

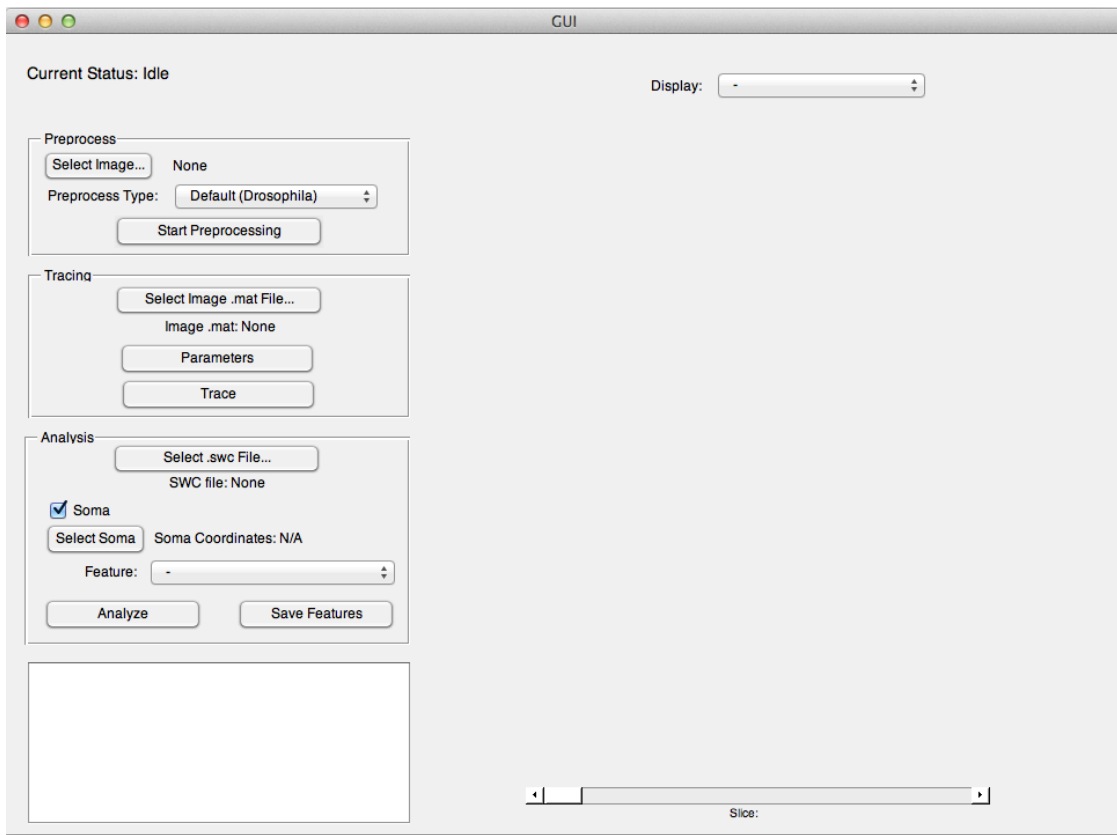
# GUI manual

## Introduction

This software is for 3D reconstruction of neurons. To trace neurons, three steps need to be done, Preprocessing, Tracing, and Analyzing. Preprocessing transforms the original image in order to increase the accuracy of tracing. Tracing locates the location of neuron. Analyzing quantifies the neuron using specific features.

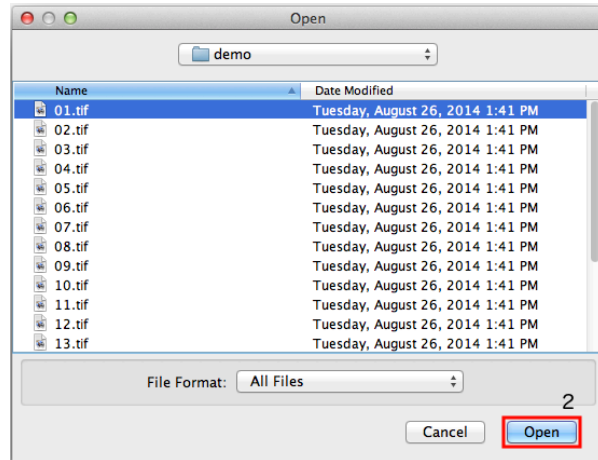
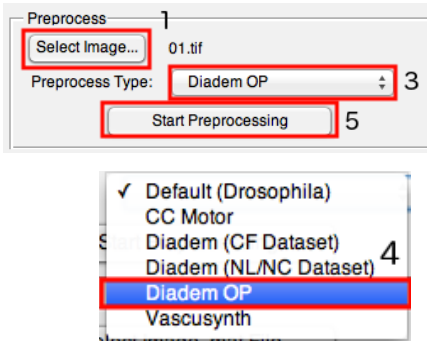
## GUI window

On the left, text at the top indicates the status of the GUI. There are three panels below it, which are Preprocess, Tracing, and Analysis. At the bottom, there is an output box that shows the progress and result in text. On the right, there is a popup menu at the top for switching between image results. The space below it is for displaying image result. At the bottom, there is a slider for navigating through image slices.



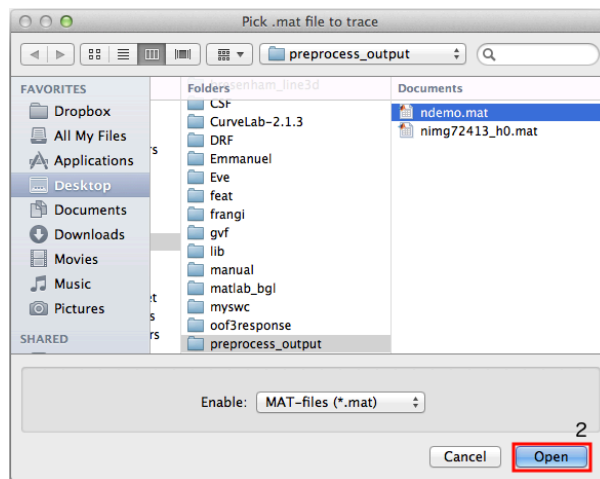
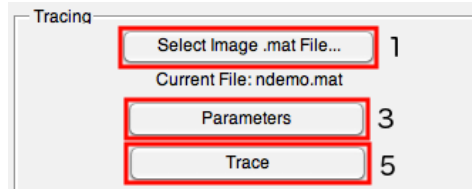
## Preprocessing

1. Click 'Select Image... '.
2. Choose the image (The folder must contain only images of the image stack), and click 'Open'.
3. Change the preprocess type.
4. Choose the preprocess type corresponds to the dataset.
5. Click 'Start Preprocessing'.



## Tracing

1. If you did preprocess, skip to 3. If you already have the preprocess image, click 'Select Image .mat File... '.
2. Choose the preprocess image, and then click 'Open'.
3. If you want to change the parameters of the snake model, click 'Parameters'.
4. Change the snake parameters in Parameters dialog, and click 'OK'.
5. Click 'Trace'.





## Appendix: List of features

Neuron Feature	Description
interpolationhistogram	Table of points that enable the length of the neuron within a certain sector to be determined
shapehistogram2	Table of points on neuron within a certain sector to be determined
curvaturehistogram	The angle measure of the curvature of dendrites within a shape histogram
shapehistogramang	The sum of angle measures for branch points within a shape histogram
shapehistogrambr	Total number of branches within a shape histogram
shapehistogramleaf	Total number of leaf nodes within a shape histogram

**Table 1.** Feature functions that return a table of values (displayed in rose plot).

Neuron Feature	Description
orientation	The direction of dendrites by looking at the direction of its edges
dendritedensity	Distribution of dendrites on the neuron, measures the number of nodes in four different directions in relation to the center of mass.

**Table 2.** Feature functions that return an array of values (displayed in compass plot).

Neuron Feature	Description
branches	Total number of branches
branches2	The total number of branches; removes the branch points that are too close together
distancebranchMean distancebranchSTD	Mean and standard deviation (SD) of the branch length or geodesic distance between branch points
tortuosityMean tortuositySTD	Mean and SD of tortuosity of branches connecting root node to leaf nodes
no_overlap_tortuo-	Mean and SD of tortuosity of each branch that connects leaf

usityMean no_overlap_tortuo- usitySTD	node to root node or leaf node to branch point, without any overlapping of paths
branchangleMean branchangleSTD	The mean and SD angle measure of every branch point
circumference	Circumference of the smallest circle that bounds the neuron
spinedensity	How compact the neuron is within its radius
spinedensity2	Frequency at which a neuron branches
neuronsymmetry	Expresses how symmetrical the neuron is by comparing sections on opposite sides of the lines of symmetry
trianglematrix	Greatest geodesic distance on the neuron between two leaf nodes
curvature_path	Longest branch with the lowest curvature value
branchaverage	Average branch lengths
dendritelengthMean dendritelengthSTD	Mean and SD of the geodesic distance between leaf nodes to the root node as well as the standard deviation
lengthofneuron	Total length of neuron
dendritelengthsum	Total length of all dendrites
longestdendrite	Length of the longest dendrite from root node to leaf node
shortestdendrite	Length of the shortest dendrite from root node to the next closest node
branch_point_ averageMean branch_point_ averageSTD	A neuron's numerical complexity, demonstrates if the neuron has many branches or few branches
leafnodefunction	Number of leaf nodes
farthestnodes	Euclidean distance of the two nodes that are farthest apart
convhullarea	Area of convex polygon around neuron

interpolation histogramMean interpolation histogramSTD	Mean and SD of interpolationhistogram table.
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**Table 3.** Feature functions that return a single value (displayed in text).