

## SSIM INDEX: a plugin written in Java for ImageJ.

### USER'S MANUAL.

To install this plugin, simply copy the file “SSIM\_INDEX.class” into the “plugins” folder of ImageJ (1). This folder is automatically created after the installation of ImageJ, under the “ImageJ” folder. You will need to restart ImageJ to use this plugin. After restarting, open the menu option “Plugins” and you will see a new option, “SSIM index”.

#### Preconditions:

1. Two images must be open simultaneously (i.e., figure 1) with ImageJ (Ver 1.41o or higher). Do not worry about the format: DICOM, TIFF, JPEG, etc. The plugin works with the memory map of the computer, not with the stored files
2. Both images must have the same dimensions and gray levels: 8, 16 or 32.

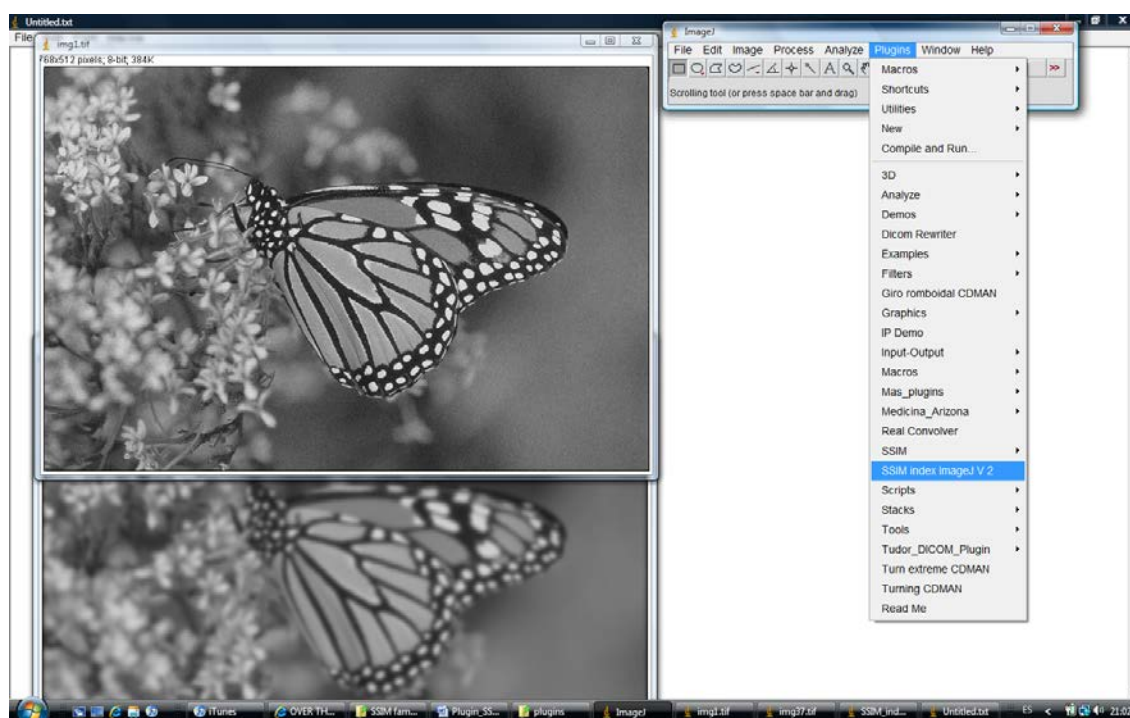


Figure 1

Under the menu option “Plugins”, you will find the option “SSIM index” (see figure 1). Select it. The next dialog box will appear (figure 2):

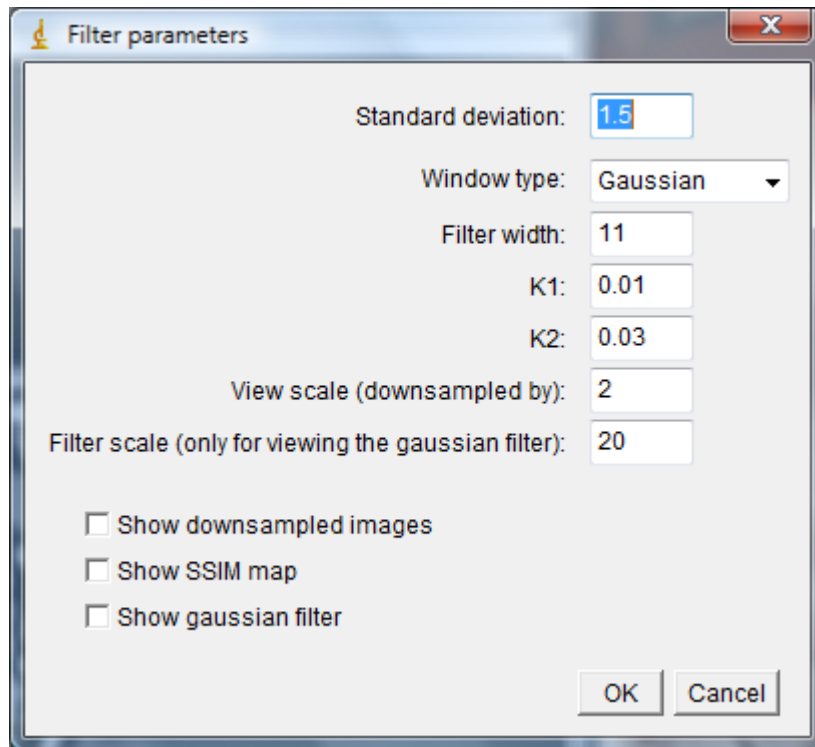


Figure 2

**Standard deviation.** In (2), standard deviation is the value of sigma for the gaussian filter we need to use to evaluate the index in the local window to avoid blocking artefacts. You can change this value.

**Window type.** It has two values, “Gaussian” or “Media”. In spite of the fact of the “blocking” problem in (2) if SSIM index is computed with a square window with the same weights for all the cells, you can calculate the index with this option.

**Filter width.** It is the width of the square window which moves pixel-by-pixel over the entire image. Some authors change this value between 7 to 15 pixels.

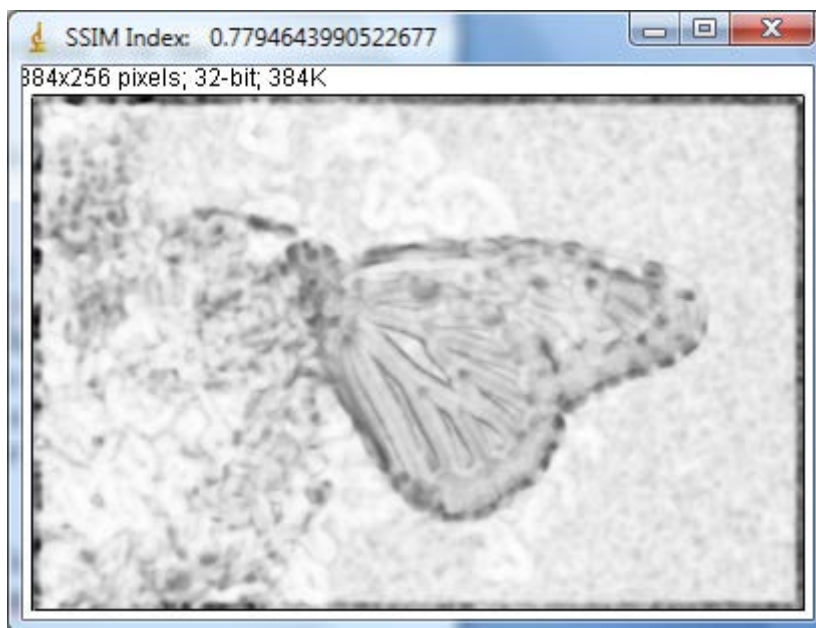
**K1 and K2** are constants  $C_1$  y  $C_2$  in (2) to avoid instability in the calculation of SSIM index.

**View scale.** It is the scale proposed by Zhou Wang in his SSIM home page <http://www.ece.uwaterloo.ca/~z70wang/>. SSIM Index changes with the viewing distance. Mr. Wang proposed a downsample of the images to a maximum of 256 pixels at a typical viewing distance of 40 – 50 cm. This plugin automatically downsamples images bigger than 512 pixels to 256 pixels to calculate the SSIM index. Anyway, the user can select the downsampling scale. It is a flexible solution, because for some high resolution monitors, it should be better to select lower downsample factors.

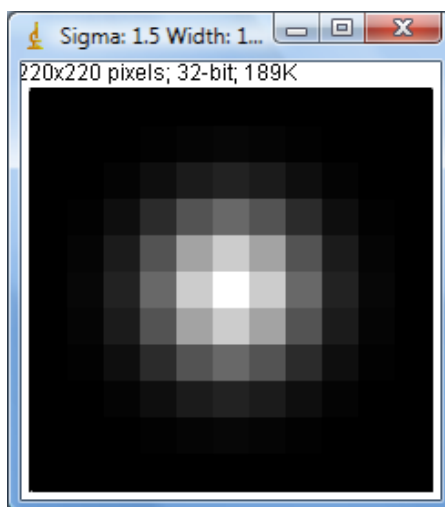
**Filter scale.** It is only a tool if you want to display the Gaussian filter. Usually this filter is tiny (11 x 11) and the “Filter scale” factor is a scale factor to see the luminance distribution in a new window.

**Show downsampled images.** If “viewing scale” is equal or greater than “2”, the program displays the downsampled images.

**Show SSIM map.** It displays the SSIM map in a new window. It is very useful to analyze the difference between the images you are measuring. Black pixels mean no difference. White pixels indicate maximum difference.



**Show Gaussian filter.** Related with “Filter scale”, if this check-box is marked, a window will appear with a luminance distribution according to the weights of the Gaussian filter.



The home page related with this plugin is [https://www.ucm.es/gabriel\\_prieto/ssim](https://www.ucm.es/gabriel_prieto/ssim)

For any question, please, email to [gprietor@med.ucm.es](mailto:gprietor@med.ucm.es)

Thank you very much.

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## References:

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2. Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, "Image quality assessment: From error visibility to structural similarity", *IEEE Trans. Image Processing*, vol. 13, pp. 600–612, Apr. 2004. <http://www.ece.uwaterloo.ca/~z70wang/publications/ssim.html>
3. Z. Wang. Zhou Wang's homepage. Dept. of Electrical & Computer Engineering. University of Waterloo. Waterloo, Ontario, Canada. <http://www.ece.uwaterloo.ca/~z70wang/> 28<sup>th</sup> november 2008.
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7. Z. Wang and A.C. Bovik, "A universal image quality index," *Signal Processing Letters, IEEE*, vol.9, no.3pp.81-84, Mar 2002.

The sample images used in this web have been extracted from a database, which includes 344 JPEG and JPEG2000 compressed images. The database is created and available for free download at the Lab for Image and Video Engineering (LIVE) at the University of Texas at Austin in <http://live.ece.utexas.edu/research/quality/subjective.htm>

Please, refer to this version as: Gabriel Prieto, Margarita Chevalier, Eduardo Guibelalde. "SSIM Index as a Java plugin for ImageJ" Department of Radiology, Faculty of Medicine. Universidad Complutense. Madrid. SPAIN. [https://www.ucm.es/gabriel\\_prieto/ssim](https://www.ucm.es/gabriel_prieto/ssim)