

## [Getting Started]

The first thing to do is download the entire [registration\\_GUI](#) folder and navigate to it in MATLAB. While using the GUI, it is imperative that the user [remains in this folder](#), or else the application may crash. Do not remove or rename any of the subdirectories, as they are referenced by name in the application.

To run the application, simply navigate to the folder indicated above, and type '[registration\\_GUI](#)' into the MATLAB command window.

## [Selecting an Operation]

There are six main operations supported by this GUI:

### [1] Register one stack – single reference

The user will input a directory containing image files and a reference image. All images selected from that directory will be registered to that selected reference image.

### [2] Register one stack – reference to previous

The user will input a directory containing image files and a reference image. The reference image will be left alone. All other images will be registered to the adjacent image closer to the reference, starting at the reference and iterating outward.

### [3] Register second stack – single reference

This operation assumes that one stack has already been registered/initialized. A chosen reference image for the second stack is registered to the image of corresponding index in the first stack. Then all other images in the second stack are registered to that second stack reference image.

### [4] Register second stack – reference to previous

This operation assumes that one stack has already been registered/initialized. A chosen reference image for the second stack is registered to the image of corresponding index in the first stack. The other images of the second stack are registered in a manner similar to operation 2.

### [5] Register second stack – parallel reference

This operation assumes that one stack has already been registered/initialized. All images of the second stack are registered to the images of corresponding indices in the first stack.

### [6] Make stack (no registration)

As the name suggests, this operation does not call the registration subroutine, and only constructs a stack from a directory containing images.

## [Registering Stack]

If the user is running operations **1, 2, or 6**, he/she will be working with the parameter inputs on the **left side** of the GUI. For all other operations, the user will be working with the **right side** of the GUI, **under the assumption that one of operations 1, 2, and 6 has already been performed.**

The user may type the path of a directory into the edit box that initially contains “Enter directory path ...”, but will probably find it easier to click the **Browse** button instead. This will open a file explorer window in the current folder which will allow the user to navigate to and select a directory. Images to be registered and/or turned into a dataset will be loaded from the selected folder.

The user must then select from the dropdown menu the type of image files to look for in the specified directory. Only files of the chosen type will appear in the box below to be put into a stack.

The user must then click the **‘Load’** button, which will populate the box below with images from the selected directory of the selected type. If the user selects **multiple-image TIFF files**, then **only one** file may be selected for registration. Otherwise, the user selects **all** images to appear in the stack.

**Note that images will appear in the stack in the order they appear in the box.** For that reason, it may be helpful to label the images in such a way that they appear in a list in the desired order, i.e. using numbers.

When choosing a reference image, the user must enter **a number** that corresponds to the index of that image in the full list of images in the directory, **NOT out of only the selected images.**

The user can then click the **‘Register’** button to perform the chosen operation. A window will appear indicating completion success or failure. At this point the user may continue to perform another operation or save data. To save data, the user must enter values for wavelength and pixel size into the appropriate boxes, along with an **expression** that, when evaluated, creates a **vector** that indicates the z distance of each image in the stack. Then the user must enter a name and click the **‘Save’** button. The data will be saved as a **\*.mat** file in the **datasets** subdirectory. Datasets created by this GUI are intended to be compatible with the **phase\_rec\_GUI**.

To view the newly created dataset, the user can type **‘stack\_viewer’** into the MATLAB command window to start another GUI which facilitates the viewing of an image stack using a slider. Use of the **stack\_viewer** GUI is fairly intuitive and has been omitted from this guide.

**Note that no change of directory is needed to run both registration\_GUI and stack\_viewer.**

## [Troubleshooting]

Expressions for various parameters must be entered in such a way that MATLAB can convert them from strings to doubles. For example, “10e2” will be recognized as 100, but “10^2” will not; “0.5” will be recognized as a valid input, but “1/2” will not. The application converts an expression from string to double, but DOES NOT evaluate the expression unless otherwise stated.

If nothing works, check the current directory. THE CURRENT DIRECTORY MUST BE **‘.../registration\_GUI/’**. MANUALLY CHANGING DIRECTORIES WILL CAUSE THE APPLICATION TO CRASH.

## [About]

This application was created by Gautam Gunjala, B.S. Electrical Engineering & Computer Science, B.S. Engineering Mathematics and Statistics, 2016, at the University of California, Berkeley. It is affiliated with the Computational Imaging Lab and Prof. Laura Waller (<http://www.laurawaller.com>). This software is intended to be open-source. Please do not attempt to profit off of this software, and please give credit where it is due. Thank you!

The registration code used in this application was written by Manuel Guizar. See the '[dftregistration.m](#)' file in the [code](#) folder for full citations and acknowledgements.

## [Bug Fixes]

*-- Version 1.0 Release: 10/8/2014 --*

*-- Version 1.1 (10/14/2014)*

*-Load button bug fixed; Added support for \*.tif multi-image files*

*(If you encounter any problems, please email me at [gautam.gunjala@berkeley.edu](mailto:gautam.gunjala@berkeley.edu))*