


8-4. Filters (spatial)

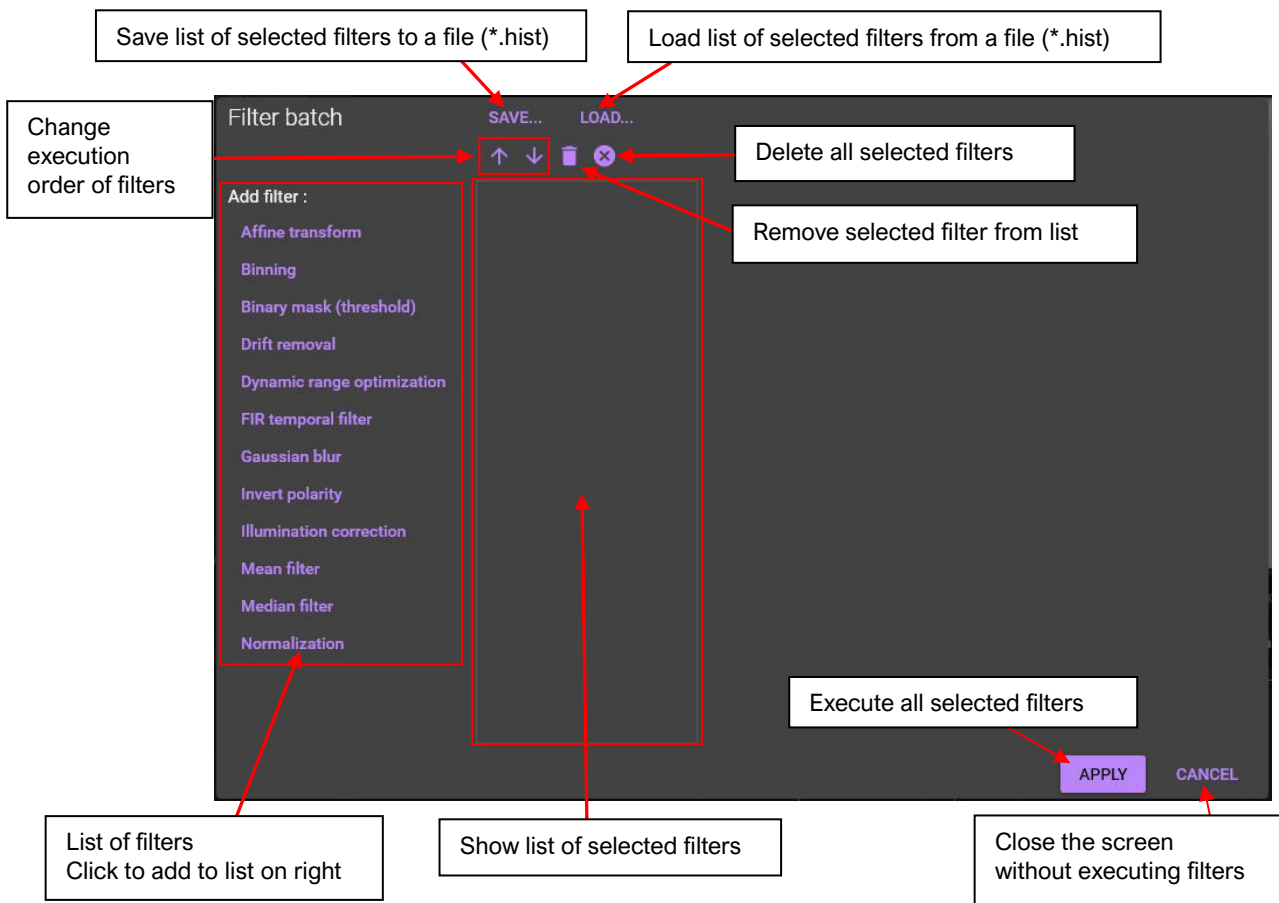
8-4-1. Undo filter (Undo)

You can undo the last processed filter and undo data by clicking the Undo icon  on the toolbar.

Number of undos that can be undone is set in [Undo levels] on the [App settings] screen. You can set 1 to 10, but the larger the number, the larger the memory usage of the PC. The recommended value is 1.

8-4-2. Automatic execution of multiple filters (Filter batch)

When [Filters (spatial)]-[Filter batch] is executed, the following screen is displayed. On this screen, multiple specified filters can be automatically executed in specified order.



[Affine transform]

Enlarge, reduce, rotate, move (up, down, left and right) image.

The screenshot shows the 'Affine transform' control panel with the following annotations:

- Enter the rotation angle (Positive: Clockwise, Negative: Counterclockwise)** - points to the 'Angle' field (0).
- Enter scale up/down (>1: Enlarge, <1: Reduce)** - points to the 'Scale' field (1).
- Enter the amount of horizontal movement (Positive: Move right, Negative: Move left)** - points to the 'Translation.X' field (0).
- Enter the amount of vertical movement (Positive: move down, Negative: move up)** - points to the 'Translation.Y' field (0).
- Load saved settings from file** - points to the 'Import...' button.
- Save settings to file** - points to the 'Export...' button.
- Expansion** - points to the expansion icon.
- Reduction** - points to the reduction icon.
- Counterclockwise rotation** - points to the counterclockwise rotation icon.
- Clockwise rotation** - points to the clockwise rotation icon.
- Move up and down** - points to the vertical movement icons.
- Move left and right** - points to the horizontal movement icons.

[Binning]

You can combine multiple pixels into one pixel. Select either addition or average as calculation method when collecting pixels.

The screenshot shows the 'Binning' control panel with the following annotations:

- Select the binning size. If 2 is selected, 2x2 pixels are targeted.** - points to the 'Size' slider (set to 2).
- Select "Average" or "Sum"** - points to the 'Mode' dropdown menu (set to Average).

[Binary mask (threshold to zero)]

A threshold value is specified between 0 and 66535, and only pixels that have a value above specified threshold value are displayed.

The screenshot shows the 'Binary mask (threshold to zero)' control panel with the following annotation:

- Specify threshold (0 to 65535)** - points to the 'Threshold' slider (set to 0).

[Drift removal (polynomial fit)]

Corrects drift curve.

The screenshot shows the 'Drift removal (polynomial fit)' control panel with the following annotations:

- Enter polynomial fitting order** - points to the 'Fitting polynomial degree' field (3).
- Downsampling (Enter an integer of 1 or more to shorten fitting time)** - points to the 'Downsampling' field (10).

[Dynamic range optimization]

Brightness value of each pixel is optimized to use entire 16-bit gradation, and dark images are corrected to be bright.

[FIR temporal filter]

Use a FIR (finite impulse response) filter to remove noise.

The screenshot shows the 'FIR filter' control panel with the following settings and annotations:

- Cutoff frequency 1:** 50 Hz. An annotation box points to this field with the text 'Cutoff frequency 1'.
- Cutoff frequency 2:** 100 Hz. An annotation box points to this field with the text 'Cutoff frequency 2 (Can be input only when Filter type=Band-pass or Band-stop)'.
- Sample rate:** 751.8791 Hz. An annotation box points to this field with the text 'Sampling rate during image acquisition'.
- Filter type:** Low-pass. An annotation box lists options: 'Low-pass', 'High-pass', 'Band-pass', and 'Band-stop'.
- Window function:** Hann. An annotation box lists options: 'Blackman-Harris', 'Hamming', and 'Hann'.
- Filter length (N):** 201. An annotation box explains: 'Increase value to make frequency response sharper. Output delay is proportional to this value.' Another annotation box points to the 'Compensate delay' checkbox with the text 'Click to remove filter delay of (N-1)/2 samples.'.
- Compensate delay:** Checked.
- Graph:** A plot of Magnitude (dB) vs Frequency (Hz) showing a low-pass filter response. The y-axis ranges from -150 to -50 dB, and the x-axis ranges from 0 to 300 Hz. A vertical line is drawn at 0 Hz.
- Buttons:** 'APPLY' and 'CANCEL' buttons are at the bottom. Below them are two boxes labeled 'Execution' and 'Cancel' with arrows pointing to the respective buttons.

[Gaussian blur]

Gaussian filter to smooth image and removes noise.

The screenshot shows the 'Gaussian blur' control panel with a slider for 'Size' set to 3. An annotation box points to the slider with the text 'Select size (=σx2)'.

[Invert polarity]

Polarity of change in F-F(0) is inverted while maintaining brightness value of background image.

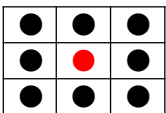
[Illumination correction]

This is a process that corrects vignetting caused by optical system settings and unevenness of brightness of excitation illumination, and corrects it by software so that background brightness on screen becomes almost constant.

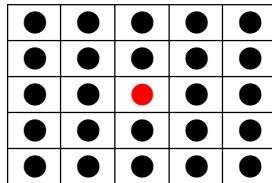
[Mean filter]

Mean filter to smooth image and removes noise. Let the pixel value be $D(t,x,y)$, and if it is indicated by ●, set average value of data values in proximity of $P \times P$ range to $D(t,x, y)$.

When $P=3$



When $P=5$



Set filter size (number of pixels)

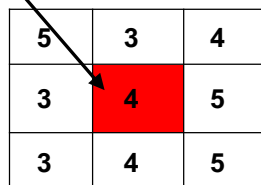
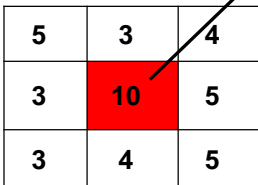
Mean filter

Size

[Median filter]

Median filter to smooth image and removes noise. Median filter sorts values around a pixel and sets median value to the pixel.

3, 3, 3, 4, 4, 5, 5, 5, 10



Set filter size (number of pixels)

Median filter

Size

[Normalization]

Correct difference in amplitude of brightness value between each pixel and calculate so that brightness values of all pixels have the same amplitude (0 to 65,535).