▸ Filter Tools

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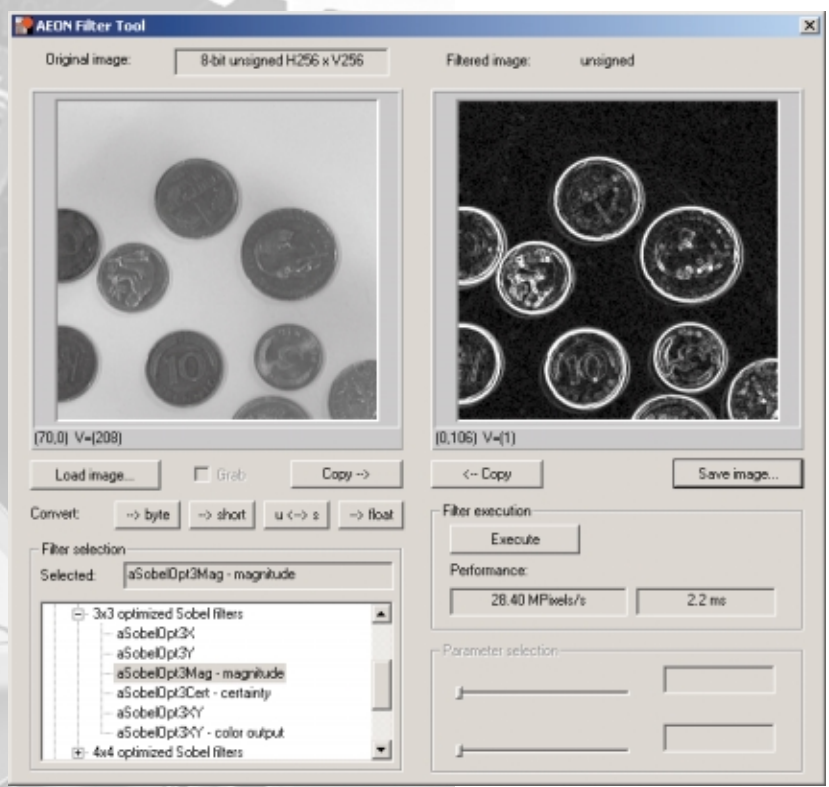


Software tools for filtering image data

STEMMER® IMAGING

▸ Filter Tools

▸ Filter tools for image processing

One of the basic functions of image processing is the filtering of image data. The use of filters allows you to enhance or reduce certain features of the image. To do this, Common Vision Blox provides the user with a range of tools:

- Common Vision Blox Filter
- Common Vision Blox AEON FILTER
- Common Vision Blox AEON FILTER+

▸ Common Vision Blox Filter

The software tool Filter is a basic tool providing a number of filter operations, for example, dilatation/ erosion, edge, Laplace, pyramid and others. These filters can be used in a matrix from 2 x 2 through 5 x 5 in size. The user can also define special filters for his individual needs.

▸ AEON Filter and AEON Filter+

The AEON Filter tool for Common Vision Blox contains »state-of-the-art« filters to ensure optimum preprocessing of images. The tool is offered with the same filters in a standard version, and in a speed-optimized version (AEON Filter+). The latter makes use of multimedia instruction sets, for example, MMX and is thus able to reach speeds which are up to ten times faster than the standard version. All filters are implemented for both grayscale and color images with 8 and 16 bits per pixel and color channel for integer data types and with 32 bits for floating point data types.
The AEON Filter tool is made up of the following filter sets:

Rapid isotropic smoothing - These filters make use of kernels which, unlike the normal approach using rectangle filters, have been optimized for isotropic or non-directional smoothing.

Edge detection - The kernels of filters of this type have been optimized to ensure the most accurate calculation possible of edge directions. The various kernels allow you to make an appropriate compromise with regard to accuracy and speed. The filters return either the edge strength, the edge direction or a method of determining the existence of an edge. In addition to this, the edge strength and direction can be output simultaneously in a color representation. Edge detection can be carried out in all directions, or just horizontally or vertically.

Adaptive noise suppression - Linear smoothing filters successfully reduce noise, but they can also flatten edges to such an extent that the signal-to-noise ratio of a filtered image doesn't actually improve anything. Adaptive noise suppression lends a helping hand here, as it suppresses smoothing for significant edges and corners. Adaptive noise suppression is ideal for preprocessing noisy images.

Control filters - These filters use parameters to control the filtering process which in turn allows the filters to be adapted to suit the current image processing task. The following filter classes are implemented: Controllable smoothing filters and directional filters for setting the smoothing gradient and to determine the filter direction.

General convolution - The tool also offers a general convolution operation in which the user can freely define the filter kernel. The point here is that the convolution operation analyzes the filter kernel prior to execution and then selects the most appropriate algorithm.

The AEON tools have been developed by Prof. Dr. Bernd Jähne. His well known book »Digital Image Processing« can be used as an additional documentation.

Noise suppression filters

Filters are most often used to remove disturbing statistical image noise. The simplest method is to use a filter with a lowpass effect which weakens the high-frequency and thus noisy parts of the image.

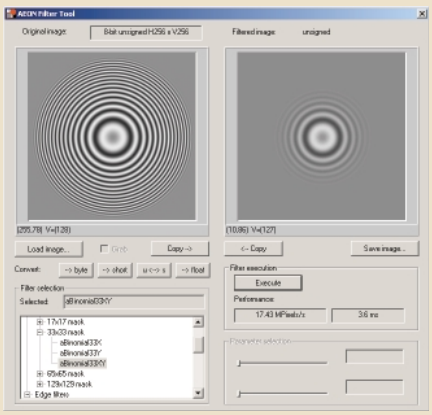
A class of lowpass filters that can, on the one hand, be implemented very efficiently and, on the other hand, give very high isotropic levels, are the binomial filters. For larger filter patterns this comes very close to reaching the standard of the Gaussian filter.

The sophisticated MMX optimization means that the AEON Filter+ is in a position to use even bionomial filters on a pattern 129 x 129 coefficients in size at a speed which allows you to carry out other processing or recognition processes on the resulting image. (On a modern PC, the typical processing speed is approximately 13.5 megapixels per second for a 129 x 129 binomial XY filter).

As well as using binomial filters for noise suppression, the slightly faster box filter and controllable and adaptive filters are also available with AEON Filter and AEON Filter+.

Edge detection

Another standard use of convolution filters is the detection and evaluation of edges with regard to intensity and direction of the change in grayscale. Here, the AEON Filter provides a class of Sobel filters (see the picture on the front page as well) whose coefficients are partially (as of filters sized 3 x 3) optimized to a higher accuracy of gradient.



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