User's guide of LuckyProfiler

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1. Brief introduction

LuckyProfiler is an ImageJ plugin that uses the Projected-line FWHM resolution method to determine the image resolution of a final image. It is suitable for fluorescence microscopy images as well as super resolution images. It presents an effectively way for quantifying image resolution without overestimation and underestimation. For it calculates FWHM resolution along structures thus avoids human selection and is convenient for users. We think LuckyProfiler will be an easy and effective tool for helping researchers quantifying their experiment's resolution.

Methods and effects can be seen in the article: LuckyProfiler: an ImageJ plug-in capable of quantifying FWHM resolution easily and effectively for super-resolution images

2. Requirements

Operation system: LuckyProfiler has been tested on Windows 10 (64-bit).

Software: ImageJ 1.53k or later, Fiji 1.53c or later.

Note: please set at least 4 GB memory buffer for ImageJ.

3. How to install

3.1 How to install ImageJ or Fiji

ImageJ download address: https://imagej.en.softonic.com/

FIJI download address: https://fiji.sc/, Select 64bit to Download.

Installation: After downloading, unpack it and use it (double-click ImageJ-win64.exe).

3.2 How to install LuckyProfiler

LuckyProfiler is built for ImageJ independently. To install, simply copy three dynamic link library (cudart64_55.dll, opencv_java450.dll, LuckyProfiler.dll) files into the ImageJ installation folder. Then copy the opencv-450.jar to the jars folder of ImageJ and LuckyProfiler_.jar to the plugins folder of ImageJ.

4. How to use

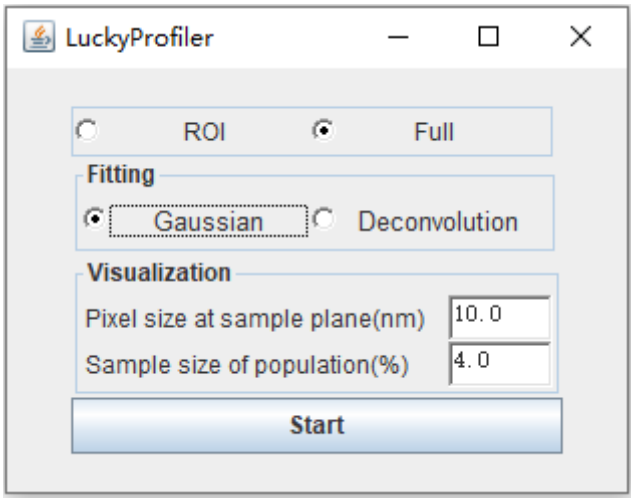

Figure 1. LuckyProfiler GUI

4.1 Parameter Description

1. Function

LuckyProfiler provides 2 functions: ROI or Full. The former is supplied to calculate projected line FWHM in user selected ROI. And the latter is to automatically calculate and find the effective FWHM value and position in whole image.

2. Fitting

LuckyProfier provides 2 fitting selections for obtaining final resolution value after finding the candidate positions that may have the minimal resolution. Gaussian fitting is to fit the projected line profile with Gaussian function ignoring the influence of structure size. And the deconvolution considers size influence and obtaining resolution value.

3. Visualization

Pixel size at sample plane (nm): Input final image's pixel size.

Sample size of population (%): Locations with narrower structures are more likely to have smaller resolutions. However, this is not absolute. So, it needs a certain number of sample size to guarantee the purpose of finding relatively smaller localization. The larger the value, the more accurate the result will be.

4.2 Load image

Users can drag and drop images directly into ImageJ or clicking File → Open →

"Image". If the image is not 8-bit or 16-bit, Users are required to perform the following steps: clicking Image → Type → 8-bit or 16-bit.

4.3 Calculating FWHM resolution

LuckyProfiler helps calculating FWHM resolution without overestimation or underestimation. To open LuckyProfiler, selecting Plugins → LuckyProfiler.

There are 2 functions for users:

1. Selecting the ROI and calculate whole ROI's projection FWHM resolution;
2. Automatically calculating FWHM resolution of whole image.

The only parameter users need to set is the pixel size of image.

4.3.1 Selecting ROI regions to calculate FWHM

(Option: Roi)

This function can help users to calculate the FWHM of the ROI area. First, users need click the ImageJ "Rectangle" button to select the ROI area and use the keyboard shortcut Ctrl+T to load the ROI into the ROI manager. Then, users can choose gaussian function or deconvolution function to calculate FWHM. Finally, click the "start" button. The typical illustrated result is as followed:

Gaussian:

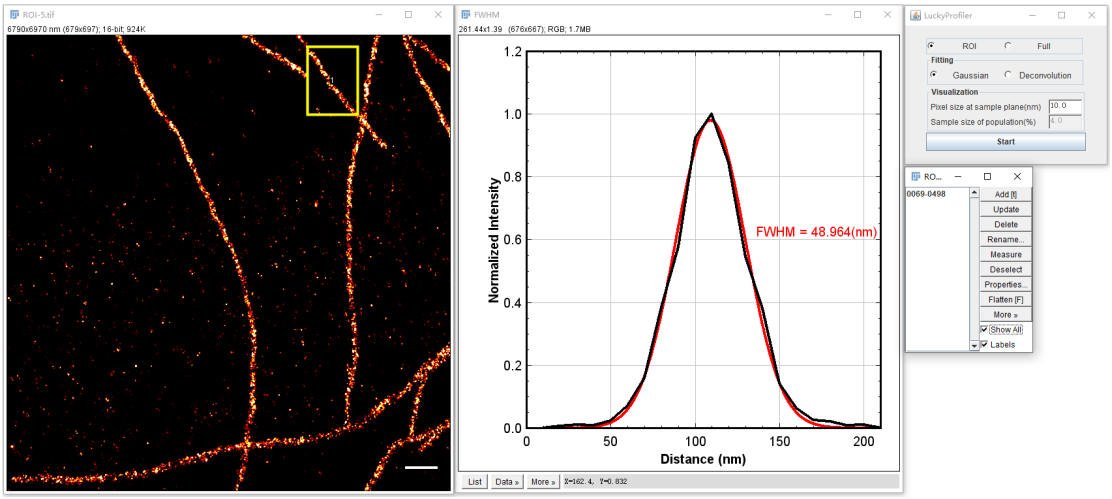

Figure 2. Example of calculating the FWHM of an ROI region with Gaussian function

Deconvolution:

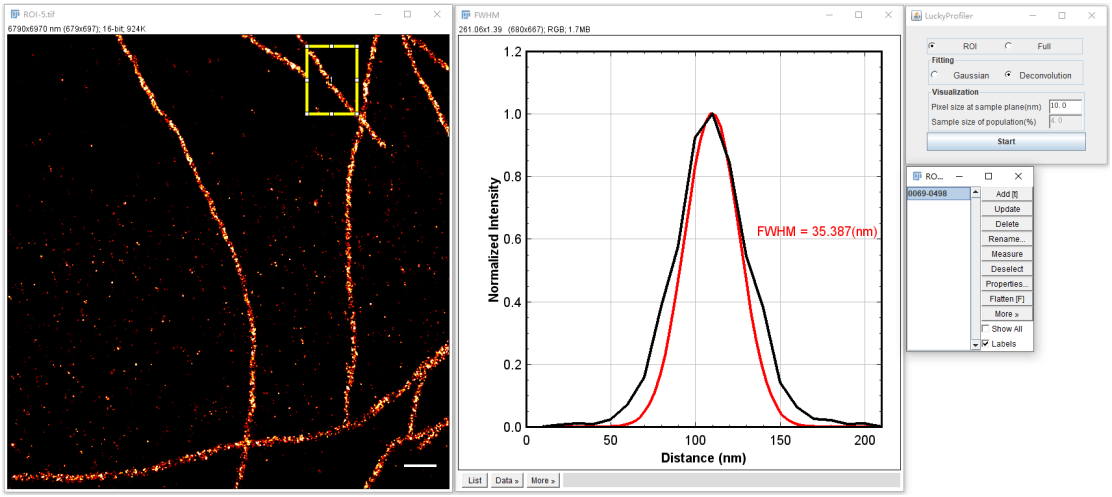

Figure 3. Example of calculating the FWHM of an ROI region with deconvolution function

4.3.2 Automatic calculation of FWHM

(Option: Full)

This function automatically finds the reliable FWHM resolution position in the image and shows its profile. Users can choose gaussian function or deconvolution function to calculate FWHM. Click the "start" button after setting the pixel size. The typical illustrated result is as followed:

Gaussian:

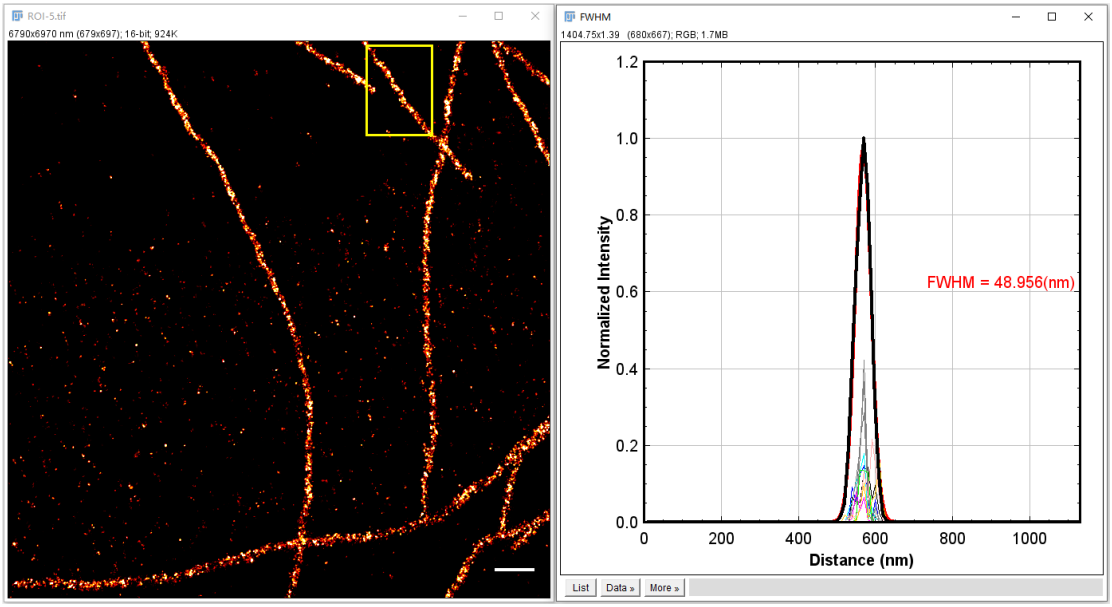

Figure 4. Example of automatic FWHM calculation with Gaussian function

Deconvolution:

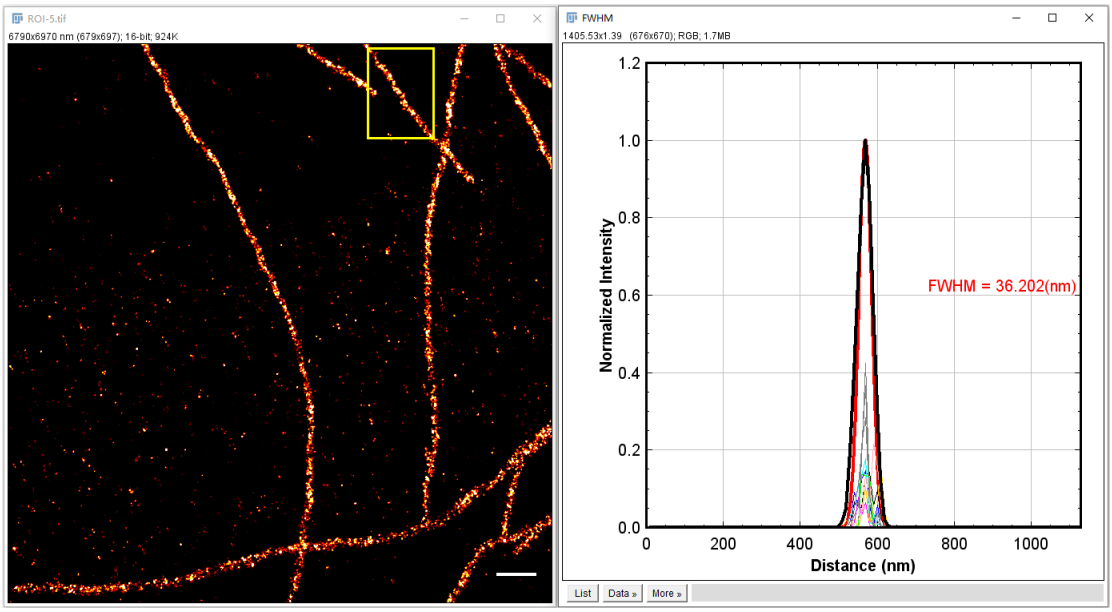

Figure 5. Example of automatic FWHM calculation with deconvolution function

If the curve in the right figure is not displayed completely you can adjust the coordinates by clicking on more in the lower left corner.

5. Note

This version add deconvolution function to calculate FWHM. And we recommend users to use Intel Core i7 9th Generation or better CPU as well as a CUDA -enabled GPU for parallel acceleration.

For CUDA-enabled GPUs, please refer to: https://developer.nvidia.com/cuda-gpus. In addition, the CUDA version must be 10.0 or higher. You can check the CUDA version by following these steps: Open NCIDIA Control Panel → System Information → Components, NVCUDA.DLL and the corresponding product name is the CUDA version number.