UI parameters and save as [guide_testingproc.m](#).

Resize figure

Tools → GUI Options



Resize behavior → Proportional



Create image objects

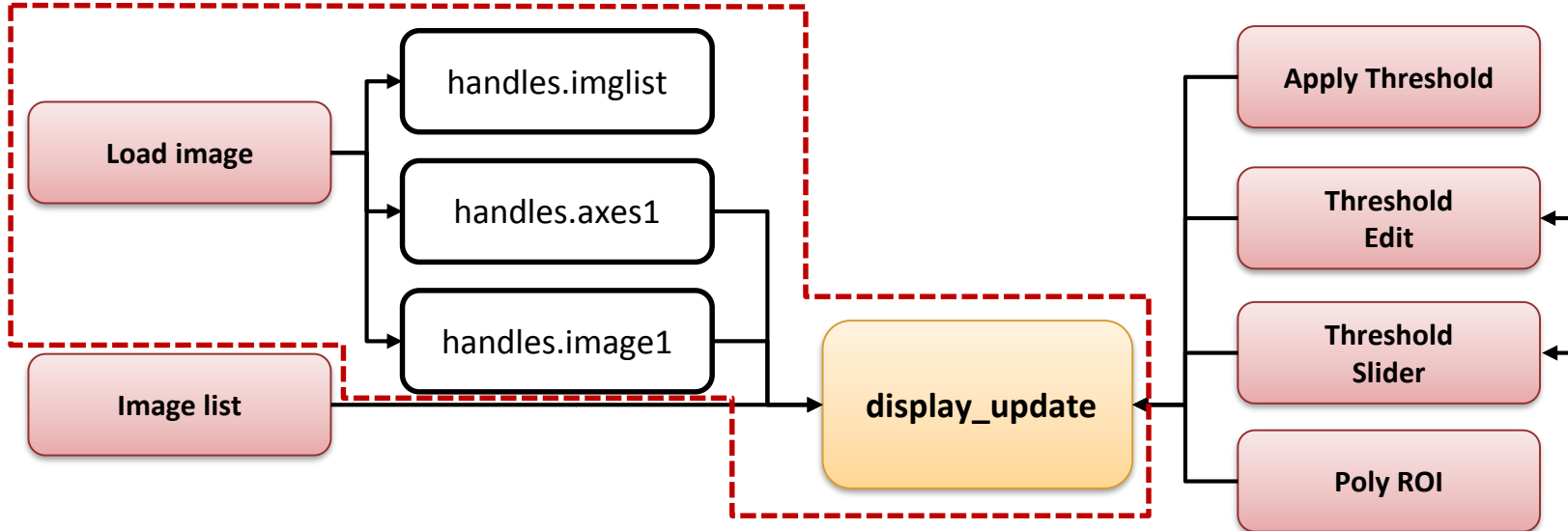
guide_test_OpeningFcn

```
55 % Choose default command line output for guide_imgthres
56 handles.output = hObject;
57
58 handles.image1 = image('parent',handles.axes1,...
59                       'Xdata',[],'Ydata',[],'Cdata',[]);
60 handles.image2 = image('parent',handles.axes1,...
61                       'Xdata',[],'Ydata',[],'Cdata',[],'alphadata',0.3);
62
63 % Update handles structure
64 guidata(hObject, handles);
```

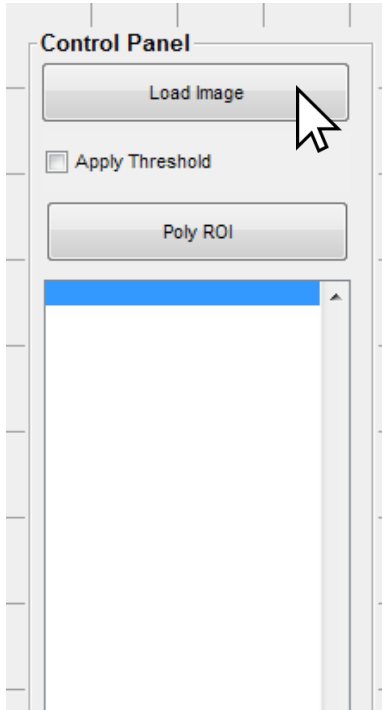
Original image

Thresholding mask

GUI flow



File list



1. Press [Load Image].
2. Select a folder with all images to load.
3. Update the file list of **handles.imglist**
4. Display selected image on **handles.image1**

load images

```
105 function loading_Callback(hObject, eventdata, handles)
106 % hObject handle to loading (see GCBO)
107 % eventdata reserved - to be defined in a future version of MATLAB
108 % handles structure with handles and user data (see GUIDATA)
109
110 % select a directory with DICOM images
111 dirname=uigetdir;
112 dirinfo=dir([dirname filesep '*.dcm']);
113 % read image using for-loop
114 handles.Data.img=[];
115 liststr={};
116 for i=1:length(dirinfo) load images
117 handles.Data.img(:,:,i)=dicomread([dirname filesep dirinfo(i).name]);
118 liststr{i}=dirinfo(i).name; Strings of file list
119 end
```

Update list, axes, image

```
121 % update handles.imglist
122 - set(handles.imglist,'String',liststr,'Value',1)
123 % update handles.axes1 and handles.image1
124 - [row,col]=size(handles.Data.img); Set up range
125 - set(handles.axes1,'Xlim',[1 col],'Ylim',[1 row],'Ydir','reverse')
126 - set(handles.image1,'XData',[1 col],'YData',[1 row],...
127     'CDataMapping','scaled') Auto-scale
128 - set(handles.image2,'XData',[1 col],'YData',[1 row])
```


Update sliders, Display

```
129 % update handles.sliderthres
130 - set(handles.sliderthres,'min',min(handles.Data.img(:),...
131     'max',max(handles.Data.img(:)))
132
133 % Update handles structure
134 - guidata(hObject, handles); This line is mandatory if any
135 - display_update %update display Call display block
```



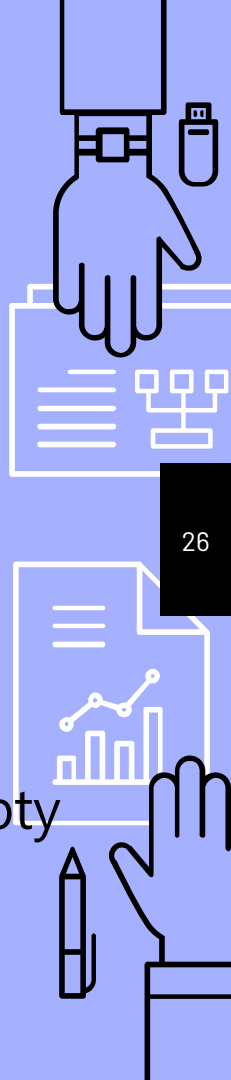
Guidata

guidata **Store or retrieve application data.**

guidata(H, DATA) stores the specified data in the figure's application data.

H is a handle that identifies the figure - it can be the figure itself, or any object contained in the figure.

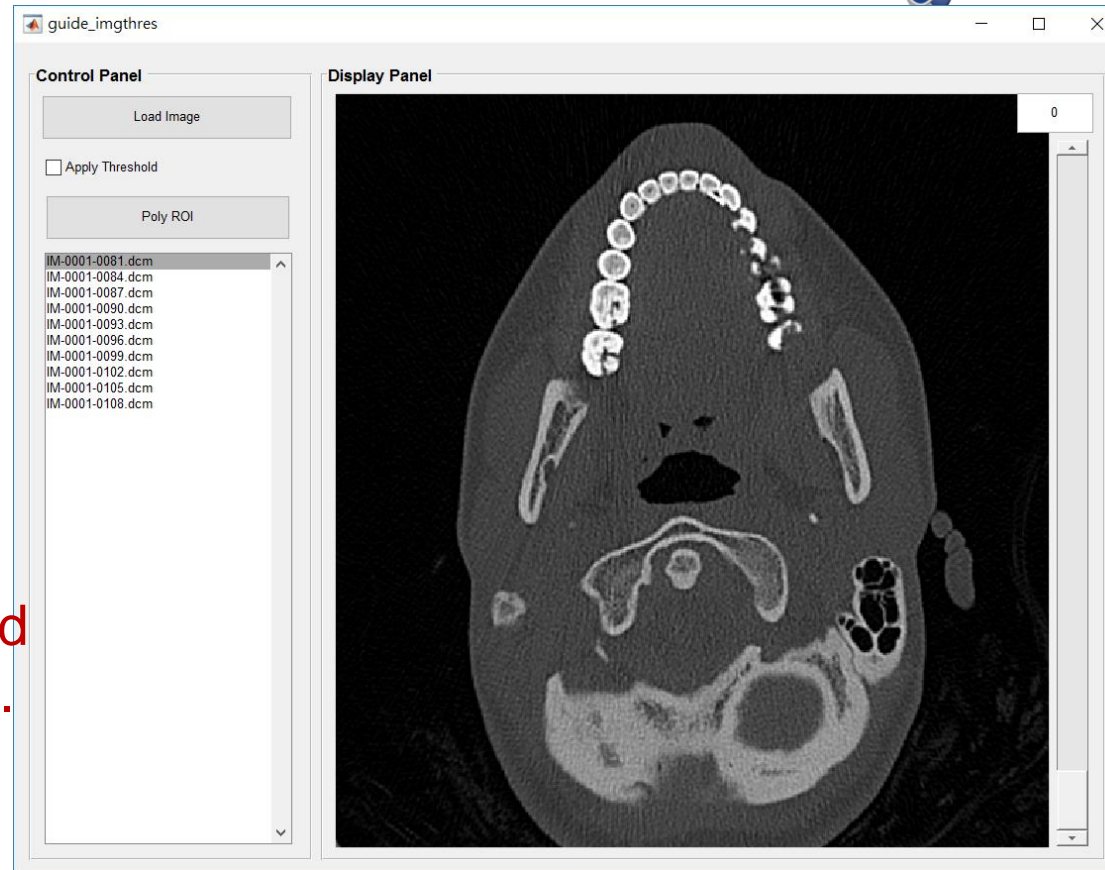
DATA = guidata(H) returns previously stored data, or an empty matrix if nothing was previously stored.



Update display

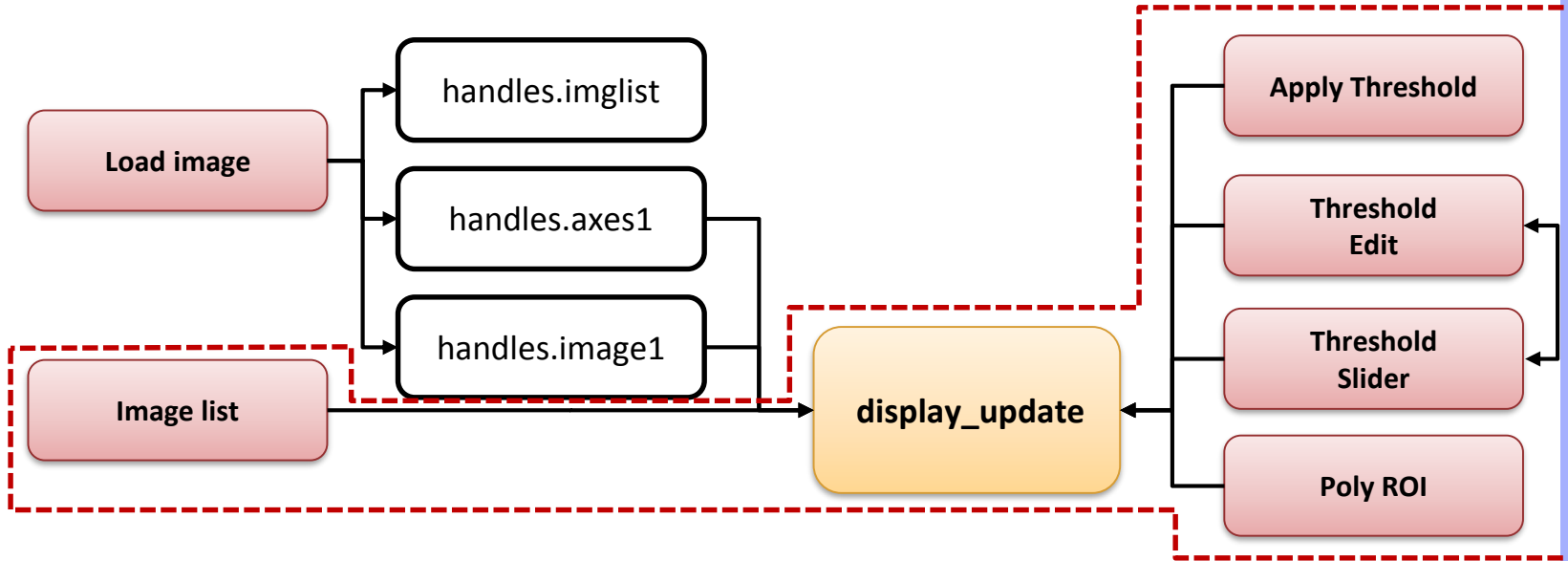
Update the selected DICOM image

206	<code>function display_update</code>	define function name
207	<code>% update display based on the values of uicontrols</code>	
208	<code>% retrieve the handles</code>	
209	<code>handles=guidata(gcf);</code>	returns handles from current figure
210		
211	<code>num=get(handles.imglist,'value');</code>	
212	<code>set(handles.image1,'CData',handles.Data.img(:,:,num))</code>	
213	<code>colormap(gray)</code>	Set up colormap

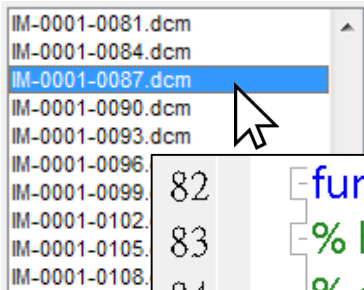


So far, we can load
and display image.

GUI flow



Switch images using file list



```
82 function imglist_Callback(hObject, eventdata, handles)
83 % hObject handle to imglist (see GCBO)
84 % eventdata reserved - to be defined in a future version of MATLAB
85 % handles structure with handles and user data (see GUIDATA)
86
87 % Hints: contents = cellstr(get(hObject,'String')) returns imglist contents
88 % contents{get(hObject,'Value')} returns selected item from imglist
89 display_update
```

Apply threshold

Load Image

Apply Threshold

```
194 % --- Executes on button press in applythres.  
195 function applythres_Callback(hObject, eventdata, handles)  
196 % hObject handle to applythres (see GCBO)  
197 % eventdata reserved - to be defined in a future version of MATLAB  
198 % handles structure with handles and user data (see GUIDATA)  
199  
200 % Hint: get(hObject,'Value') returns toggle state of applythres  
201 display_update
```

Adjust threshold

```
146 function sliderthres_Callback(hObject, eventdata, handles)
147 % hObject handle to sliderthres (see GCBO)
148 % eventdata reserved - to be defined in a future version of MATLAB
149 % handles structure with handles and user data (see GUIDATA)
150
151 % Hints: get(hObject,'Value') returns position of slider
152 % get(hObject,'Min') and get(hObject,'Max') to determine range of
153 - value=get(handles.sliderthres,'value');
154 - set(handles.editthres,'string',num2str(value))
155 - display_update
```


Adjust threshold

```
173 - function editthres_Callback(hObject, eventdata, handles)
174 - % hObject   handle to editthres (see GCBO)
175 - % eventdata reserved - to be defined in a future version of MATLAB
176 - % handles   structure with handles and user data (see GUIDATA)
177
178 - % Hints: get(hObject,'String') returns contents of editthres as text
179 - %        str2double(get(hObject,'String')) returns contents of editthres
180 - value=get(handles.editthres,'string');
181 - set(handles.sliderthres,'value',str2num(value))
182 - display_update
```

Roipoly

```
139  function roipoly_Callback(hObject, eventdata, handles)
140  % hObject  handle to roipoly (see GCBO)
141  % eventdata reserved - to be defined in a future version of MATLAB
142  % handles  structure with handles and user data (see GUIDATA)
143  handles.Data.roi=roipoly;
144  % Update handles structure
145  guidata(hObject, handles);
146  display_update
```



Update display

Step1: Display selected DICOM image

Step2: Update the thresholding image

Step3: Try to apply roipoly mask to the thresholding image

MImaterials_L15\guide_imgthres.m
display_update: Lines 206~243

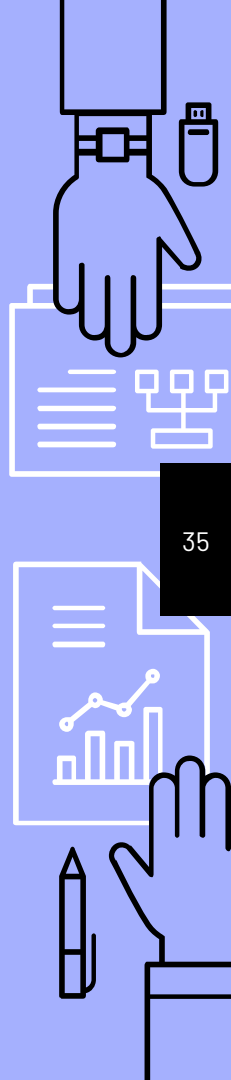
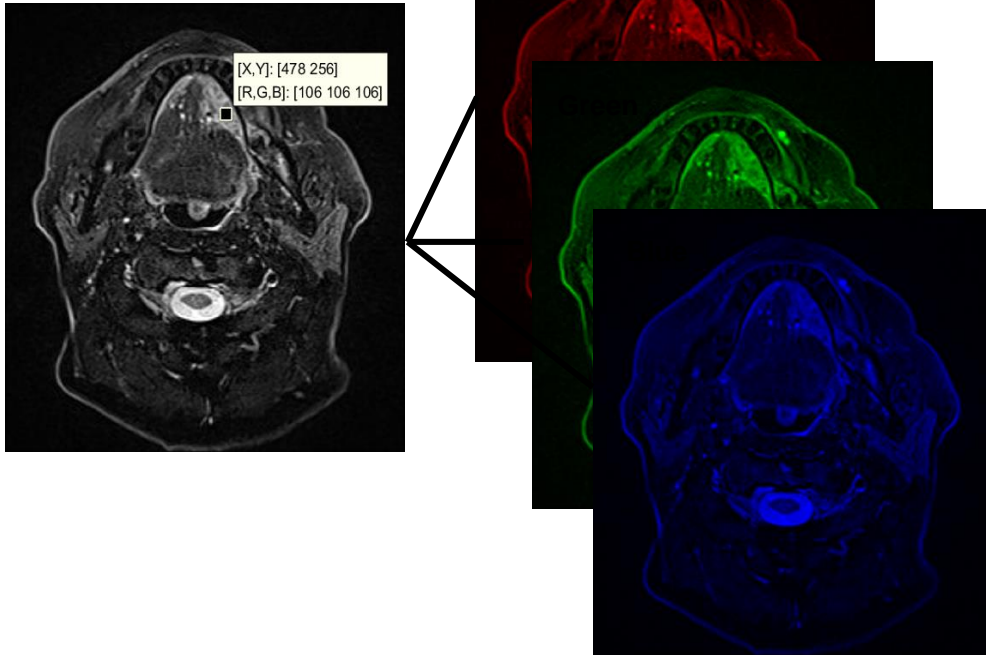
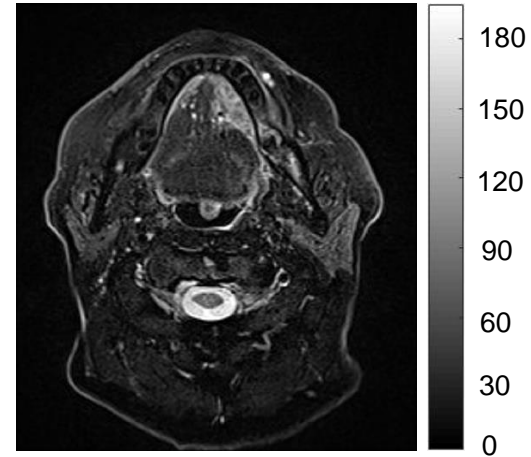


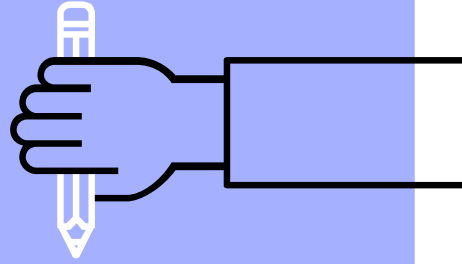
Image Display

Can be R.G.B 3 layers/values



or single layer/value with a colormap





THE END

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