1 Introduction

This ImageJ plugin convolves 2D images or movies (image stacks) with a 2D Bessel point spread function (PSF).

The convolution kernel of size $w \times h$ reads\[2]:

$$PSF(x, y) = \frac{2J_1(a \sqrt{x^2 + y^2})}{\sqrt{x^2 + y^2}}$$

(1)

$$a = \frac{2\pi NA}{\lambda}$$

with $x \in [-w/2, w/2]$ and $y \in [-h/2, h/2]$ the coordinates measured from the center of the kernel. $w$ and $h$ are equal to the user defined parameter $r_{\text{max}}$. $J_1(x)$ stands for the Bessel function of order one. The implementation of this function is taken from [1]. The convolution is performed by the ImageJs ImageProcessor classes.

2 Installation

Copy the mosaic_plugins.jar file to the ImageJs plugins directory. Restart ImageJ. The plugin can be launched from the Mosaic submenu in ImageJs plugin menu.

The plugin handles 8-bit, 16-bit and 32-bit grayscale images or stacks.

Prerequisites: At least Java 5.0 and ImageJ 1.36.
3 How to use the plugin

Open the image or an image stack in ImageJ to process. Make sure that the *pixel width* and *pixel height* properties are set correctly in the image properties dialog. Use the Ctrl-p shortcut to open this dialog. Please note that the plugin only recognizes the metric system.

Start processing by selecting the BesselPSF Convolver entry in the plugin→mosaic menu. You might process only one slice or even the whole stack.

Please note that there is no undo for this operation.

The parameters to enter in the dialog before the calculation starts are:

- **Numerical Apparture** The numerical apperture NA of the objective lens.
- **Wavelength** The wavelength λ of the light emitted by the specimen and gathered at the sensor.
- **Max Radius** The maximal radius $r_{\text{max}}$ of the convolution kernel. For all pixel not in that range, the effect is neglected. Please note that the calculation time is proportional to $r_{\text{max}}^2$.

4 Disclaimer

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References
