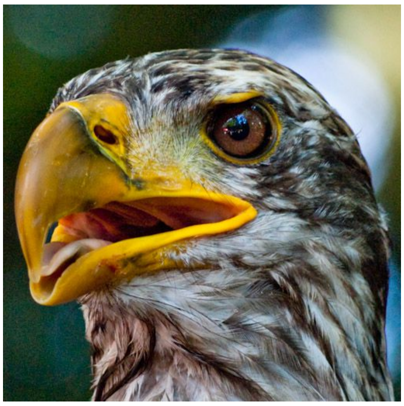
Photiosity – Manual (Version 1.7)



Photiosity is an application to sharpen blurred images

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System Requirements

MacOSX 10.7 or 10.8 (Lion or Mountain Lion), 64 bit.

Technical Preliminaries

Photiosity uses the OpenCL library. OpenCL provides a good optimization for the CPU (SSE, multi-core) and also for the graphics card (GPU). *Photiosity* runs on Macs with and without an OpenCL graphics card (eg: HD Graphics 3000 or 4000), but is significantly faster on Macs with an actual GPU.
Photiosity uses a computationally intensive method to deblur the image. It is possible to achieve results that are better than the image sharpening in many image editing programs. However, this requires the interactive cooperation of the user.

Changes in Version 1.5

Now Photiosity uses an optimized algorithm, which is much faster than the previous one (1.0.3). Nevertheless the old algorithm is included and can be easily reactivated (switch off the Fast Calculation Method checkbox).
Photiosity uses the CPU as standard computing device.

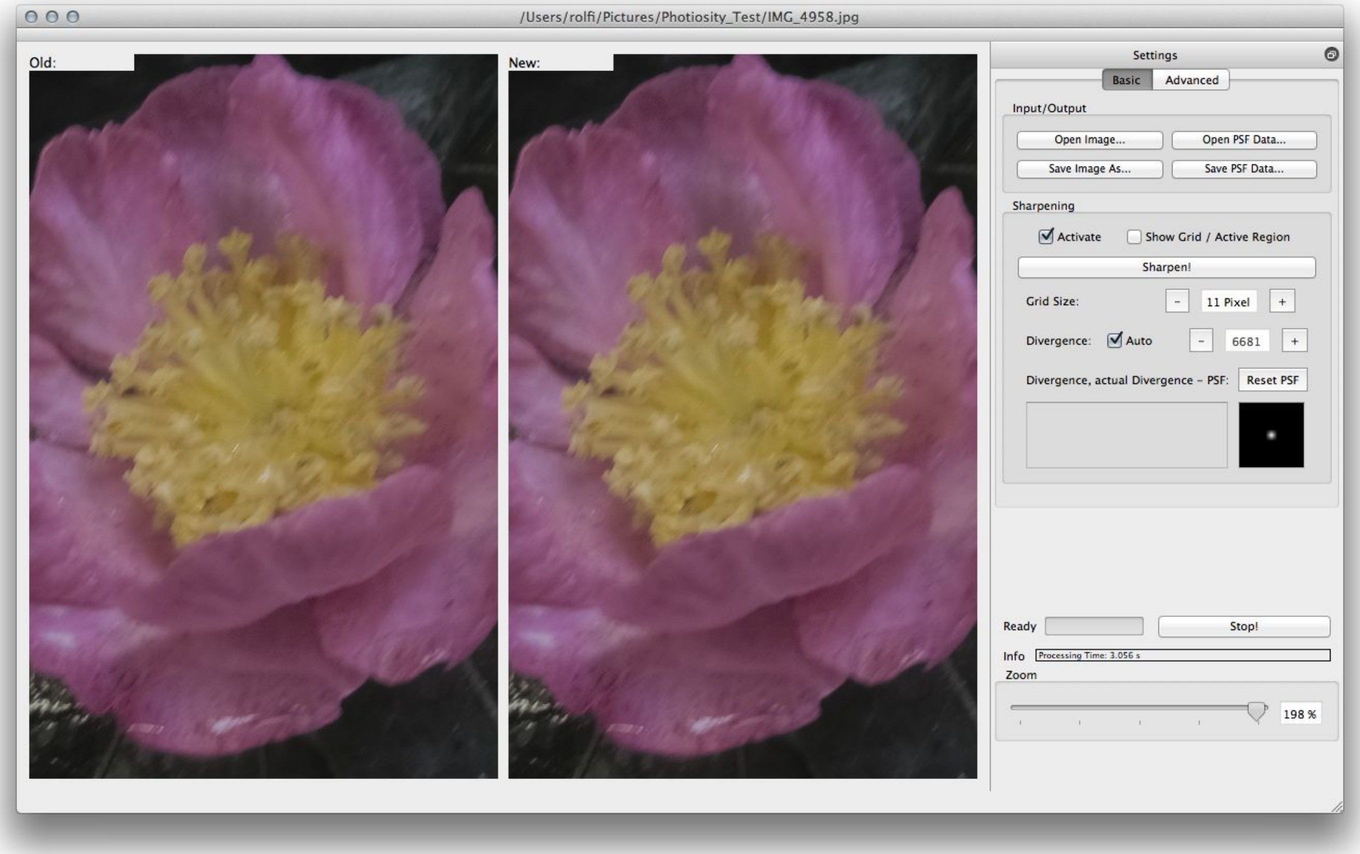
Changes in Version 1.6

Compatibility with Mountain Lion (10.8). Optimizations and improvements of the “Fast Calculation Method”.
Improvements in the OpenCL-Kernel of Photiosity, Compatibility with OpenCL-1.2, Bug-fixing.

Changes in Version 1.7

A better method to find the “blur-free” optimum, Bug-fixing.

Standard procedure for sharpening a blurred image



/Users/rolfi/Pictures/Photiosity_Test/IMG_4958.jpg

☑ Activate ☐ Show Grid / Active Region

Grid Size: 11 Pixel

Divergence: ☑ Auto 6681

Divergence, actual Divergence – PSF:

Ready

Info Processing Time: 3.056 s

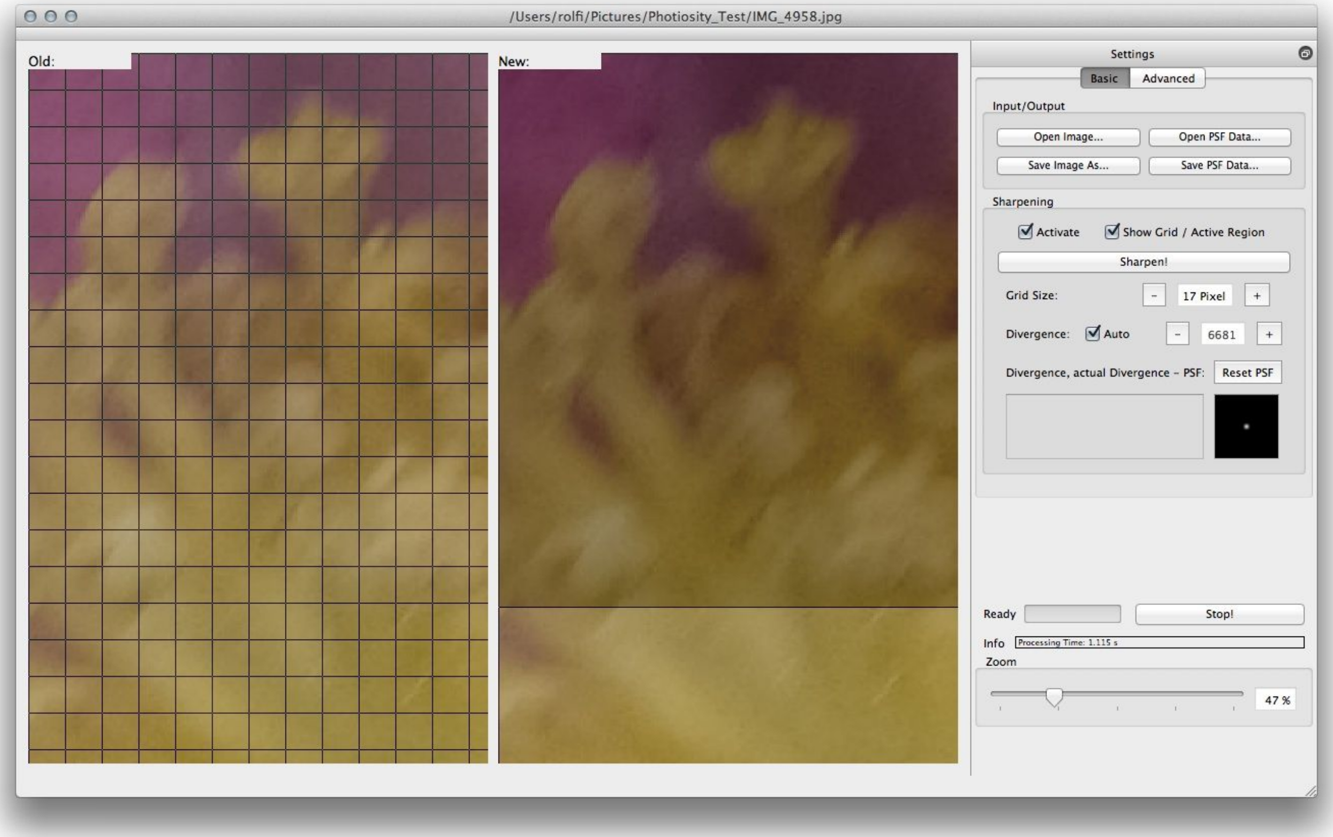
Zoom 198 %

➔ Open the image.

➔ Select a Grid Size that is about the size of the blur in the picture, by activating the square lattice (Show Grid) and estimating the dilatation (in unit of pixels) in smeared regions, especially edges.

➔ Press Reset PSF.

➔ Select the active region of the picture, which will be used to calculate the sharpening parameters (the active image region is always the top visible part of the image window). The calculated parameters are valid for the whole image and will be used to calculate the whole (!) sharpened image. The exact size of the region is shown by pressing the Active Region checkbox:



☑ Activate ☑ Show Grid / Active Region

Grid Size: 17 Pixel

Divergence: ☑ Auto 6681

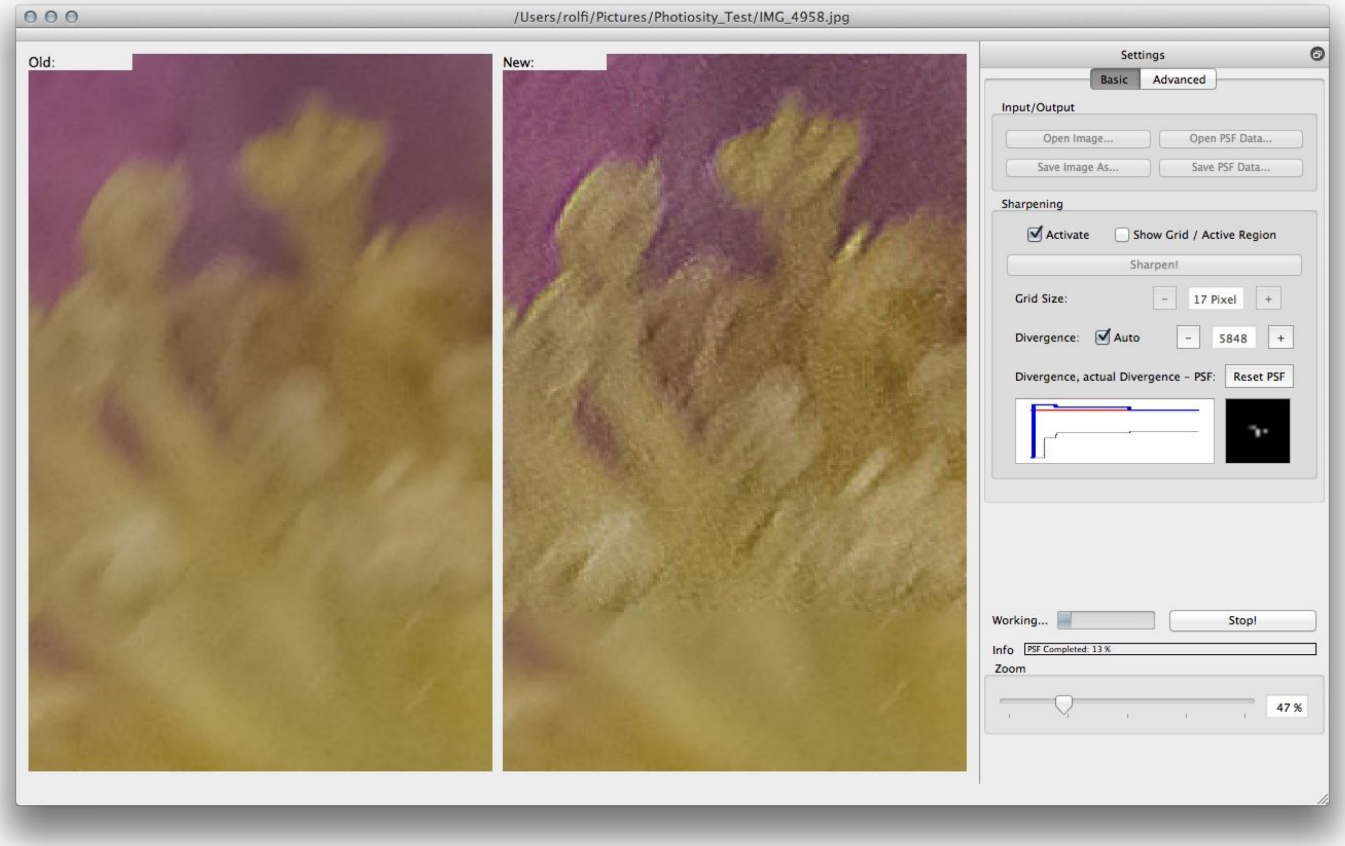
Divergence, actual Divergence – PSF:

Ready

Info Processing Time: 1.115 s

Zoom 47 %

➔ Press Sharpen! or choose the appropriate menu item. Watch what happens...:



☑ Activate ☐ Show Grid / Active Region

Grid Size: 17 Pixel

Divergence: ☑ Auto 5848

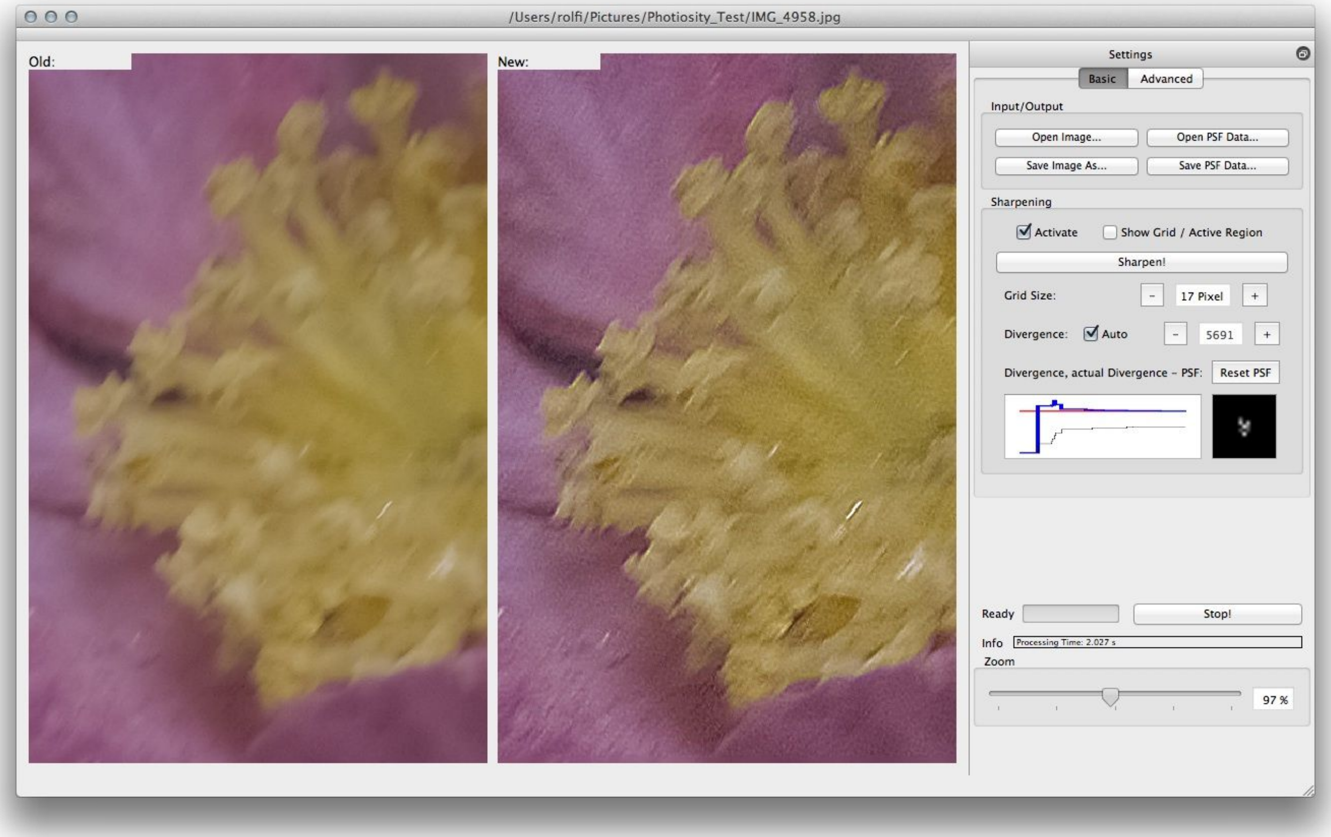
Divergence, actual Divergence – PSF:

Working...

Info PSF Completed: 13 %

Zoom 47 %

➔ You can stop the calculation at any time (Stop!-button). After that, the calculated parameters are applied to the visible image region.



/Users/rolfi/Pictures/Photiosity_Test/IMG_4958.jpg

☑ Activate ☐ Show Grid / Active Region

Grid Size: 17 Pixel

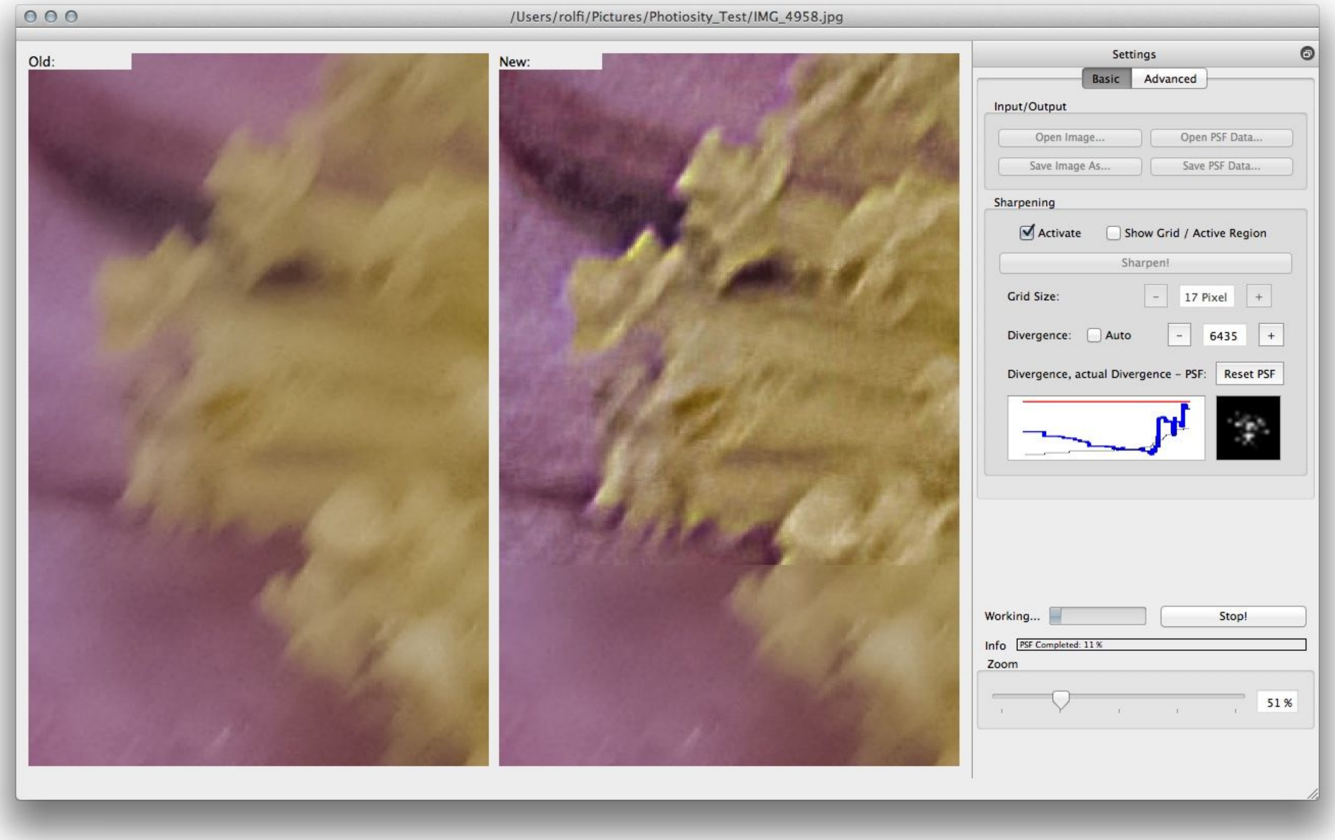
Divergence: ☑ Auto 5691

Ready

Info: Processing Time: 2.027 s

Zoom: 97 %

➔ You can optionally improve the result by changing the Divergence. In case you are unhappy with the result, you can switch off the Auto-checkbox and change the Divergence value by yourself. To see the impact on the result, it is best to start the calculation again. If you increase the value, *Photiosity* strengthens the deblurring, by decreasing it, the result resembles the original source image:



/Users/rolfi/Pictures/Photiosity_Test/IMG_4958.jpg

☑ Activate ☐ Show Grid / Active Region

Grid Size: 17 Pixel

Divergence: ☐ Auto 6435

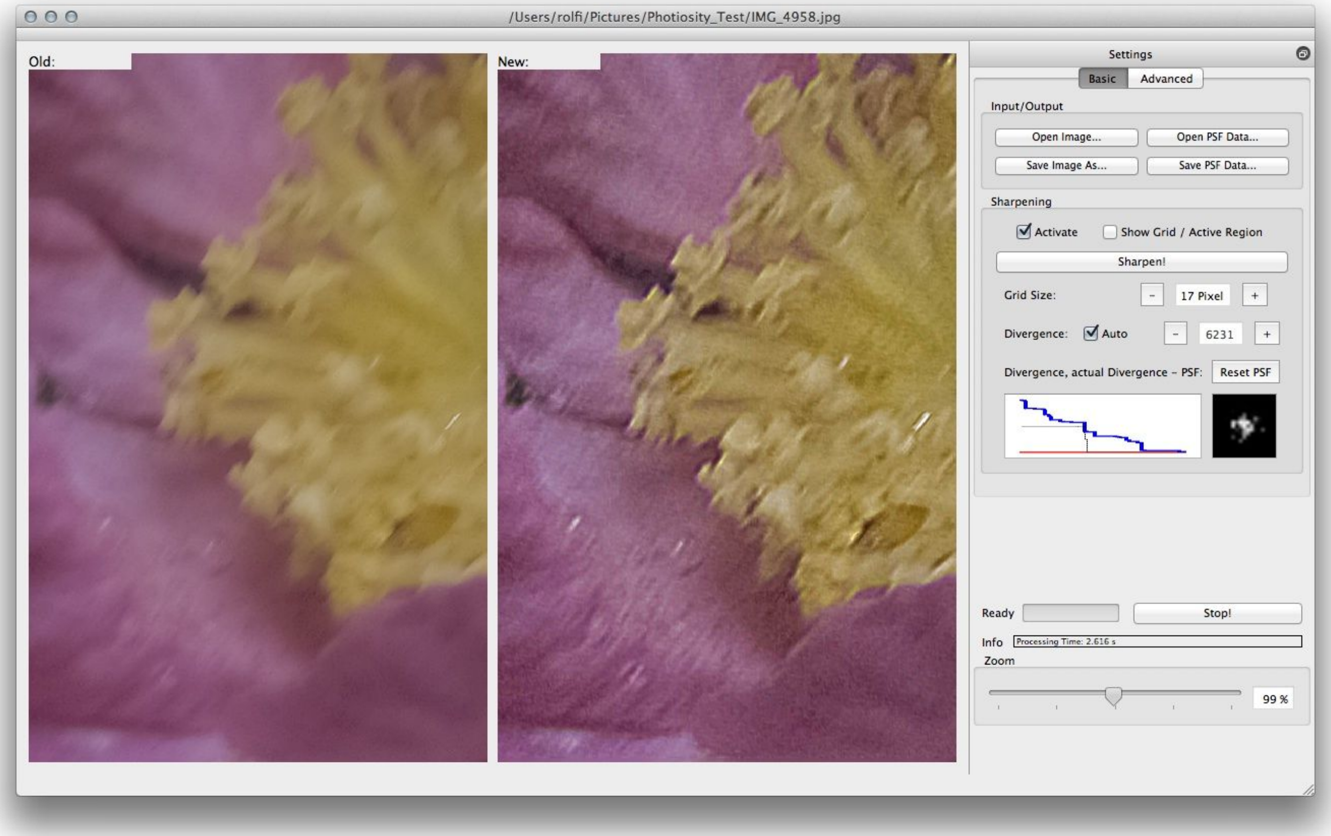
Working...

Info: PSF Completed: 11 %

Zoom: 51 %

➔ The <u>Grid Size</u> has also an strong impact on the results of the sharpening. If it is to large, the algorithm tends to produce doubled structures. It is often better (also for the performance) to underestimate the <u>Grid Size</u> a little bit.

➔ When you are satisfied with the result, you can save the sharpened image (as jpg, tiff, png) or copy it to the clipboard (menu: <u>Copy whole picture</u>). During the saving or copying the calculated sharpening parameters are applied to the whole image. Therefore these processes require a few seconds.



/Users/rolfi/Pictures/Photiosity_Test/IMG_4958.jpg

Old:

New:

Settings

Sharpening

☑ Activate ☐ Show Grid / Active Region

Grid Size: 17 Pixel

Divergence: ☑ Auto 6231

Ready

Info Processing Time: 2.616 s

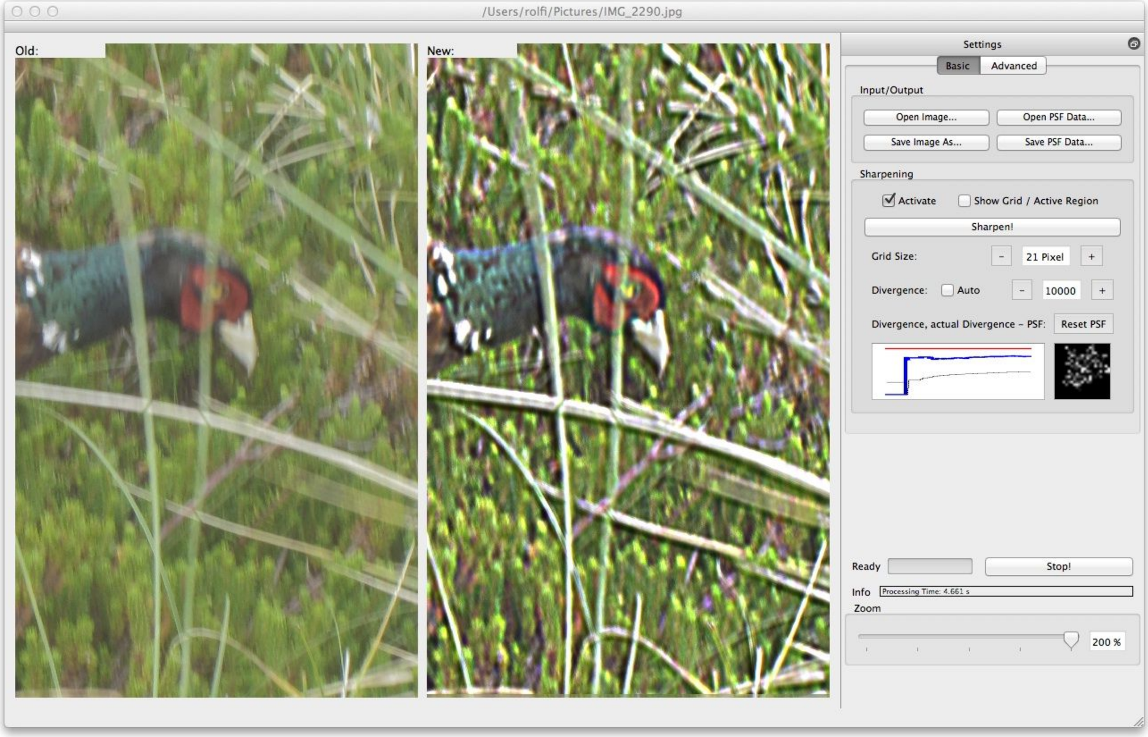
Zoom 99 %

➔ You can also save the current parameters (<u>PSF Save Data</u>). So they can be recovered after a restart of the program.

➔ Please expect no miracles... .

Additions

The Divergence is automatically determined at the beginning of the sharpening process (Auto in Settings), but is sometimes not exactly predictable. Therefore, you can affect the quality of the result (disable Auto-checkbox) by manually changing the divergence value.
If the difference between the original and the sharpened image is hardly visible, then the divergence value is too low (eg 0). If the sharpened image has high contrast areas (in the example: the white areas, which are to large), the divergence (example: 10000) is too high:



☑ Activate ☐ Show Grid / Active Region

Grid Size: 21 Pixel

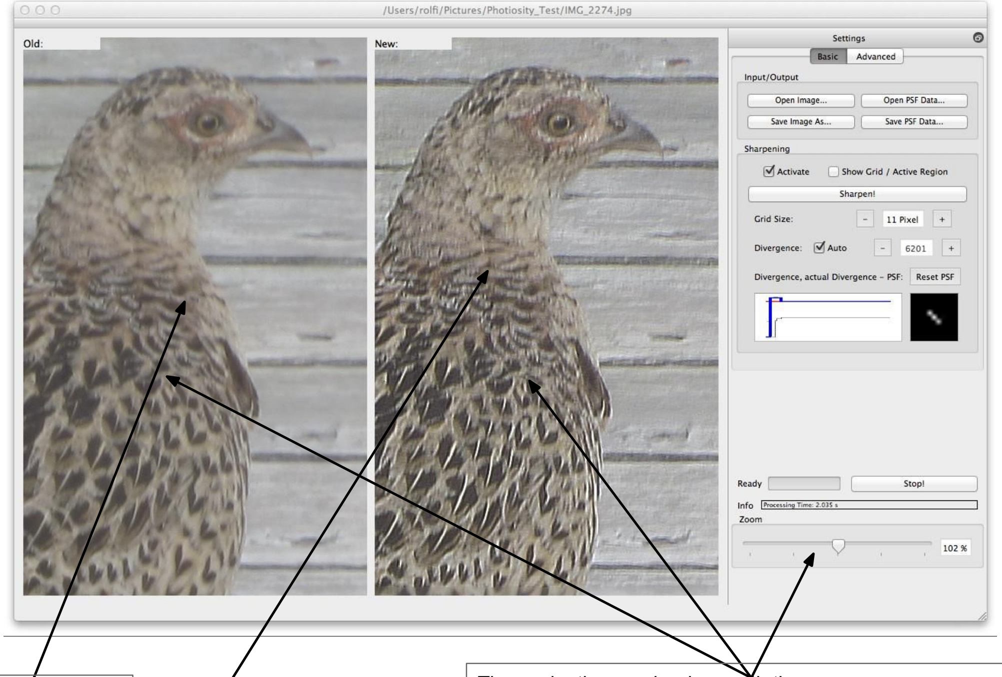
Divergence: ☐ Auto 10000

Divergence, actual Divergence – PSF:

Info: Processing Time: 4.661 s

Zoom: 200 %

The Controls of Photiosity



☑ Activate ☐ Show Grid / Active Region

Grid Size: 11 Pixel

Divergence: ☑ Auto 6201

Divergence, actual Divergence – PSF:

Info: Processing Time: 2.035 s

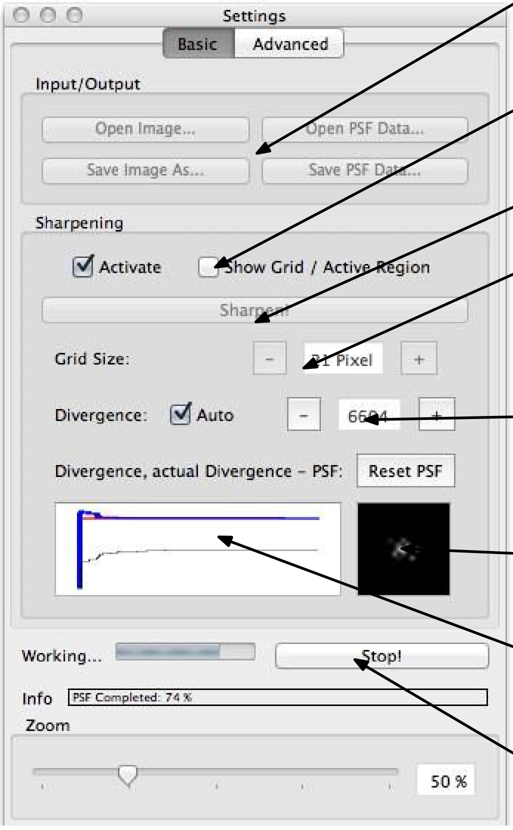
Zoom: 102 %

The original image.

The sharpend image. It shows always the same cutting like the original image and it displays the current state of sharpening.

The navigation can be done with the mouse:
Scrollwheel respectively left mouse button for moving, zooming with the "Zoom"-slider,
or with theTrackpad: Two and three finger touches for moving and the usual three finger gesture for zooming.

Settings



☑ Activate ☐ Show Grid / Active Region

Grid Size: 21 Pixel

Divergence: ☑ Auto 6604

Working...

Info: PSF Completed: 74 %

Zoom: 50 %

Open and save the processed image and the calculated sharpening data (PSF).

Display a grid accordingly to the "Grid size". It helps to estimate the pixel size of the blur.
Show the active region which is used to calculate the sharpening parameters.

Start the calculation.

Grid size - all pixels inside the cell contribute to the sharpening of the central cell point.

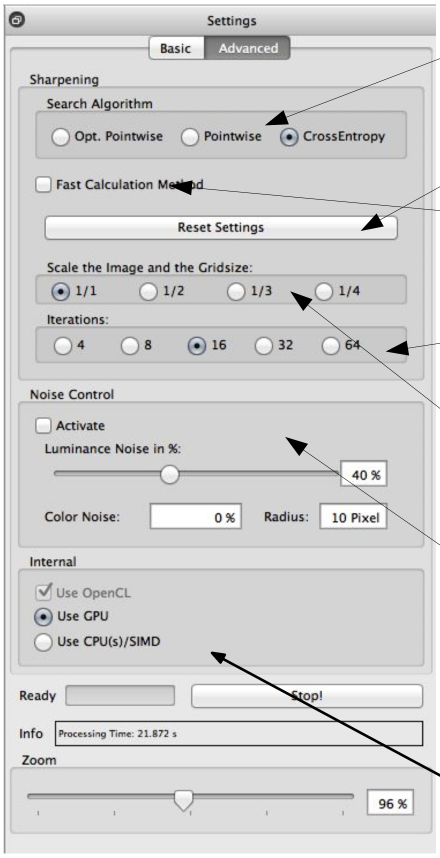
A low divergence attracts the sharpened image to the inital image.
A high divergence attracts the image to high sharpening contrasts.
If the "Auto"-checkbox is marked, an optimal value will be continuously calculated during the sharpening process.
This value of the divergence can be changed at all times.

The actual sharpening data (PSF - Point Spread Function).

Blue line: A measure for the quality of the sharpening process – the smaller the better.
Thin black line: A measure for sharpness – the higher the better.

Stops all active processes.

Additional Settings



○ Opt. Pointwise ○ Pointwise ● CrossEntropy

☐ Fast Calculation Method

Scale the Image and the Gridsize: ● 1/1 ○ 1/2 ○ 1/3 ○ 1/4

Iterations: ○ 4 ○ 8 ● 16 ○ 32 ○ 64

☐ Activate

Luminance Noise in %: 40 %

Color Noise: 0 % Radius: 10 Pixel

☑ Use OpenCL
● Use GPU
○ Use CPU(s)/SIMD

Ready

Info: Processing Time: 21.872 s

Zoom: 96 %

The search method to find the optimal sharpness.
Pointwise: Tests every point in the Point Spread Function Matrix.
Optimized Pointwise (Photiosity 1.6.): Tests the points in the PSF-Matrix with some limitations, e.g. the points have to be connected.
CrossEntropy (preferred): A new method (>1.6), which tries to iterate from random PSFs to the optimal one.

Resets the Settings.

Activates the new (>= Version 1.5) or the old (Version 1.0.3) Algorithm.

Only if "Fast Calculation Method" is unchecked:

The number of iterations to calculate the sharp image out of the blurred image and the sharpening data. Normally 8 is a good compromise between computing time and accuracy.

Only if "Fast Calculation Method" is unchecked:

Scale image, grid and point spread function.

Activates a noise supression algorithm.
Supressing of Luminance and color noise:
0%: maximal supression.
100%: no supression.
Radius is the circle radius in pixels, which contributes to the noise supression of the central point in this circle.

Use OpenCL definitely.
CPU/SIMD: Use the CPU-kernels for the calulations (Default).
GPU: Use the graphics processors for the calculations. Due to some problems with some older Macs, the use of the GPU is marked as experimental.

Some comments on sharpness, divergence, and iterations

The theoretical sharpness of the calculated image is shown as a thin black curve in the graphics on the page Basic Settings. This value is approximately a function of the sum of differences in luminance of neighbouring pixels in the image. The visual sharpness of the image is a very subjective term, which isn't necessarily proportional to the theoretical sharpness. Nevertheless the theoretical sharpness gives a strong hint on the visual sharpness.

The term divergence is a kind of measure that indicates the difference of the sharpened image from the original image. Therefore a small divergence value (< 100) means that the sharpened image approximates the original one. A high divergence value (>100) escalates the sharpening process. The result of these two extreme cases is often unsatisfactory. In the first case, it gives you an image that differs hardly from the original source. In the second case, it gives you a sharpened image which is characterized by high contrast and distortions.

How so often, the best divergence value lies in the middle (10...1600).

The mentioned graphics shows the quality of the sharpening process as blue line. The smaller the value, the better the quality. Therefore during the sharpening the blue line tends to smaller values.

If the Auto-checkbox is set, *Photiosity* tries to calculate the optimal value for the divergence, at the beginning of the sharpening process. The value can be changed at any time (even during the calculation). This requires only to switch off Auto.

PSF is an abbreviation of “Point Spread Function”. In principle, it is a visualization of the blurring that leads to the unsharpness in the image. It shows how the picture of one pixel would look like, after applying the assigned blurring. *Photiosity* tries to calculate the PSF in order to determine the original sharp image from the PSF and the blurred image. For this calculation an optimized variant (Fast Calculation Method) of the iterative “Lucy Richardson Method” is used. Therefore the PSF of Photiosity is not comparable to the PSFs of other blind deconvolution programs.

In the current version of Photiosity (>=1.7), it is possible to choose the Search Method to find the optimal sharpness (the minimum of the blue line). The Pointwise method tests every pixel in the PSF. The Optimized Pointwise method (used in Photiosity 1.6) tests the points in the PSF-Matrix with some limitations, e.g. the points have to be connected. CrossEntropy is the preferred new method (>1.6). First random PSFs are calculated. The best of them (hence the “smallest” PSFs) are used to calculate new PSFs - and so on, and so on... .