**COSC 4372 PROJECT: MRI ACQUISITION SIMULATOR (CODE EXECUTION INSTRUCTIONS)**

**Instructions on installing MATLAB**

* If you have a **MathWorks** account, install MATLAB using this link: <https://www.mathworks.com/help/install/ug/install-products-with-internet-connection.html>

**OR**

Follow these instructions if you plan to install MATLAB using **UH email address**:

1. Click this link: <https://www.mathworks.com/academia/tah-portal/university-of-houston-972711.html>
2. Sign in with **UH cougarnet email**.
3. You will be redirected to a UH SSO portal.
4. You can then download MATLAB. Make sure you download and install the latest version of MATLAB **(MATLAB R2023b)**

We created a Graphical User Interface (GUI) for our MRI Acquisition Simulator using **Matlab’s App Designer**.

**Detailed Instructions on how to run the Graphical User Interface (GUI) :**

1. There are **6** MATLAB files for this project. They are:

* GUI.m
* drawCircle.m
* GeneratePhantomPushed
* DisplayKSpacePushed
* RunAcquisitionPushed
* CompareImagePushed

All the Matlab files except GUI.m are contained in the ProjectFunctions folder.

1. The **main GUI code** needed to start/run the GUI is contained in **GUI.m** file. The other Matlab files contain the functions needed to perform the required tasks for the MRI Acquisition Simulator and these functions are called in **GUI.m**. (Instructions continued in next page)
2. **Only the** **GUI.m** file needs to be run to use the MRI Acquisition Simulator. The other Matlab files can of course be checked for what code it contains. (Instructions continued in next page)
3. When you open the GUI.m file and run it, the GUI will open in a separate window and you can see all the buttons (Generate Phantom, Display K-space, Run Acquisition, Compare Image).
4. But the **"Run Acquisition"** button and **"Compare Image"** button in the GUI would not work and won't produce the phantom images due to an error that will appear in the command window of MATLAB. The error is because of an **image package** not being installed.

Here is the screenshot of the error:

A screenshot of a computer

Description automatically generated

1. To fix **the above error**, you just need to install the image package which is **Image Processing Toolbox**. Image Processing Toolbox is an add-on in MATLAB. You can install this package by clicking on the link to "Image Processing Toolbox" given in the command window which shows the error **OR**

You can install this package by going to the Add-Ons section in the "Home" section of the MATLAB toolbar window under "Environment" segment. Basically, in MATLAB toolbar, go to **HOME 🡪 ENVIROMENT 🡪 Add-Ons 🡪 Get Add-Ons 🡪 Search for Image Processing Toolbox and install it.**

1. After installing the image add-on package, the GUI should run perfectly without any errors. But before running the GUI.m file, make sure the “ProjectFunctions” folder is **added to the MATLAB path**. Otherwise, the GUI will not run properly. You can add the ProjectFunctions to MATLAB path by right clicking the ProjectFunctions, and click on Add to Path 🡪 Selected Folders. It is very important that ProjectFunctions folder is added to MATLAB path.
2. When you click "Run" in the GUI.m file, a separate window will open (maximize the window for full view) with the MRI Acquisition Simulator, which contains 4 panels namely, Generation of Input Phantom, Displaying K-space of Phantom, then Sampled-K-space image of phantom (Radial or Cartesian sampling), and then the last panel being the Reconstructed image of phantom for comparison. (Instructions continued in next page)
3. You can choose the input Phantom (Phantom 1 or Phantom 2) in the first panel of the GUI and can even adjust the length and width of it. Once you click the "**Generate Phantom**" button, the input phantom will be displayed. Then when you click the **"Display K-space"** button (which is the second panel), the K-space image of the phantom will be displayed. The **"Run Acquisition"** button will display the Sampled K-space image (depending on which type of sampling you choose - Radial or Cartesian) and it will also display the **reconstructed image of the phantom** in the fourth panel of the GUI. You can even adjust the number of lines and number of points per line in the third panel of the GUI to display the sampled K-space image and the reconstructed image of the phantom accordingly. It might take some time to generate the images, like 1-2 minutes. As the images get displayed , they get saved as a png files. While testing our MRI Acquisition Simulator with certain specifications, the saved images were included in the outputs folder.
4. Last but not the least, the **"Compare Image"** button in the fourth panel of the GUI will open a **separate window** displaying the input phantom and the reconstructed image of phantom (side by side) which would be very essential for analysis and comparison.