Adaptive **Vision**

Studio 4

intuitive ▪ powerful ▪ adaptable

software for machine vision engineers

Introduction

Adaptive Vision Studio

Adaptive Vision Studio software is the most powerful graphical environment for machine vision engineers. It is based on dataflow 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

Intuitive

Drag and drop

All programming is done by choosing filters and connecting them with each other. You can focus all your attention on computer vision.

You can see everything

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

HMI designer

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

Powerful

1000 effective filters

There are over 1000 ready-for-use machine vision filters tested and improved in hundreds of applications. They have many advanced capabilities such as outlier suppression, subpixel precision or any-shape region-of-interest.

Hardware acceleration

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

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.

Adaptable

GigE vision and GenTL

Adaptive Vision Studio is a GigE Vision compliant product, supports the GenTL interface, as well as a number of vendor-specific APIs. Thus, you can use it with most cameras available on the market.

User filters

You can use user filters to integrate your own C/C++ code with the benefits of visual programming. It takes 30 seconds to build first user filter and 5 seconds to update one after recompilation.
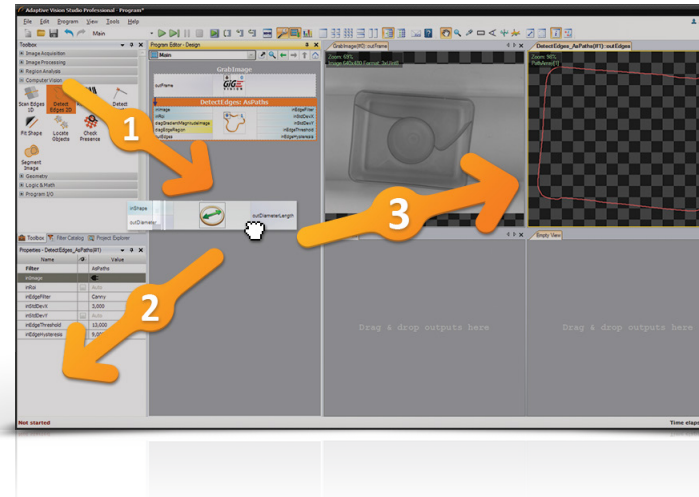
C++ and .NET generators

Programs created in Studio can be exported to C++ code or to .NET assemblies. This makes it very easy to integrate your vision algorithms with applications created in C++, C# or VB programming languages.

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 Adaptive Vision Studio is that you can develop this competence quickly through intuitive experimentation.
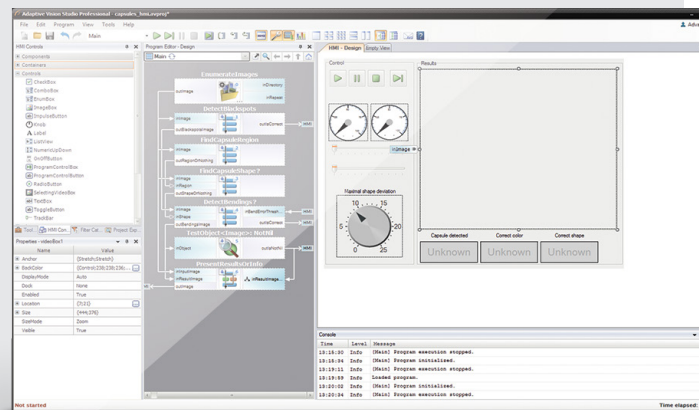

Create a custom HMI ②

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.

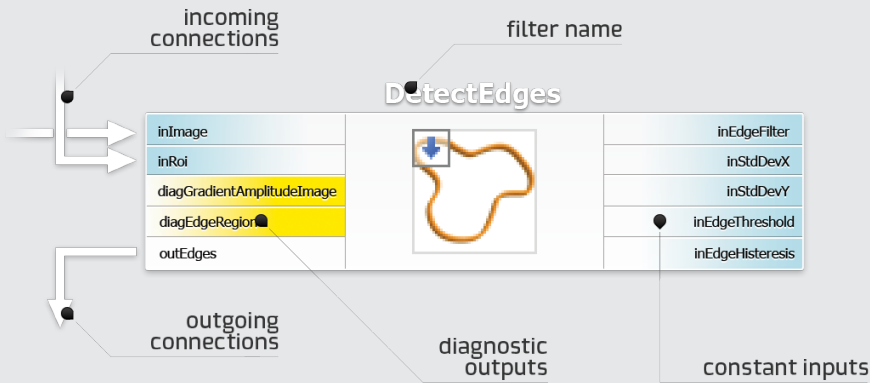Note that you can also easily integrate your algorithm with an HMI created in C++ or C#.

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.

Data Flow Programming

Introduction

Adaptive Vision Studio 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 and you have to understand its 4 core concepts: Data, Filters, Connections and Macrofilters.
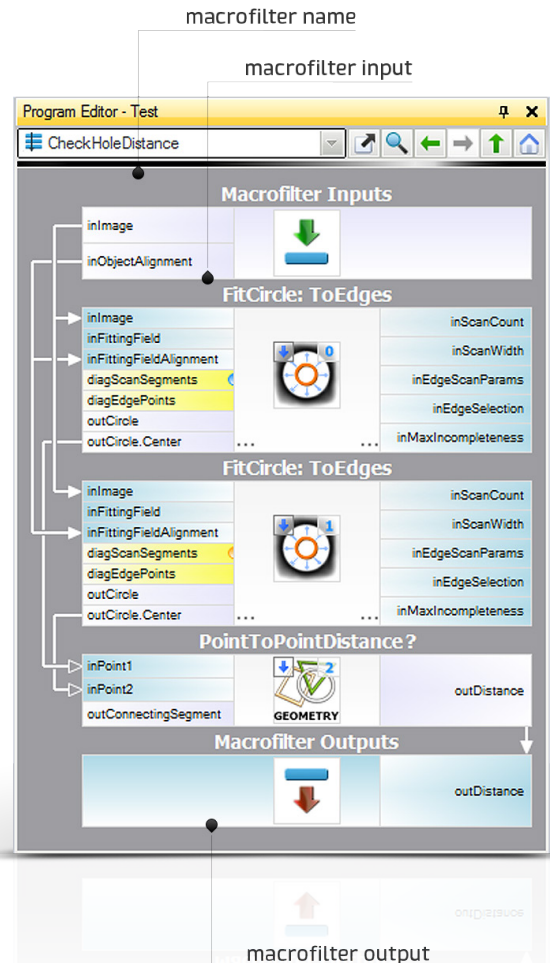
Data & Filters

Filters are the basic data processing elements in the data flow driven programming. In a typical machine vision application input images are tranformed by a sequence of filters into regions, contours, geometrical primitives and then into final results such as a pass/fail indication. Adaptive Vision Studio 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* ➡, *automatic conversions* ➡, *for-each processing* ➡ and *conditional processing* ➡. The connection types are inferred automatically on the *do what I mean* basis.

More information can be found on our web page and in the user manual.

Macrofilters

Macrofilters provide a means for building 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.

Tutorial

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

1 An 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:
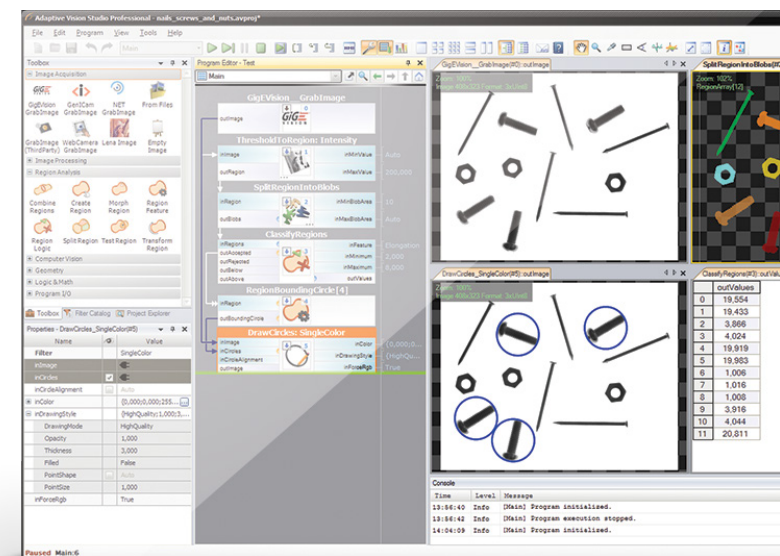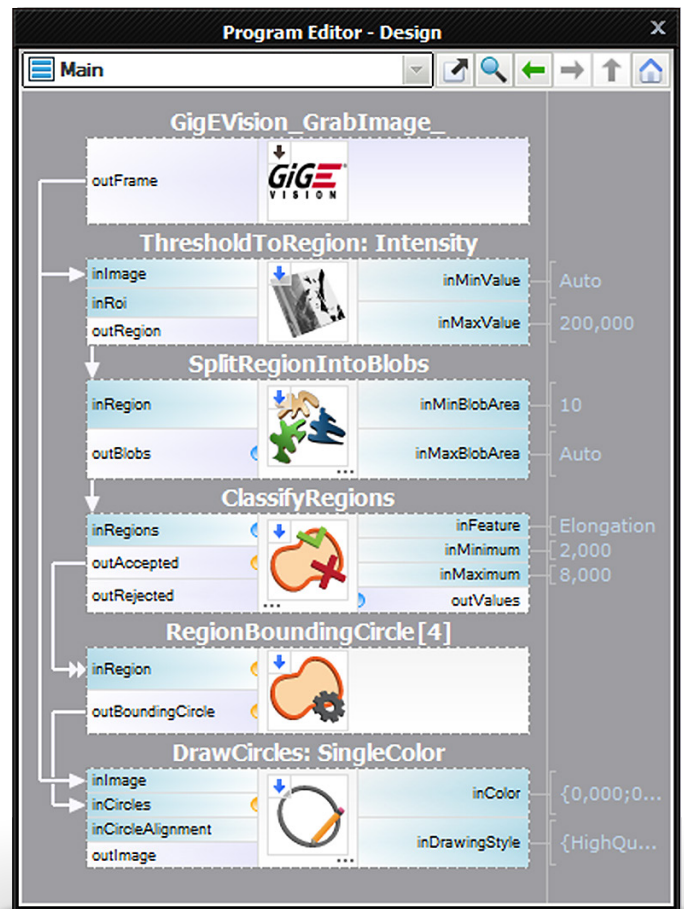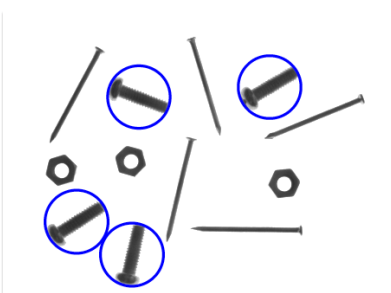

3 ClassifyRegions filter analyzes the *elongation* feature of each component:

{ 19.554, 19.433, 3.866, ...}

4 ...and splits the array of regions into arrays of accepted and rejected elements accordingly to the specified range:

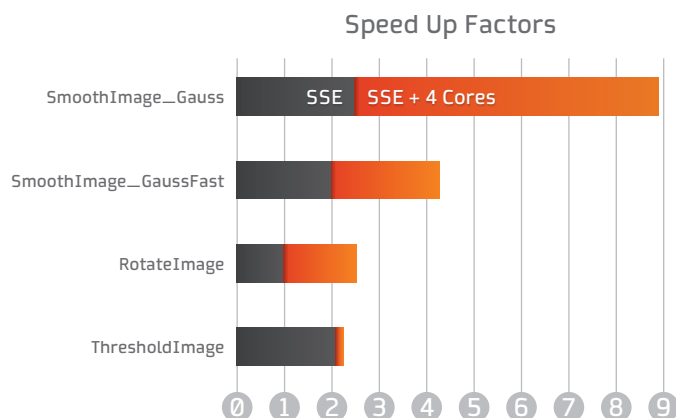**5** Finally the bounding circles of the accepted objects are drawn:

Adaptive Vision 4 | Data Flow Programming

Capabilities

Filters

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

- Image Processing
- Blob Analysis
- Contour Analysis
- Planar Geometry
- Shape Fitting

- Camera Calibration
- Fourier Analysis
- Hough Transform
- Barcode Reading
- Data Code Reading

- Corner Detection
- 1D Profile Analysis
- 1D Measurements
- 2D Measurements
- Gray Template Matching

- Edge Template Matching
- Histogram Analysis
- OCR
- Machine Learning
- GigE Vision and GenTL

Performance

The filters of Adaptive Vision Studio are highly optimized for modern multicore processors with SSE2 technology. Speed-up factors that can be achieved are however 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.
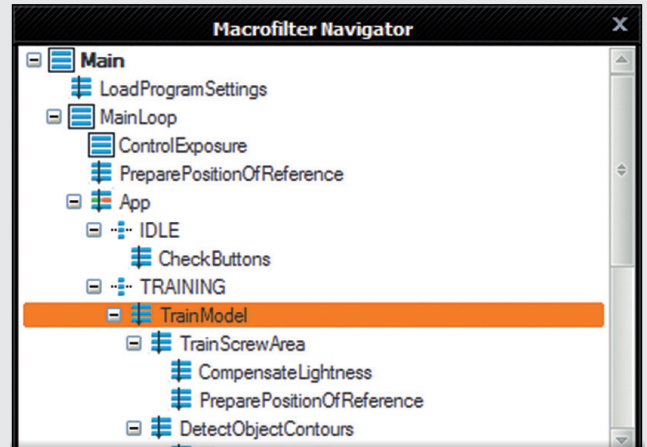
FILTER	AVS 4	ANOTHER PRODUCT	OPEN LIBRARY
Image negation	0.055 ms	0.103 ms	0.055 ms
Image difference	0.050 ms	0.125 ms	0.055 ms
Rgb to Hsv conversion	0.632 ms	1.243 ms	0.586 ms
Gauss filter 3x3	0.063 ms	0.290 ms	0.439 ms
Gauss filter 5x5	0.071 ms	0.323 ms	0.661 ms
Gauss filter 21x21	0.559 ms	1.815 ms	3.132 ms
Image erosion 3x3	0.055 ms	0.127 ms	0.156 ms
Image erosion 5x5	0.059 ms	0.128 ms	0.209 ms
Threshold to region	0.061 ms	0.032 ms	
Bilinear image resize	0.205 ms	0.272 ms	0.114 ms
Splitting region into blobs	0.039 ms	0.082 ms	

Speed Up Factors

	SSE	SSE + 4 Cores
SmoothImage_Gauss		
SmoothImage_GaussFast		
RotateImage		
ThresholdImage		

0 1 2 3 4 5 6 7 8 9

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.

More than Visual Programming
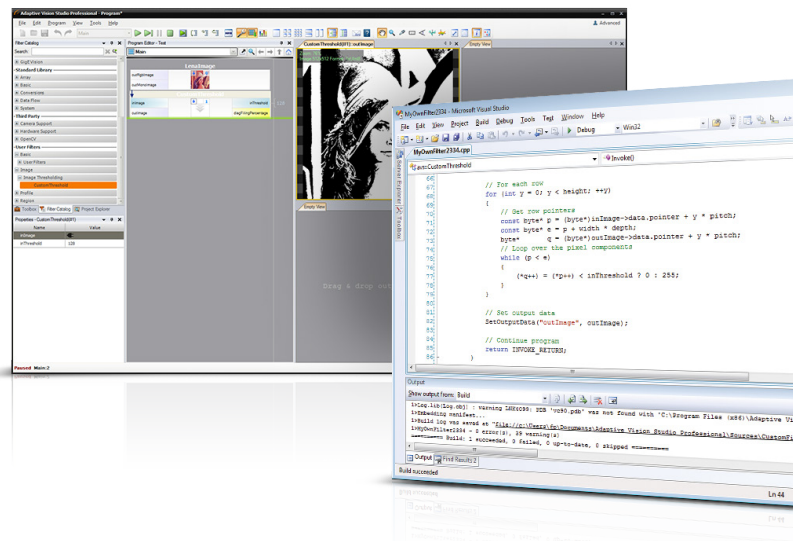
Large-Scale Projects

One of the most distinguishing features of Adaptive Vision Studio 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 enviroments and have your filters automatically reloaded each time you build the C++ project.

Adaptive Vision Library

Adaptive Vision Library 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 Adaptive Vision Studio there is a corresponding function in Adaptive Vision Library 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 Adaptive Vision Studio. This creates a unique possibility to create a program in a graphical environment and then compile it to a native Windows executable.


```
void ThresholdImage
(
    const Image&            inImage,
    Optional<const Region&> inRoi,
    Optional<real>          inMinValue,
    Optional<real>          inMaxValue,
    real                    inFuzziness,
    Image&                  outMonoImage
);
```

About Adaptive Vision

Adaptive Vision is a reliable supplier of high quality machine vision software and libraries.

Our team has been concentrating on creating computer vision software designed for specific applications for the last 16 years. Initially, we have built our expertise in projects related to intelligent video surveillance, biometric systems and medical imaging, which were delivered under individual contracts with companies from the UK. In 2007 we have moved our focus to industrial vision systems and today we deliver standard software products for this market.

Looking for Developers?

We also operate as a team of programmers supporting machine builders and system integrators in developing bespoke machine vision algorithms and solutions. Moreover, as a part of Future Processing Sp. z o. o., one of the leading European software outsourcing companies, we can also offer you highly scalable services in general software engineering.

Design by:

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