Chapter 3

Deconvolution

In this exercise we will apply deconvolution to a 3D widefield dataset. We will first create a theoretical point spread function (psf) and then use it to deconvolve the input image. We will use the the ImageJ plugins “PSF Generator“ and “DeconvolutionLab2“ [6].

3.1 PSF Generation

Open the image “CElegans-DAPI.tif“. This is the image to which we want to apply deconvolution. Visualize the image in napari. Before visualizing the image in 3D, make sure the voxel size is set correctly. You can see and modify the voxel size in FIJI from the menu “Image>Properties“. You can find the information about the acquisition in the file “info.txt“. Save the image after you have corrected the voxel-size.

We will now create a theoretical psf, which we will use in the next step to deconvolve the image. Run the “PSF Generator“ plugin. The plugin proposes different theoretical models of PSFs. Select the “Richards & Wolf 3D Optial Model“. Fill in the acquisition parameters and press the “Run“-button.

Save the PSF to a file, so that we can use it in the next step. Visualize the PSF in napari.

3.2 Deconvolution with DeconvolutionLab2

Run the the command “DeconvolutionLab2 Run“ to open the plugin. Drag the input image from your file-browser onto the “Image“-field and the saved PSF onto the “PSF“-field. Select the “Richardson-Lucy“ algorithm and choose the number of iterations. Press the “Run“-button.

If the deconvolution takes too long, try to run it with less iterations or on a cropped zone of the image or use a faster algorithm.

Visualize the original and the deconvolved image in napari. Do you see a difference?

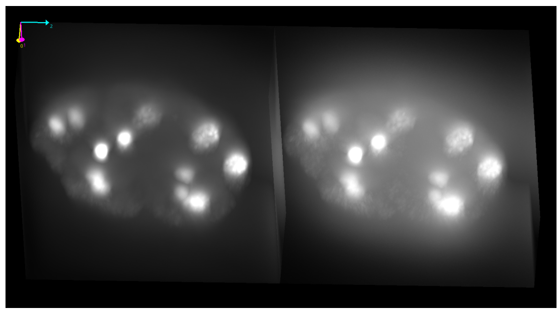

Figure 3.1: The C. Elegans DAPI image after and before deconvolution with 10 iterations of the Richardson-Lucy algorithm.

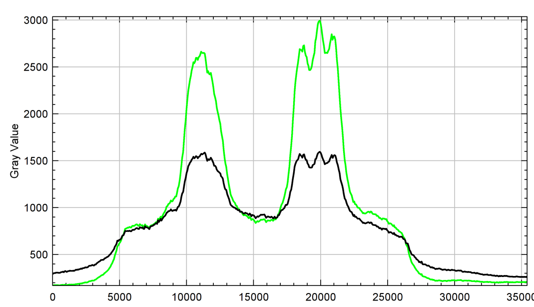

Figure 3.2: A profile plot after (green) and before (black) deconvolution.