Synapse on Dendrite Quantifier V 2.0

An automatic tool for high throughput synapse quantification

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Tool Functionality

Given channels of dendritic morphology and synapses (they can be different images, or in different color channels or separate slices in a stack, or folder containing different images), the tool estimates the dendrite length and the synapses count. It then calculates the synapse count per unit dendrite length and the average intensity of synapses in the image. The tool also assists the adjustment of critical parameters. After the parameters are chosen, the whole quantification process is fully automatic and can be used for high throughput process.

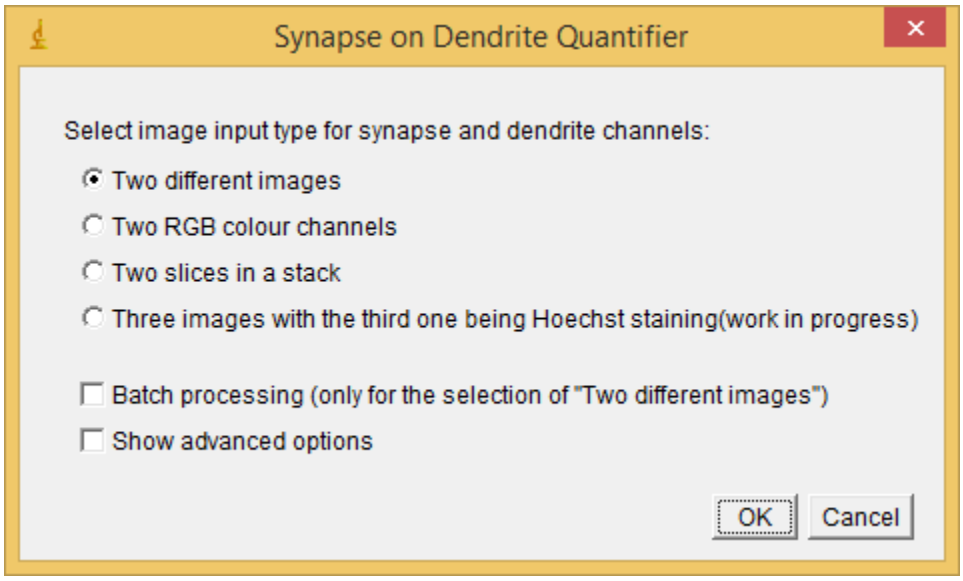
Installation

Unzip the file Synapse_on_Dendrite_Quantifier_v2.zip to ImageJ > Plugins folder (Image version 1.48+).

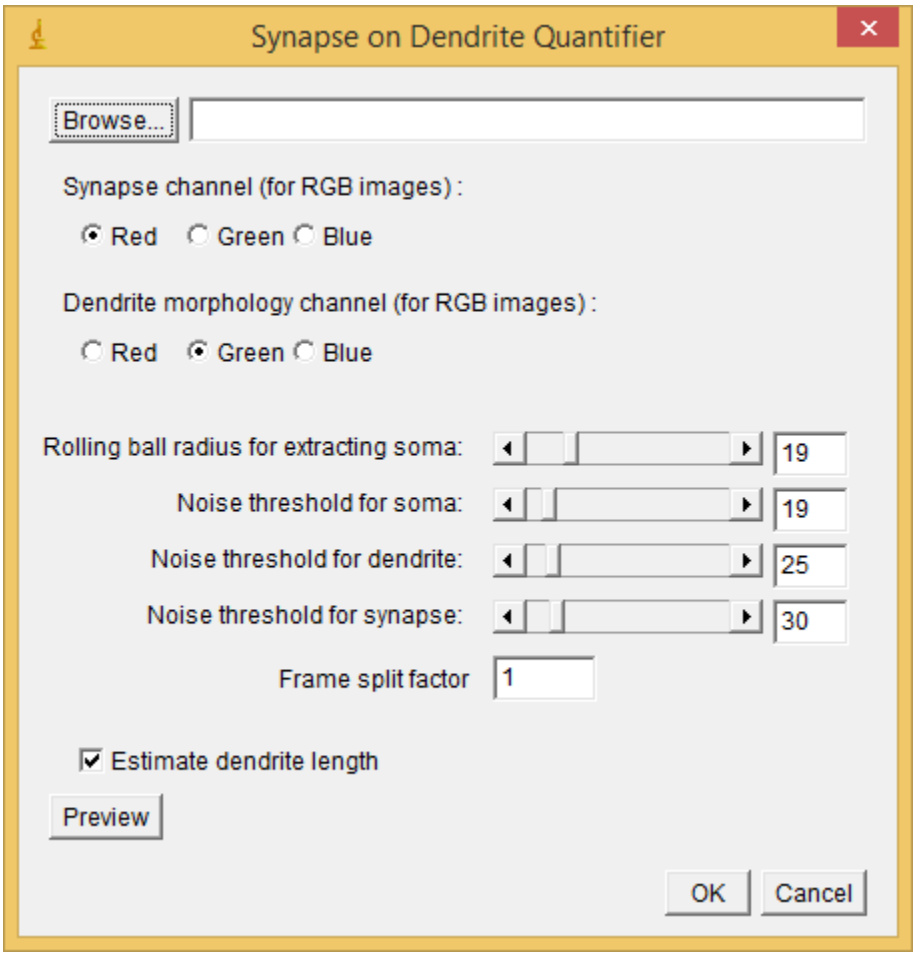
Now, run ImageJ GUI, and the plugin can be found at:
Menu > Plugins > Synapse_on_Dendrite_Quantifier_v2> Synapse on Dendrite Quantifier v2.

GUI and Parameter

Select the image input type for the synapse and dendrite channels.



Load the image to be quantified in the plugin using the file chooser. The following GUI assumes that the input image has two color channels on same image.



Following parameters are needed:

- **Rolling ball radius for extracting soma.**
  This parameter is used to detect and remove soma, you can adjust the scroll bar to change the value and see the effect of changed value in preview.

- **Noise Threshold for soma**
  This parameter is used for soma detection and can be changed using the scroll bar, you can see the effect of changed value in preview.

- **Noise threshold for dendrite**
  This parameter is used for dendrite detection and can be changed using the scroll bar, you can see the effect of changed value in preview.

- **Noise threshold for synapse**
  This parameter is used for synapses detection and can be changed using the scroll bar, you can see the effect of changed value in preview.

- **Frame split factor**
  This parameter is used for processing images with multiple frames. For example, if an image is 4*4, then frame split factor is 4. For regular images, it can be set to 1. In addition, if set it to the higher number during preview, it also serves the purpose of zooming since preview window only shows the first frame, as explained below.

PREVIEW WINDOW: Preview window shows up when "Preview" button is clicked. It only shows the first frame of the images. When any of the 4 parameters in bold font (4 slides on the GUI) is adjusted, a Preview window *dynamically* updates several intermediate masks used in the estimation process, which is a montage that contains 4 sub-images including the dendritic image after soma removal.

- **Estimate dendrite length**

  Check this box if you want to estimate dendrite length and to get dendrite length, synapse count ratio. If this is unchecked, the plugin only outputs the synapse count.

- **File to save the results** (exclusive for batch processing)

  Enter the name of the file to save the results in. If the file is already present, the new results will be appended.

Output

Once the "OK" button is pressed in the GUI window, the plugin starts estimating the synapse count, then the total length of dendrites, and finally shows the ratio between these two, along with the average intensity of synapses. The whole estimation process can take a few minutes.

Note

If "Show advanced option" is checked in the first screen, two more options will show on GUI for numbers of dilation operations for soma and dendrite, respectively. They will impact the sizes of the soma mask and dendrite mask. You can see the effect of the changed values in preview.