

OPTO ENGINEERING



INTUITIVE ■ POWERFUL ■ ADAPTABLE



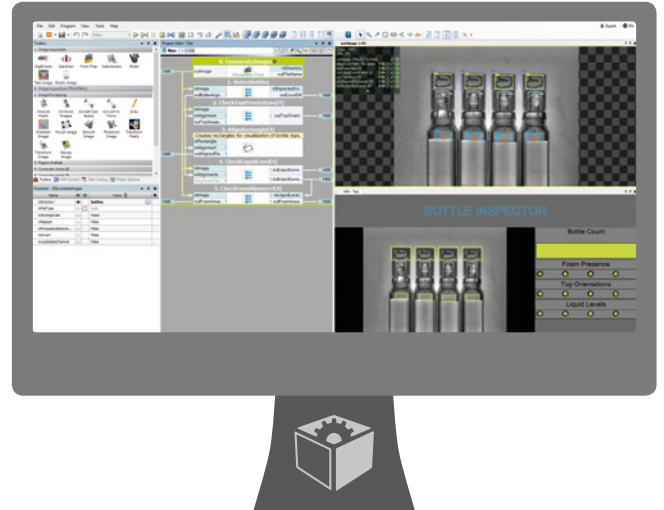
Software
for machine vision
engineers

INTRODUCTION

FabImage Studio Professional

FabImage Studio Professional is the most powerful graphical environment for machine vision engineers. It is based on dataflow programming and comes with a comprehensive set of powerful, ready-for-use image analysis filters.

Its unique strength lies in its focus on professional users - it allows you to create typical applications easily, but at the same time makes it possible to efficiently develop highly customized and large-scale projects.



Features



DRAG AND DROP

All programming is done by choosing filters and creating connections between each other. You can focus all your attention on computer vision.



1000+ READY-FOR-USE FILTERS

There are more than a thousand ready-for-use machine vision filters. They are organized into a well-defined category structure and comply to clear and consistent naming conventions.



LOOPS AND CONDITIONS

Without writing a single line of code, you can create custom and scalable program flows. Loops, conditions and subprograms (macrofilters) are realized with appropriate data-flow constructs in the graphical way.



ANY-SHAPE ROIs

Image processing operations can be performed on entire images or within regions of arbitrary shape.



VERSION CONTROL FRIENDLY

The files created by FabImage Studio Professional have a textual format and thus allow for the use of version control systems like SVN and Git.



YOU CAN SEE EVERYTHING

Inspection results are visualized on multiple configurable data previews; when a parameter in the program is changed, you can see the previews updated in real time.



HARDWARE ACCELERATION

The filters are aggressively optimized for the SSE technology and for multicore processors. Our implementations are amongst the fastest in the world!



MACROFILTERS

Large programs can be organized into small, easy to understand portions called macrofilters.



USER FILTERS

You can use user filters to integrate your own C/C++ code with the benefits of visual programming.



TEST DRIVEN DEVELOPMENT

A single project can contain multiple programs. The recommended strategy is to have a set of programs testing the algorithms on a set of images representing all possible variations. Assertion filters are used as the check points.



HMI DESIGNER

You can easily create custom graphical user interfaces and thus build the entire machine vision solution using a single software package.



COMPREHENSIVE SET OF DATA TYPES

You can easily create custom graphical user interfaces and thus build the entire machine vision solution using a single software package.



MODULES

A collection of related macrofilters can be moved to a separate file. This constitutes a module that can be shared among many different projects.



GIGE VISION AND GENTL SUPPORT

A collection of related macrofilters can be moved to a separate file. This constitutes a module that can be shared among many different projects.



C++ AND .NET GENERATOR

Programs created in FabImage Studio Professional can be exported to C++ code or to .NET assemblies for easy integration with bigger software projects.

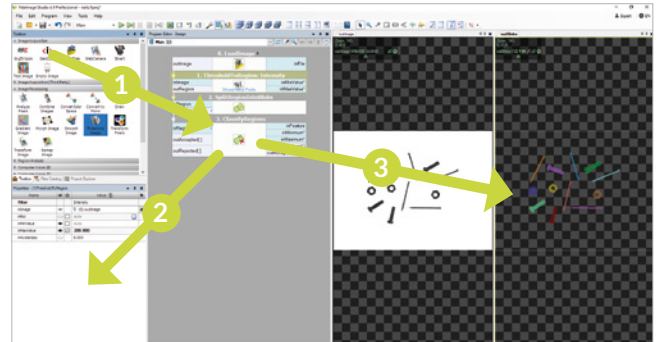
Design the algorithm

1

Creating vision algorithms consists in repeating three intuitive steps:

- 1 Drag & drop filters from the toolbox to the program editor.
- 2 Drag & drop connections between the filters or set constant input values.
- 3 Drag & drop filter outputs to data preview panels for interactive analysis.

The only expertise users need to have is about the core art of computer vision - which filters to connect and how. And yet another great feature of FabImage Studio Professional is that you can develop this competence quickly through intuitive experimentation.



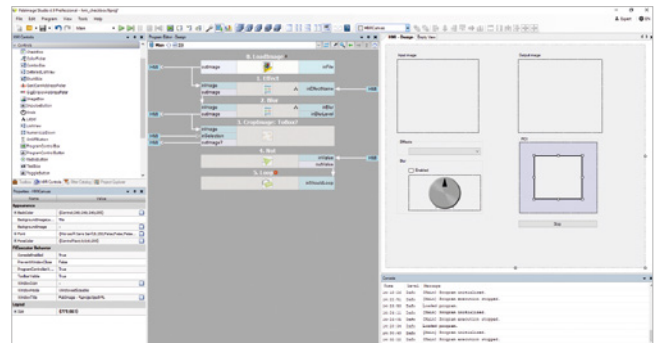
Create a custom HMI

2

Creating a custom graphical user interface is just as easy:

- 1 Drag & drop controls from the control catalog to the HMI panel.
- 2 Set the controls' properties.
- 3 Drag & drop connections between the filters and the controls.

Note that you can also easily integrate your algorithm with an HMI created in C++ or C#.



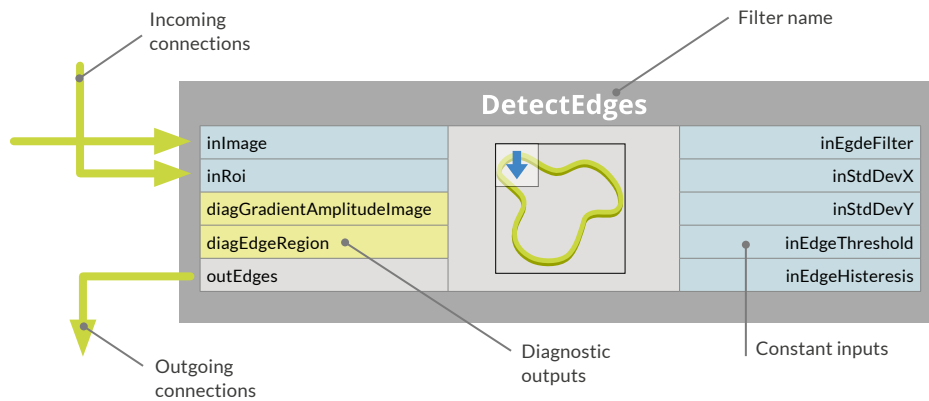
Deploy

3

When the program is ready, you can export it to a runtime executable and deploy it on a PC-based industrial computer or on a smart camera such as CORSIGHT from NET, NEON from Adlink and more.



DATA FLOW PROGRAMMING



Introduction

FabImage Studio Professional is a drag and drop environment designed for machine vision professionals. Experience in low-level programming is not required. Nevertheless, it is a fully fledged visual programming language based on 4 core concepts: Data, Filters, Connections and Macrofilters.

Macrofilters

Macrofilters are a tool we can use to build large real-life programs. They are reusable subprograms with their own inputs and outputs, and as a whole they can be used just as any regular filter. Moreover, macrofilters can perform iterative computations with state registers, thus providing an elegant way to create programs of any complexity.

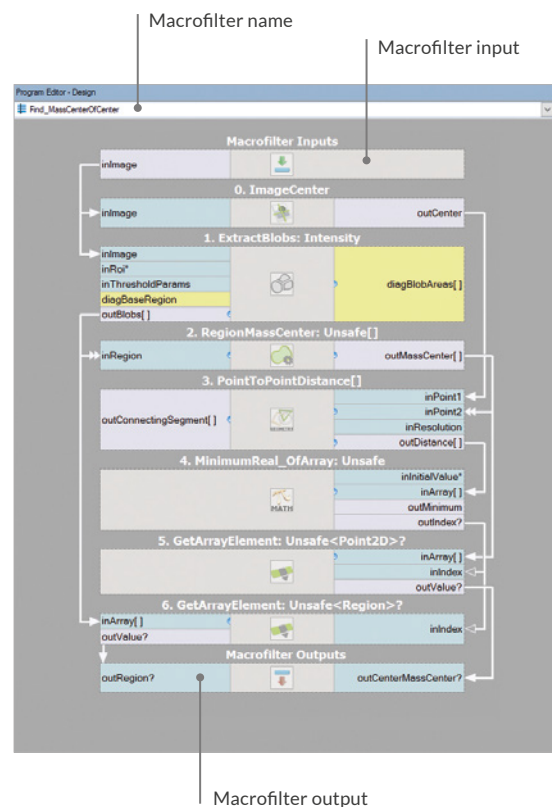
Data & Filters

Filters are the basic data-processing elements in the dataflow driven programming. In a typical machine vision application input images are transformed by a sequence of filters into regions, contours, geometrical primitives and then into final results such as a pass/fail indication. FabImage Studio Professional also supports data collections (arrays) and filters that store information between consecutive iterations to compute aggregate results.

Connections

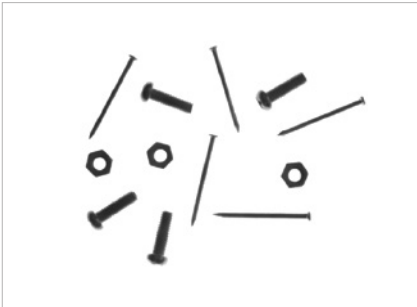
Different types of connections between filters support: **basic flow of data** \Rightarrow , **automatic conversions** \Rightarrow , **for-each processing** \Rightarrow and **conditional processing** \Rightarrow . The connection types are inferred automatically on a "do-what-I-mean" basis.

More information can be found in the user manual.

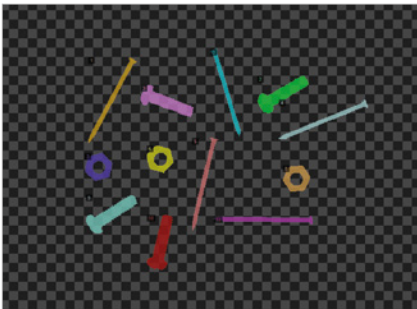


Here is a simple example of a data-flow driven program

- 1 An the image is acquired from a camera.

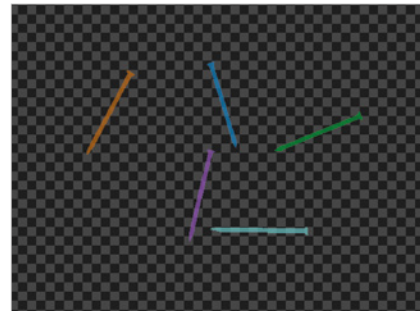


- 2 The image is thresholded into a region (a run-length encoded binary image) and then split into connected components.

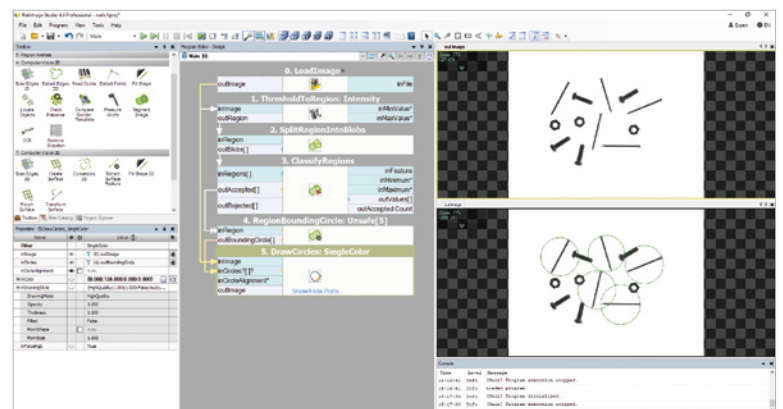
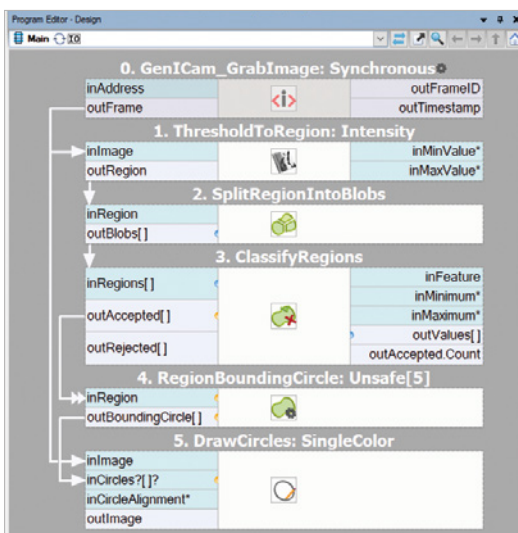
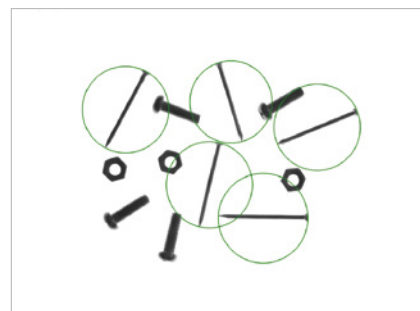


- 3 The ClassifyRegions filter analyzes the elongation feature of each component, i.e. { 19.554, 19.433, 3.866, ...}

- 4 The ClassifyRegions filter then splits the array of regions into arrays of accepted and rejected elements accordingly to the specified range.



- 5 Finally the bounding circles of the accepted objects are drawn

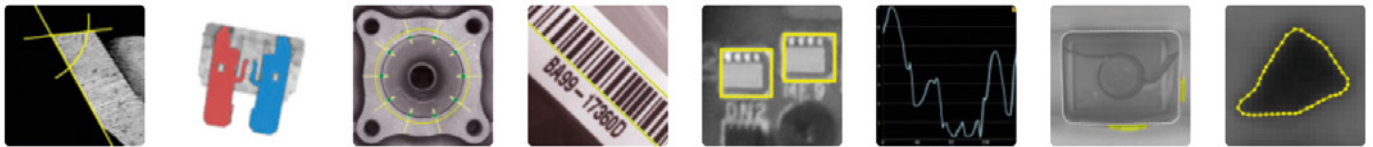


CAPABILITIES

Filters

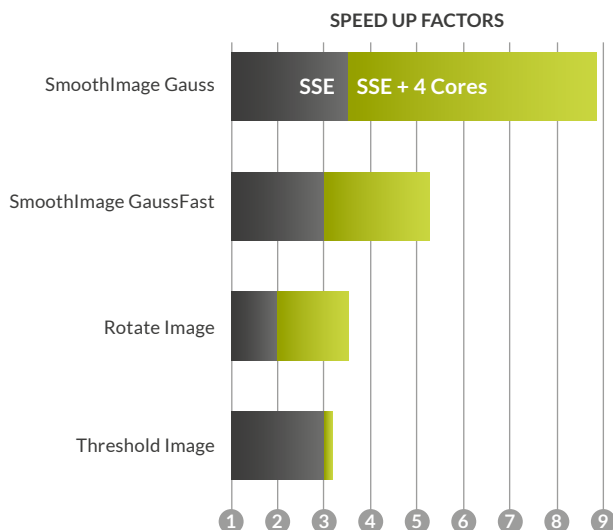
There are over 1000 filters encompassing both basic transforms and specialized machine vision tools.

- Image processing
- Camera calibration
- Corner detection
- Edge-based template matching
- Blob analysis
- Fourier analysis
- 1D Profile analysis
- Histogram analysis
- Contour analysis
- Hough transform
- 1D Measurements
- OCR
- Planar geometry
- Barcode reading
- 2D Measurements
- Machine learning
- Shape fitting
- Data code reading
- Gray-based template matching



Performance

The filters of FabImage Studio Professional are highly optimized for modern multicore processors with SSE2 technology. The achievable speed-up factors however are highly dependent on the particular operator. Simple pixel-by-pixel transforms after the SSE-based optimizations already reach memory bandwidth limits. On the other hand, more complex filters such as gauss smoothing can achieve even 10 times lower execution times than with C++ optimizations only.



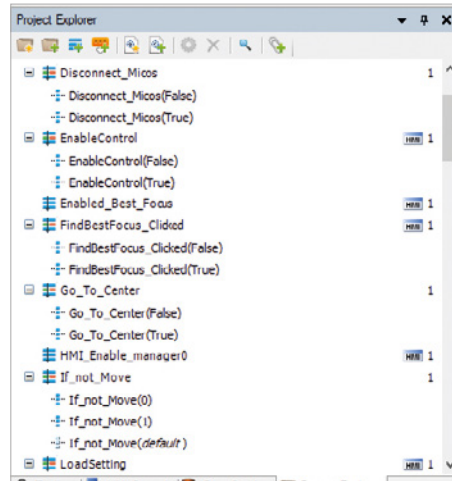
FILTER	FIS	ANOTHER PRODUCT	OPENCV 3.4.1
Image negation	0.097 ms	0.096 ms	0.104 ms
Add two image (pixel by pixel)	0.101 ms	0.131 ms	0.091 ms
Image difference (pixel by pixel)	0.090 ms	0.125 ms	0.085 ms
RGB to HSV conversion (3xUINT8)	1.696 ms	2.679 ms	1.829 ms
Gauss filter 3x3	0.101 ms	0.542 ms	0.208 ms
Gauss filter 5x5	0.110 ms	0.546 ms	0.374 ms
Gauss filter 21x21 (std-dev: 4.3)	1.730 ms	4.003 ms	6.442 ms
Mean filter 21x21	0.318 ms	0.301 ms	1.110 ms
Image erosion 3x3	0.093 ms	0.201 ms	0.104 ms
Image erosion 5x5	0.095 ms	0.209 ms	0.146 ms
Sobel gradient amplitude	0.100 ms	0.106 ms	
Sobel gradient amplitude	0.104 ms	0.114 ms	
Threshold to region	0.049 ms	0.046 ms	
Splitting region into blobs	0.081 ms	0.079 ms	
Bilinear image resize	0.417 ms	0.537 ms	0.277 ms

The above results correspond to 640x480 resolution, 1xUINT8 on an Intel Core i7 - 3.4 GHz (4 cores) machine. To assure the most precise results big images were tested and the results were normalized.

Note also that the functions from the different libraries do not always produce exactly the same output data.

Large-Scale Projects

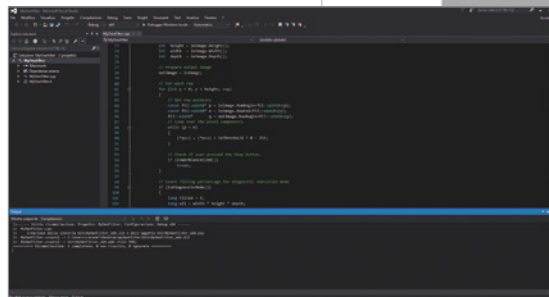
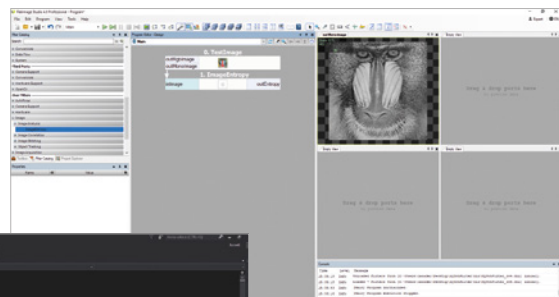
One of the most distinguishing features of FabImage Studio Professional is its applicability for large-scale projects. It has been used to build algorithms composed of hundreds of tools and in systems that required maintenance of many different product versions. Creating such systems is possible due to the feature of modules, hierarchical view of the program structure, version control friendly file format and support for test-driven development.



User Filters

User filters allow C++ programmers to integrate their existing or new code with the benefits of the rapid graphical development. It works with Microsoft Visual C++ (including Express edition).

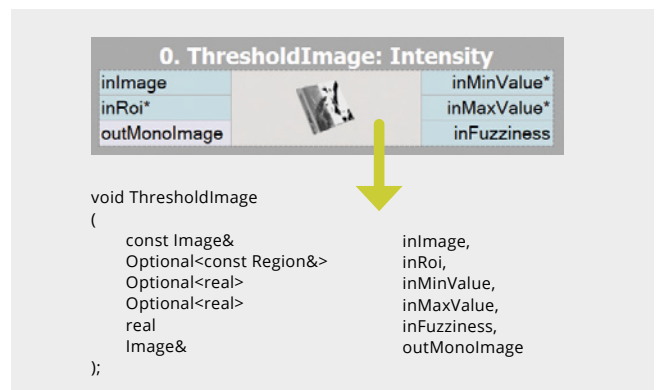
To add a new user filter click **File / Add New Filter** to have a sample C++ filter ready and functional in less than 30 seconds. Then on you can work side by side in both environments and have your filters automatically reloaded each time you build the C++ project



FabImage Library Suite

FabImage Library Suite is a tool for C++ and .NET programmers available as a single DLL file with appropriate headers. The design is simple - for each filter of FabImage Studio Professional there is a corresponding function in FabImage Library Suite with several input and output parameters corresponding to the input and output ports of the filter.

The C++ code or a .NET assembly can also be generated automatically from algorithms created with FabImage Studio Professional. This creates a unique possibility to create a program in a graphical environment and then compile it to a native Windows executable.





OPTO ENGINEERING



EUROPE

Opto Engineering Europe Headquarters

Circonvallazione Sud, 15
46100 Mantova, IT
phone: +39 0376 699111
eu@opto-e.com

Opto Engineering Germany

Marktplatz 3
82031 Grünwald
phone: +49 (0)89 693 9671-0
de@opto-e.com

Opto Engineering Russia

official partner
ViTec Co., Ltd, Fontanka emb., 170,
Saint-Petersburg, 198035, RU
phone: +7 812 5754591
info@vitec.ru

UNITED STATES

Opto Engineering USA

11321 Richmond Ave
Suite M-105, Houston, TX 77082
phone: +1 832 2129391
us@opto-e.com



ASIA

Opto Engineering China

Room 1903-1904, No.885, Renmin RD
Huangpu District 200010
Shanghai, China
phone: +86 21 61356711
cn@opto-e.com

Opto Engineering Taiwan

Opto Engineering Southeast Asia LTD.
4F., No.153, Sec. 2, Shuangshi Rd.,
Banqiao Dist., New Taipei City 22043,
Taiwan (R.O.C)
phone: +886 282522188
tw@opto-e.com

Opto Engineering Japan

official partner
Optart Corporation
4-54-5 Kameido Koto-ku
Tokyo, 136-0071 Japan
phone: +81 3 56285116
jp@opto-e.com

Opto Engineering Korea

official partner
Far Island Corporation Ltd.
Seoil Building #703, 353 Sapyeong-daero,
Seocho-gu, Seoul, Korea 06542
phone: +82 70 767 86098
+82 10 396 86098
kr@opto-e.com