Installation DeconvolutionLab2

DeconvolutionLab2 is a versatile Java software package to test deconvolution algorithms
DeconvolutionLab2 works as a standalone application, seamlessly running on all OS such as Windows, Linux, and MacOSX.

https://imagej.net/ij/

- Download ImageJ IJ1
- Move ImageJ in your working place

OR

https://fiji.sc/

- Download Fiji
- Move Fiji in your working place

http://bigwww.epfl.ch/deconvolution/

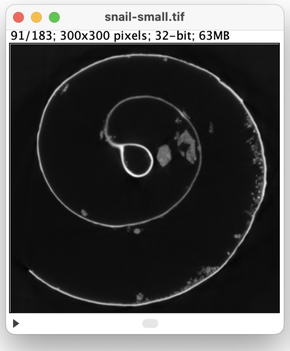
- Get DeconvolutionLab2.jar
- Get PSFGenerator.jar
- Copy theses files in the plugins folder

DeconvolutionLab2

- Purely deconvolution: no pre-, no post-processing
- Pedagogical tool: test the effect of the parameters
- 3D real datasets, simulation, noise
- Java platform to host algorithms, scriptable
- Formula translation close to the theory
- FFT: AcademicFFT, JTransforms, FFTW

3D Viewers

Stack



MIP

Orthoview

Check

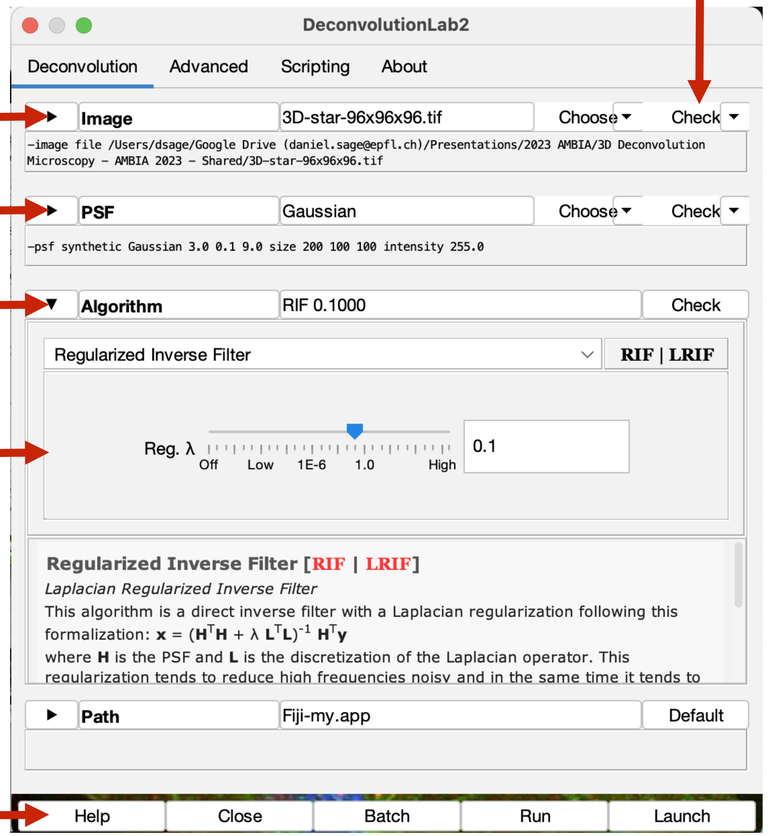
1) Select an image

2) Select a PSF

3) Choose an algo

4) Set parameters

5) Run or launch



Point-Spread Function

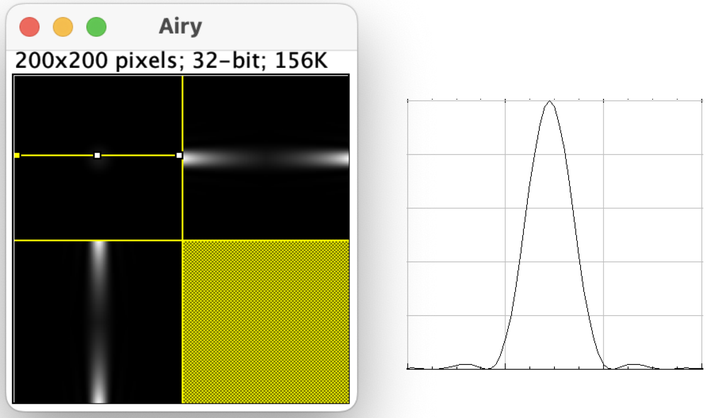
Synthetic PSF
Simple shape

Choose "Get Synthetic" on DeconvolutionLab2

Gaussian (default 100x100x100)

or

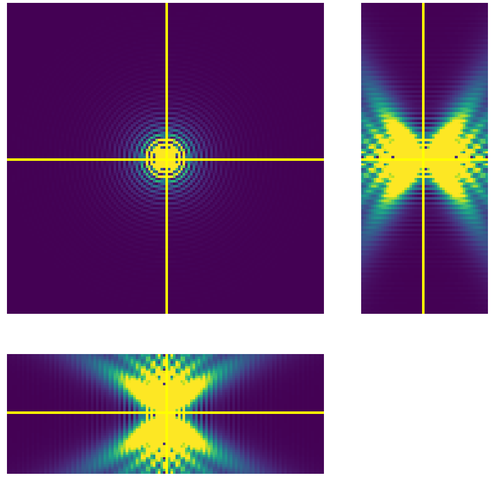
Airy (default 100x100x100)



Theoretical PSF
Microscopy shape

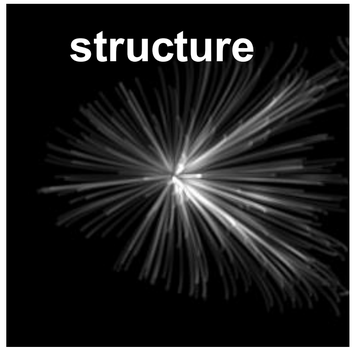
Use the PyTorch library: psf_generator or
the Napari plugin: PSF Generator

Library Documentation: https://psf-generator.readthedocs.io/



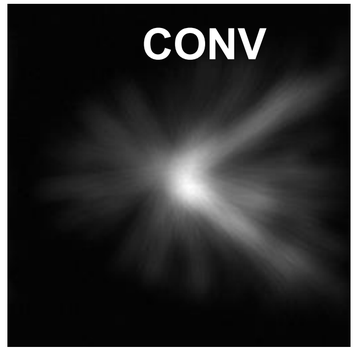
Inverse Filter

Using DeconvolutionLab2 we want to show that a naive inverse filter can not work properly in presence of noise or with an imperfect PSF. We provide a 2D image structure and a 2D PSF (Airy). We ask you to test DIV (non-stabilized division) and NIF (stabilized division).



256x256

128x128



256x256

1. No noise, perfect PSF

Prepare an input image by convolving the structure with PSF using CONV. Deconvolve it with DIV, NIF.

2. Small amount of noise, perfect PSF

Prepare an input image by convolving the structure with PSF using SIM with an additional Gaussian noise (mean=0, stdev=1). Deconvolve it with DIV, NIF.

3. No noise, imperfect PSF

Prepare an input image by convolving the structure with PSF using CONV, reduce the size of the PSF to 120x120 pixel using bicubic interpolation. Deconvolve it with DIV, NIF.

Deconvolution - Drosophila

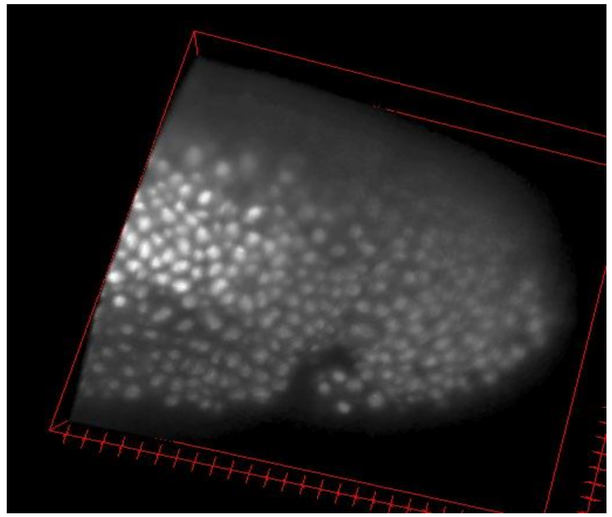
A biologist wants to count the nuclei in the 3D image **drosophila**. The image present too much out-of-focus to be segmented with a simple method. Fortunately, she/he properly saved the optical parameters,

- wavelength=610 nm,
- NA=1.4
- refractive index immersion = 1.5,
- voxel size = 100 nm in all direction
- Model: Sperical-Scalar Propagator

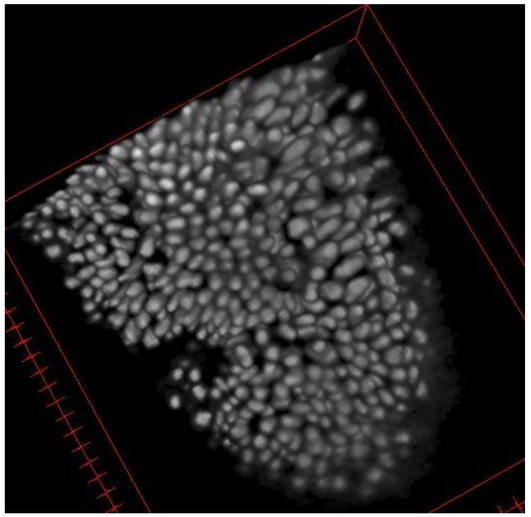
Help him/her to generate a PSF and to deconvolve this image to remove the out-of-focus.

Check the Jupyter Notebook: GeneratePSFs.ipynb
Or use directly the PSF (psf_drosophila.tif)

Input 300x275x50



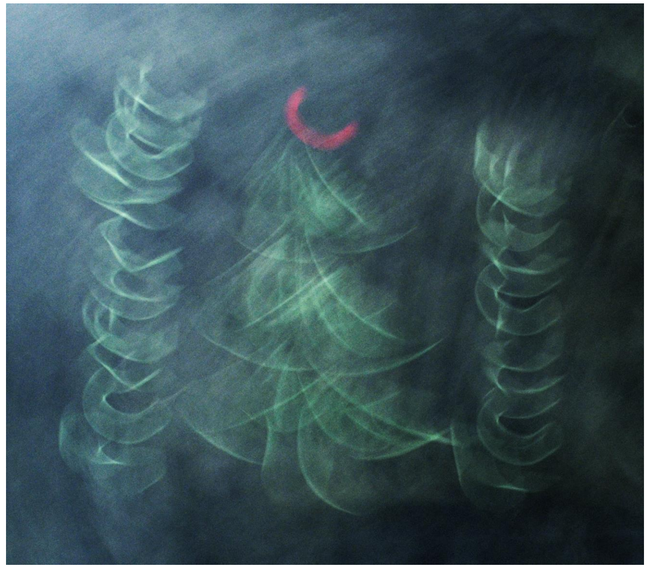
Desired output



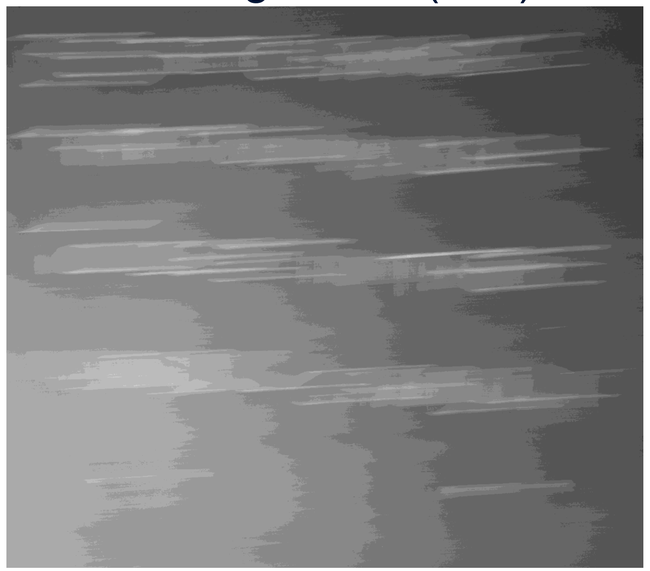
Save Sherlock Holmes!

quote.tif (simulation)

blackboard.tif (real)



moving-text.tif (real)



Challenging tasks

Could help Sherlock Holmes to read the text written in these images?

These three images were badly recorded by a moving camera:

They have a strong motion blur but no no additional information have been saved!