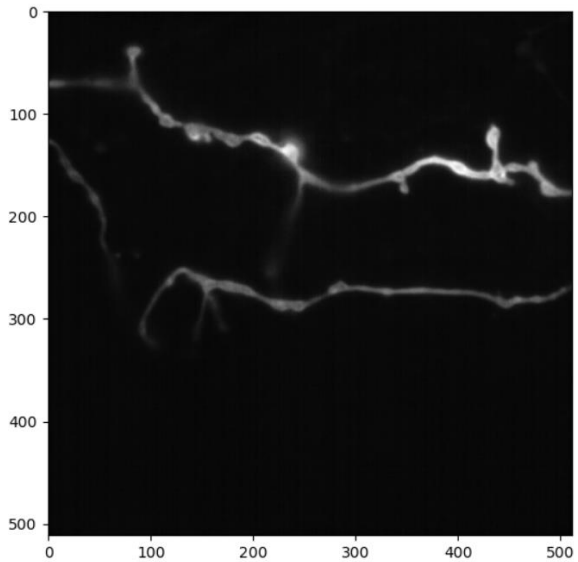
Neurotorch

Technical Notes v24.10.1



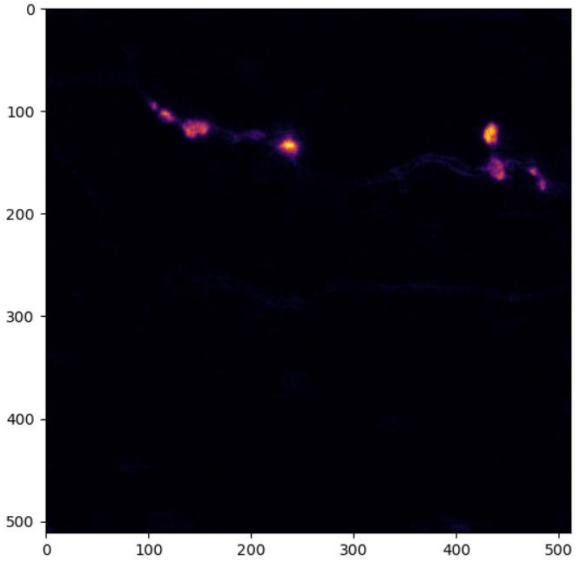


Table of Contents

QuickStart

Open Image

- Use Neurotorch to open Images directly (File → Open) or start ImageJ via ImageJ → Start ImageJ
    - The image needs to be a series of image. Open a single image will not work
    - Neurotorch was tested to open TIF/TIFF Images directly, but other formats may work
- If you have a noisy, not denoised image, you probably need to apply a Gaussian filter for detection
    - Note: Applying the Gaussian filter does NOT alter the image, but only the difference image series.
    - You can apply the filter by clicking on Image → Diff Gaussian Filter
        - Use File → Open noisy image as a shortcut as it will do exactly the same

Glossary:

- For short, when speaking of the image (in the program shortened to img) it refers to the series of image frames
- Neurotorch finds transient increases in pixel brightness. It does this by calculating the difference between two consecutive frames. This is called the difference image (shortened in the program to diffImage or diffImg)
    - When displaying or exporting to ImageJ, Neurotorch sets all values in the diffImage below zero to 0. This is done to improve signal quality as the increase is transient but the decrease in brightness gradual and therefore not suitable for detection.
    - Note that the term diffImage refers to a series of frames. Also note that this documentation will use the term "frame" of diffImage which can be ambivalent, as difference image frames are per definition the difference in brightness *between* two image frames.

Analysis of image:

- Use the Image tab to inspect the Image
    - Grey colours indicate you see the normal, provided image
    - A magma colormap indicates you see calculated image data

    - You can plot in 2D or 3D
    - You can plot the Maximum or the standard deviation (shortened to std) of each pixel in the diffImage
- Use the Signal tab to find the frames with signals (= synapses fire = increase in brightness)
    - On the left you see a plot of the signal in your data generated by the algorithm you choose. This signal is used to find the signal frames
        - The signal frames detected are marked with an orange dot
        - Use the slider peak prominence to change the sensitivity
    - There are two algorithms to choose from:

        - diffMax (short for difference Image Maximum) will use the maximum of each diffImage frame. Usually a good first choice. The peak height is proportional to the most bright synapse.
        - diffStd (short for difference Image Standard deviation) uses the standard deviation of each pixel frame. Use this for noisy images, as it will yield better results, but usually you need to adjust the peak prominence slider. The peak height is proportional to the number of synapses firing and their brightness.
    - You can this tab, to slider trough the image. Use the arrows below the plot
        - You can also use the slider, if you disable “Snap frames to peaks”
    - Activate “Normalize” to keep the same brightness over all frames
    - You can also view the original image using “Show original image”