EPFL

Bioimage Informatics

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Workshop

3D Deconvolution Microscopy

DeconvolutionLab2

👁 Installation on Fiji or ImageJ

DeconvolutionLab2 is a versatile Java software package compatible with both ImageJ and Fiji.
DeconvolutionLab2 can function as a standalone application, seamlessly running on all OS.

http://bigwww.epfl.ch/deconvolution/deconvolutionlab2/

- Get DeconvolutionLab2.jar

- Get PSFGenerator.jar

- Download FFTW2.zip (optional)

- Copy theses files in the plugins folder

DeconvolutionLab2
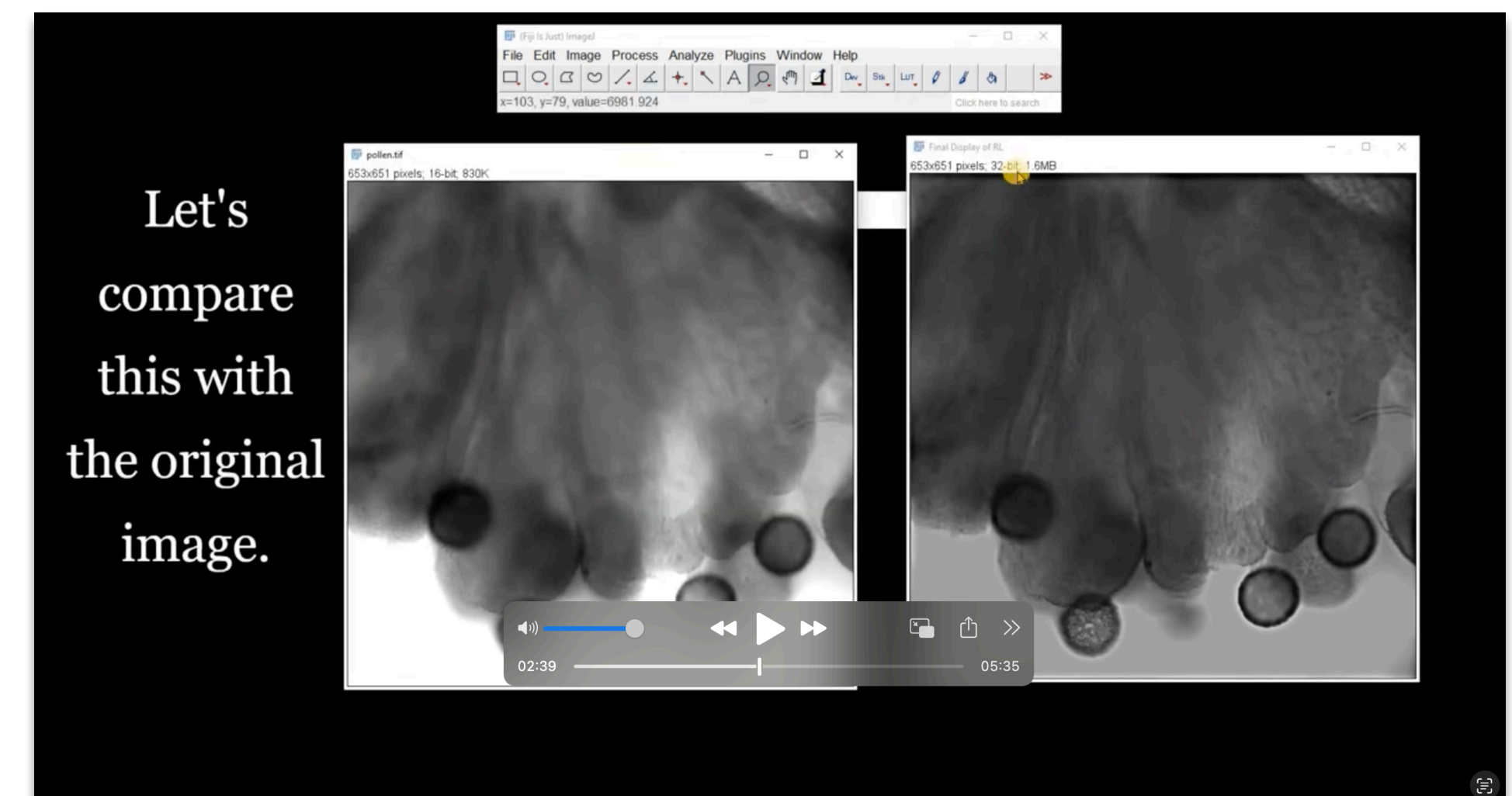
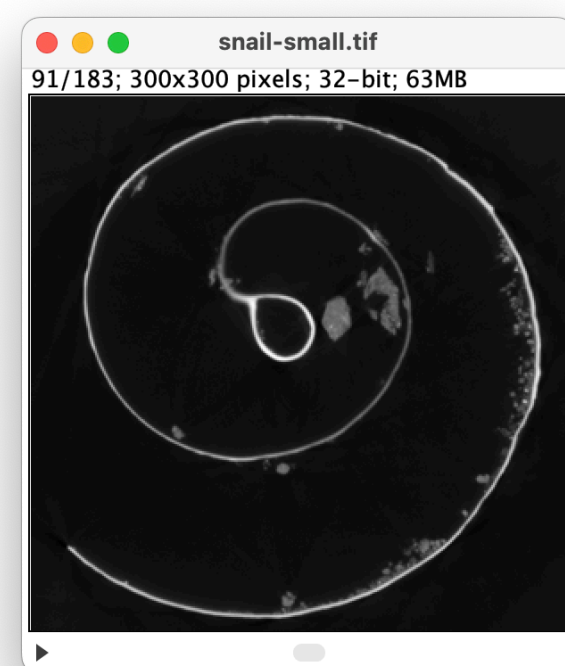FIJI (ImageJ): Image Deconvolution [Experimental PSF]
Johanna M. Dela Cruz

DeconvolutionLab2

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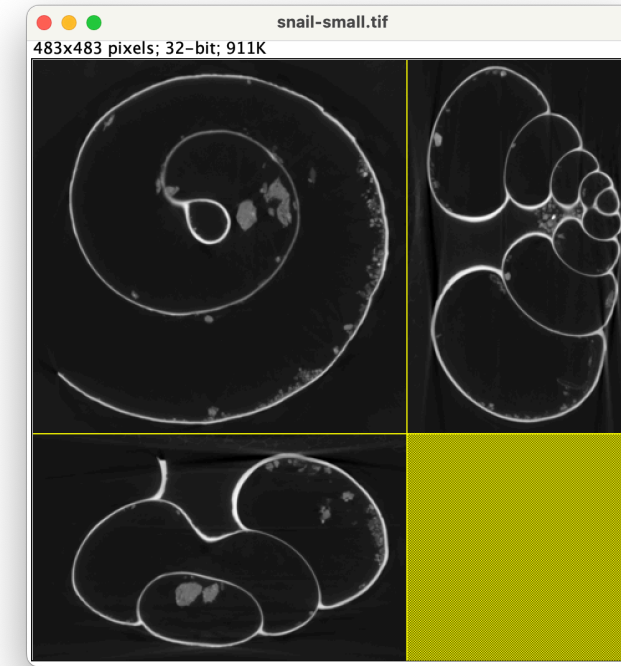- FFT: AcademicFFT, JTransforms, FFTW
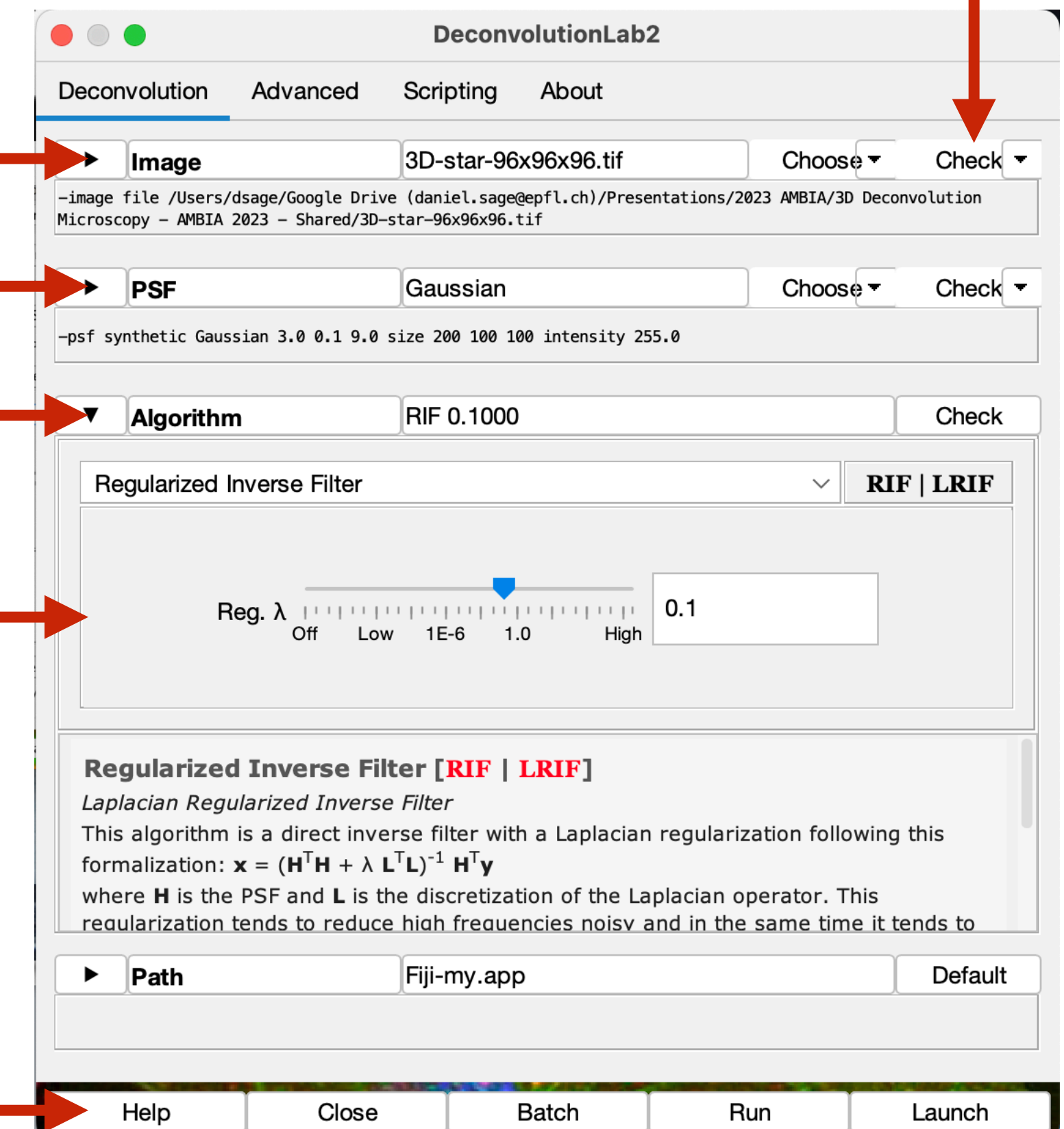
3D Viewers

Stack   MIP   Orthoview

Check

1) Select an image

2) Select a PSF
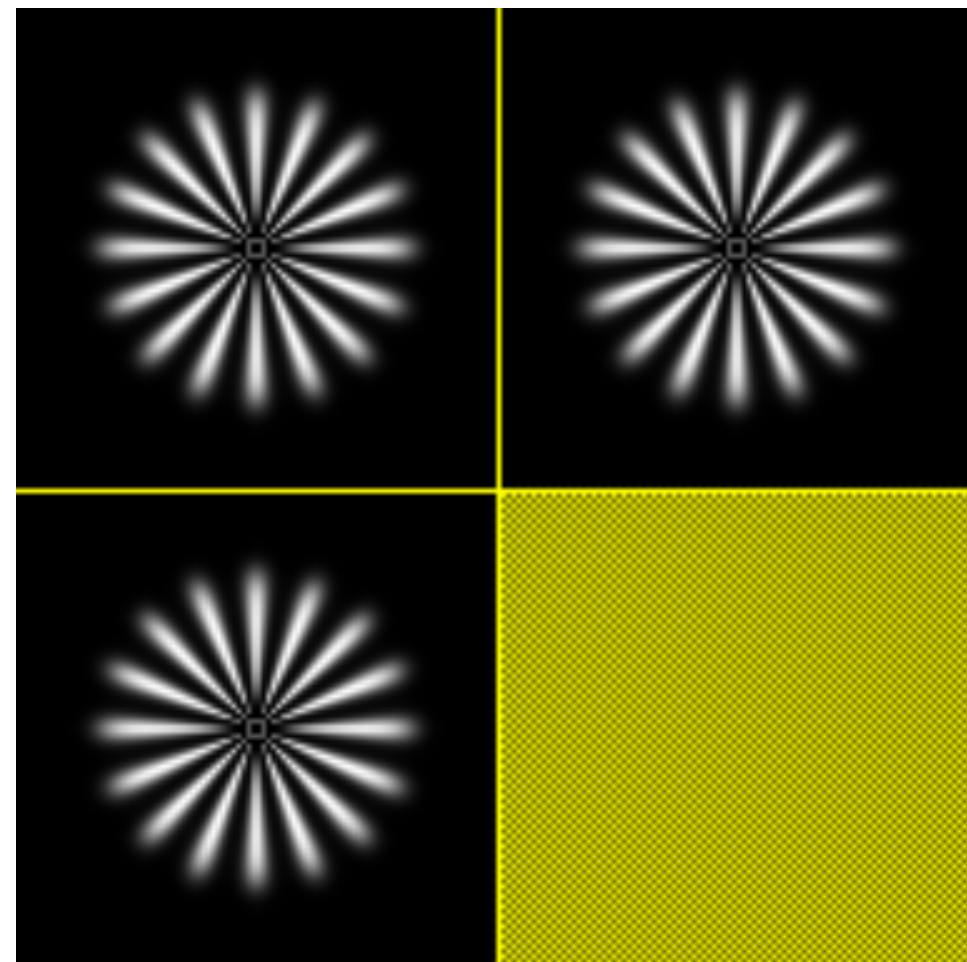
3) Choose an algo
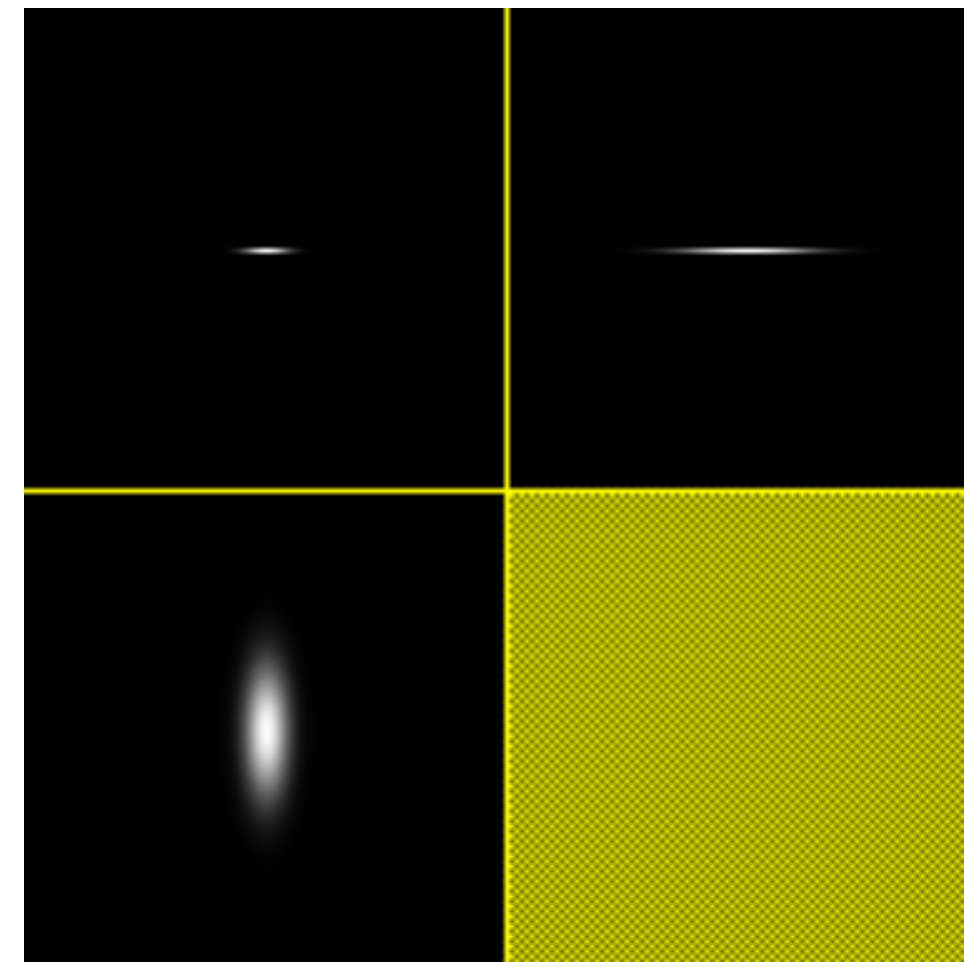
4) Set parameters

5) Run or launch

Image Formation

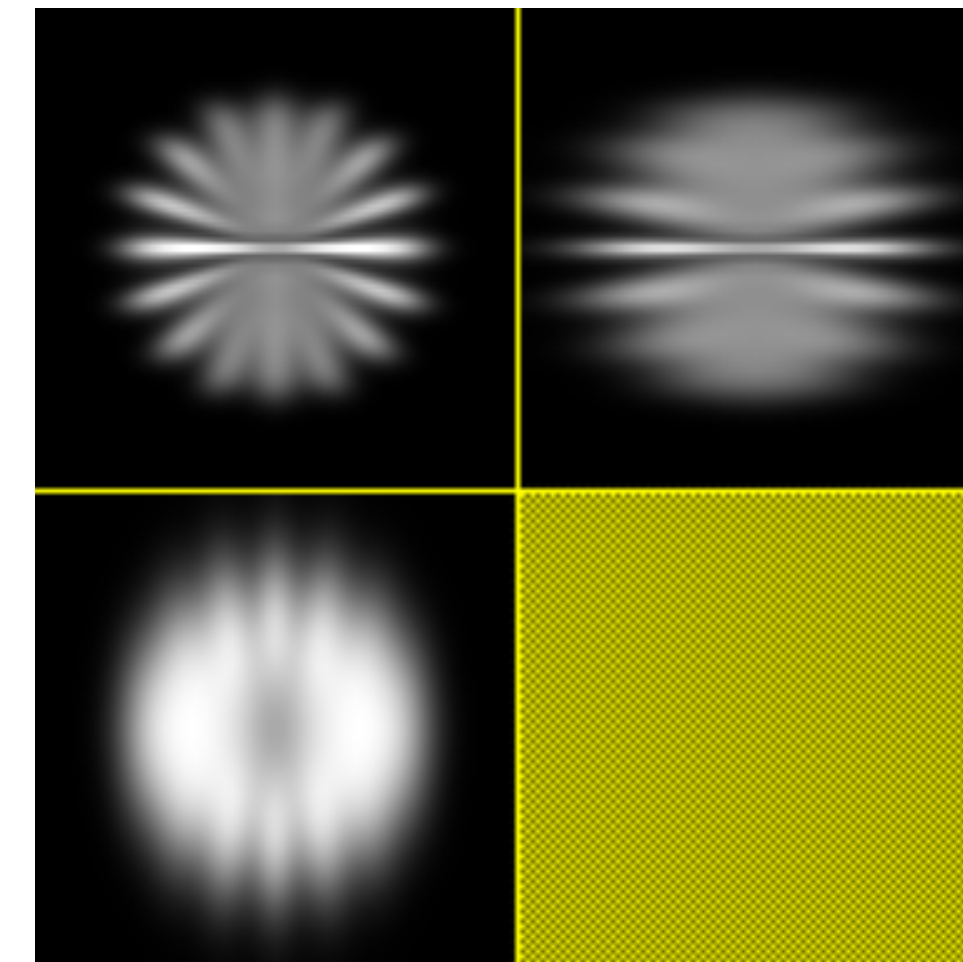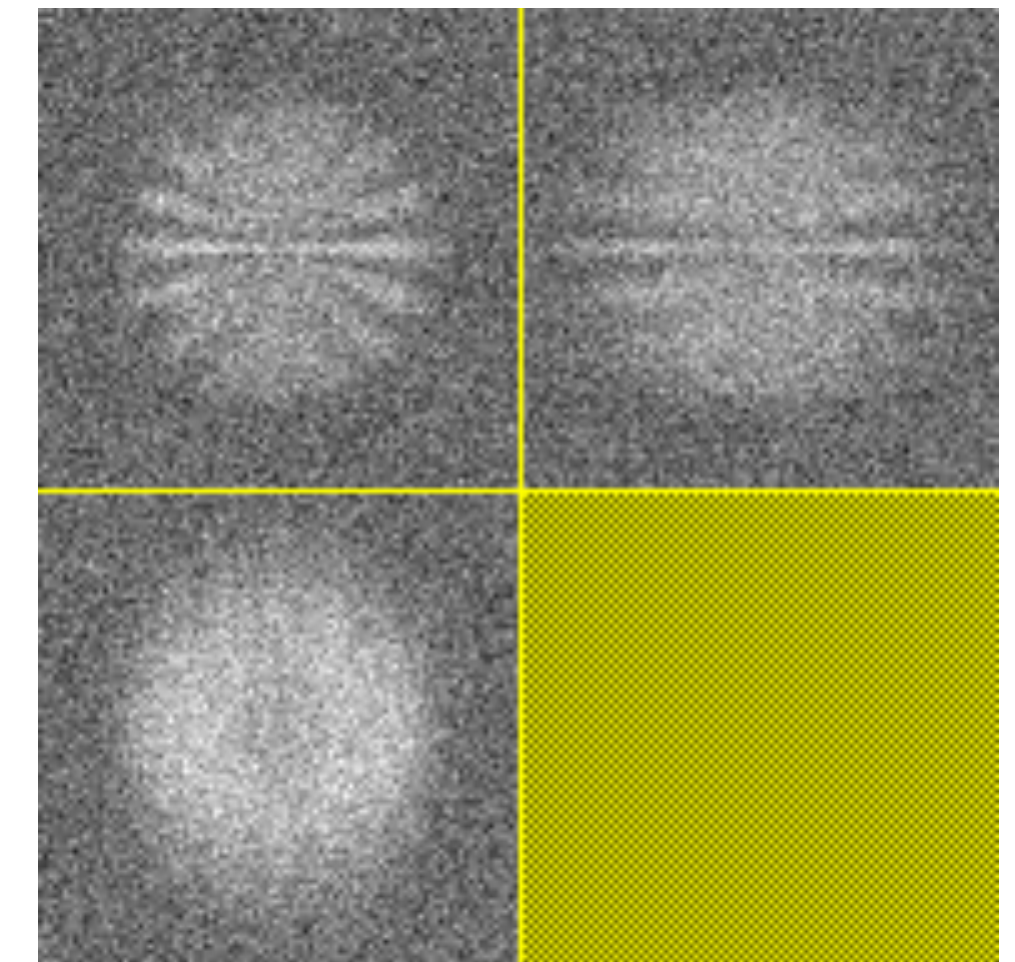| Input	PSF	Convolution	Simulation
3D-star-96x96x96.tif	Gaussian (3, 0.1, 9)	CONV	Gaussian noise (mean=0, stdev=20)

Output
- As stack
- As MIP
- As Orthoview
- (snapshot) for iterative algorithms

Selection of the FFT (Advanced Panel)
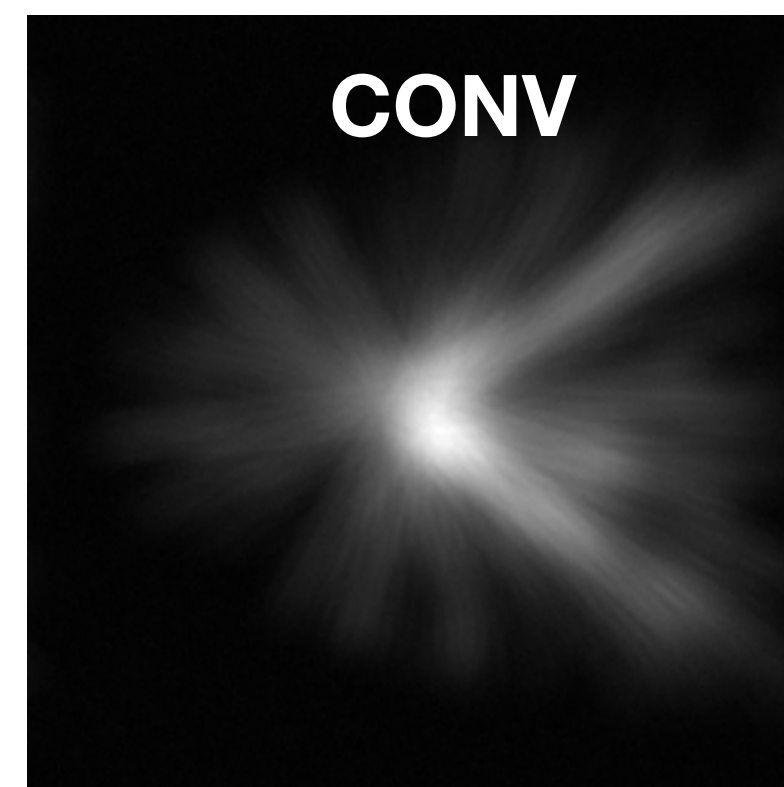- AcademicFFT
- JTransforms
- FFTW

Inverse Filters

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).

structure
256x256

PSF
128x128
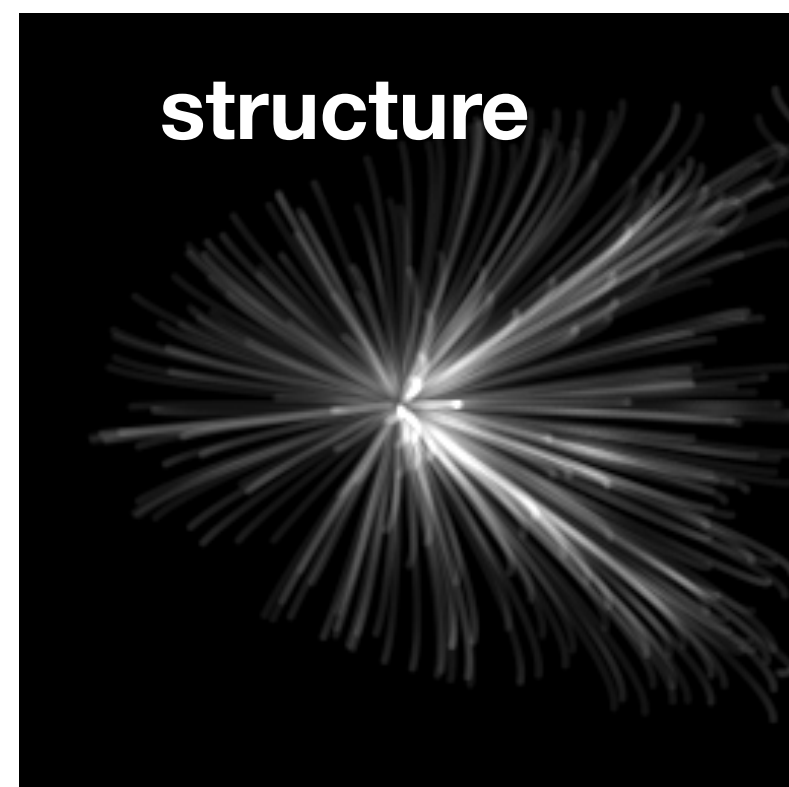
CONV
256x256

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.

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,
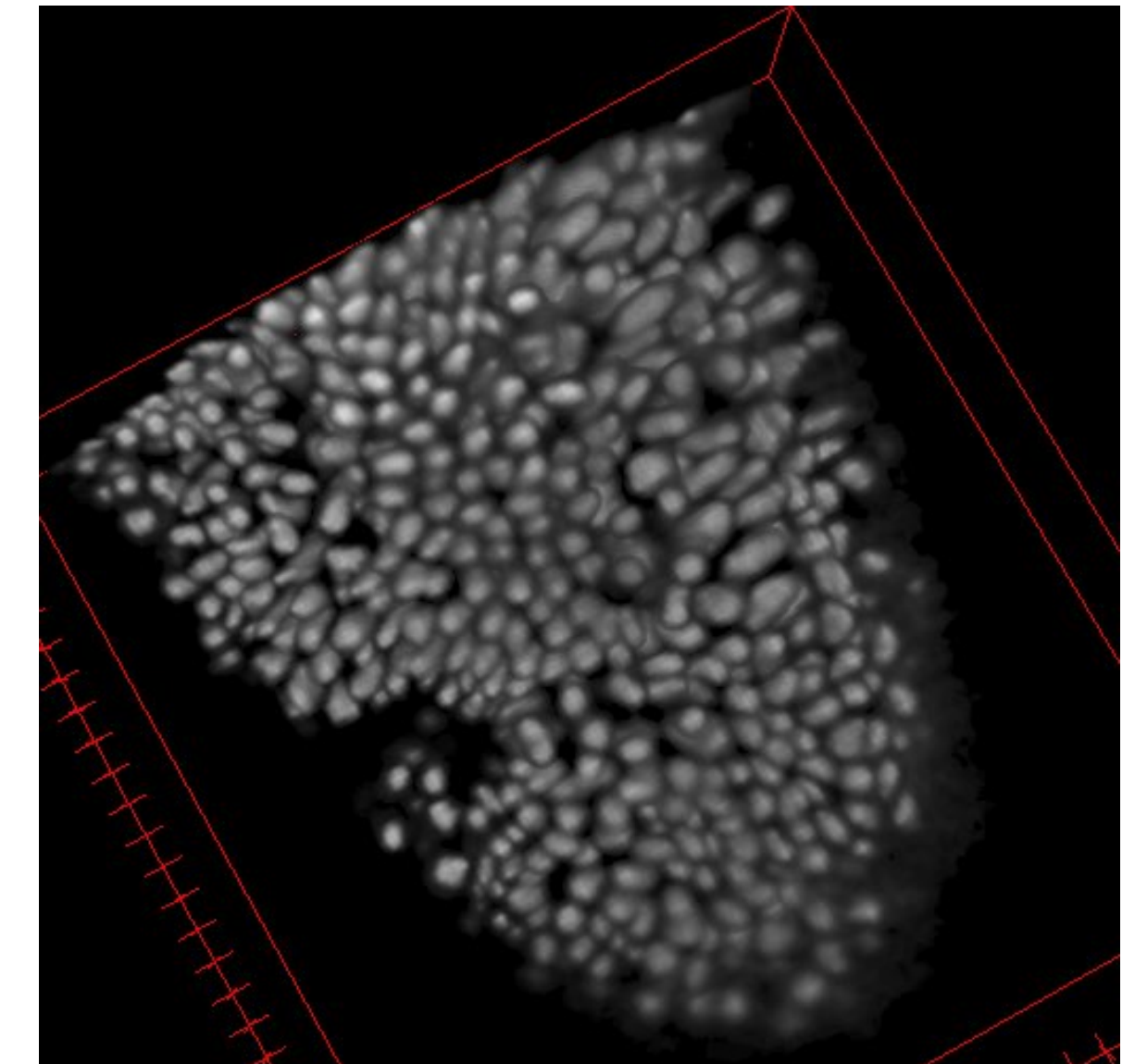
- wavelength=610 nm,
- NA=1.4
- refractive index immersion = 1.5,
- voxel size = 100 nm in all direction
- Model: Born&Wolf

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

Input 300x275x50
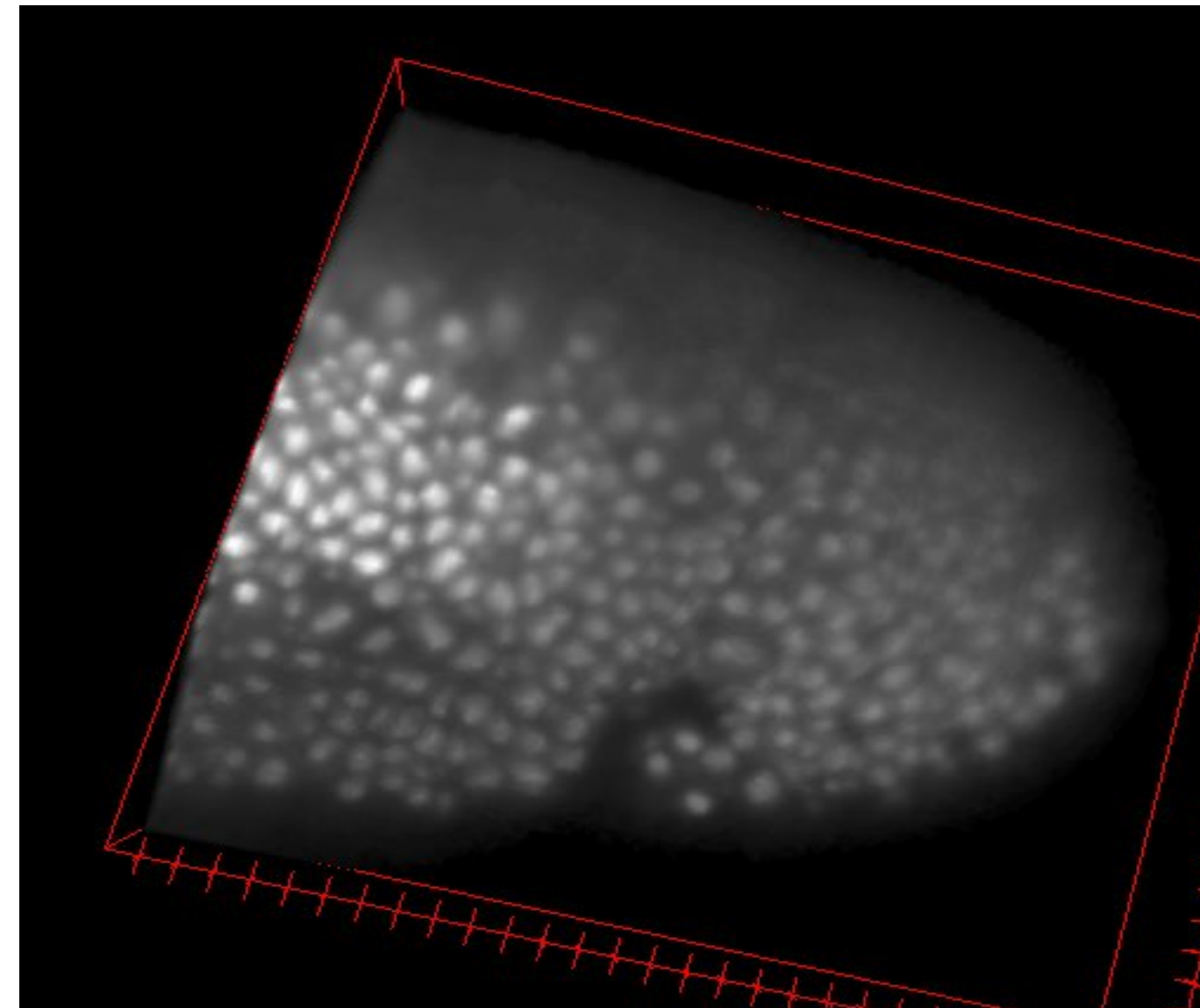
Desired output

Save Sherlock Holmes!

Challenging tasks

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

These two images were badly recorded by a moving camera:

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

quote.tif (simulation)

moving-text.tif (real)