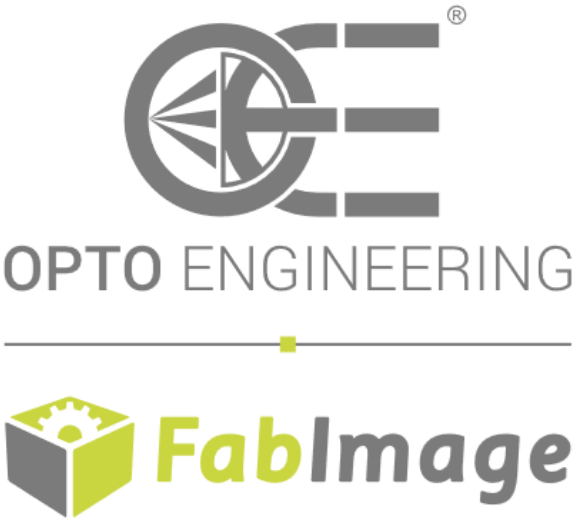


FabImage Studio

Review of Example Applications

ABOUT

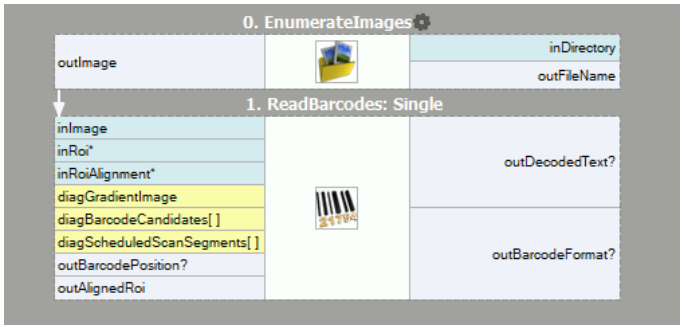
This document illustrates the capabilities of FabImage Studio 4.10 with short examples of basic, intermediate and advanced applications.

LEVEL-1 APPLICATIONS: BASICS

Although FabImage Studio can be used to create highly sophisticated machine vision applications, there have been hundreds of projects where only three or four tools proved effective enough. This section demonstrates application examples which can be implemented instantly in the graphical environment.

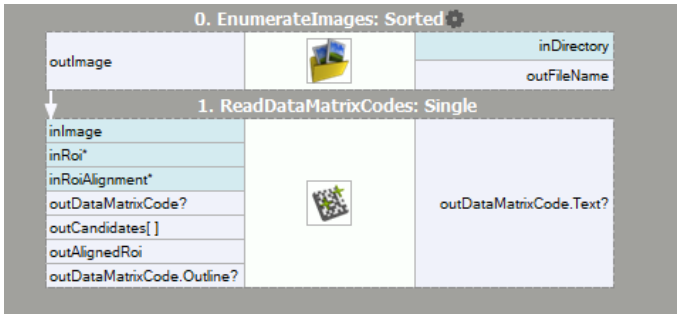
Reading barcodes

To create a barcode reader you need an image acquisition filter or beforehand prepared images and a barcode reading ready-made tool.



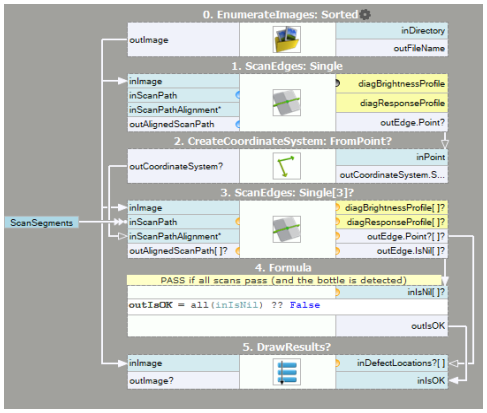
Reading Data Matrix codes

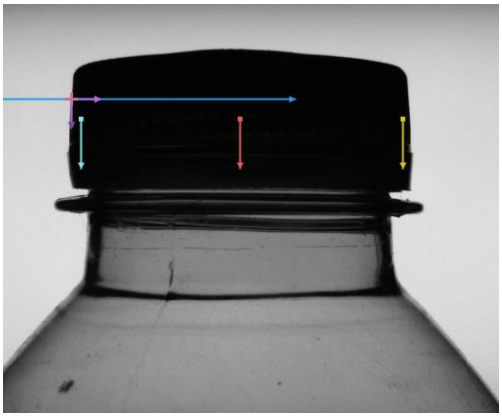
Reading Data Matrix codes is just as simple. Here we read the image in which the Data Matrix code is very small and still it is correctly located and decoded.



Detecting a bottle with 1D Edge Detection

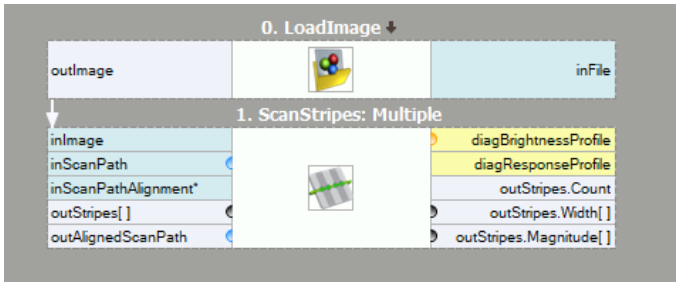
1D Edge Detection is a set of ready-made tools which are simple yet very effective. Here, we detect the object displacement by looking for its first edge. The coordinate system, which is created, can be used to adjust further inspections to the bottle position.





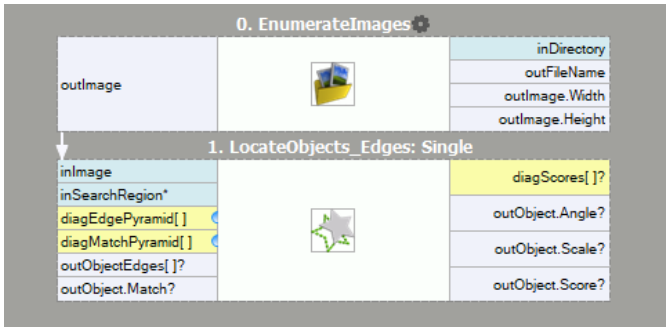
Counting objects with 1D Edge Detection

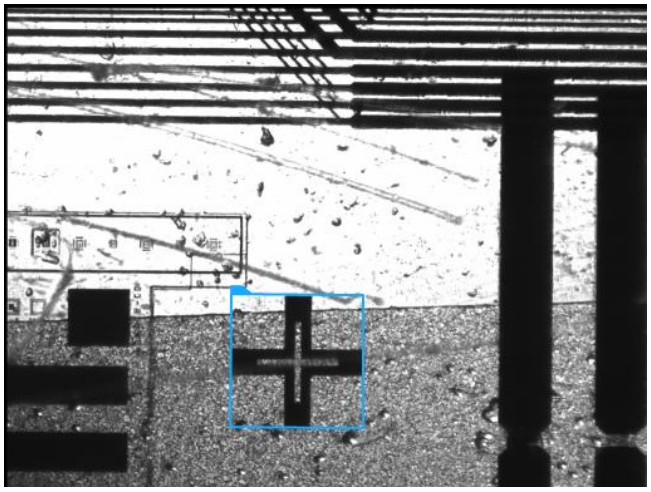
1D Edge Detection can also be used for object counting as in this example. We are looking for multiple stripes, i.e. pairs of opposite edges. The *Count* property output contains the number of objects.



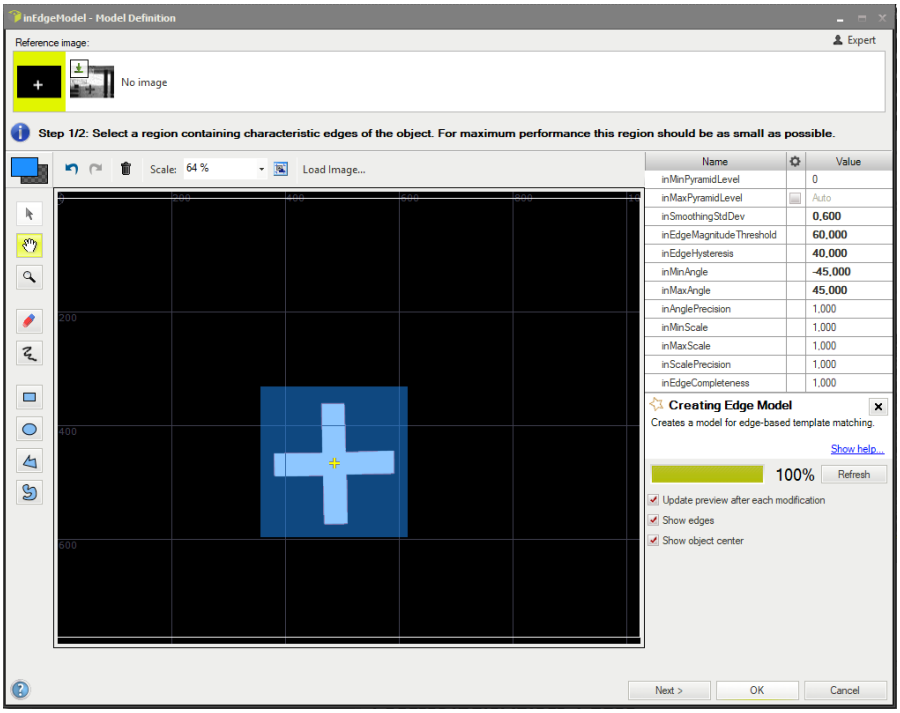
Locating a fiducial marker

Edge-based Template Matching filters can be used to locate objects regardless of variable rotations, scaling, uneven illumination or even with arbitrary background clutter. Here, we are looking for fiducial markers that guide robot assembly of a PCB board.



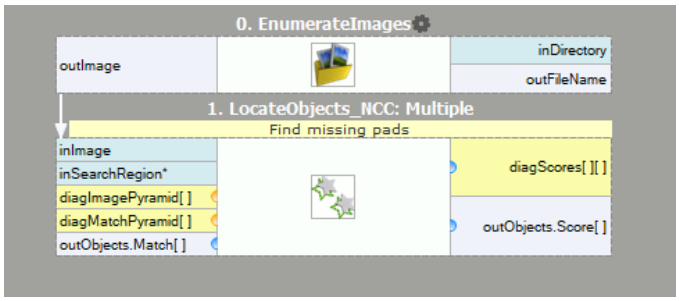


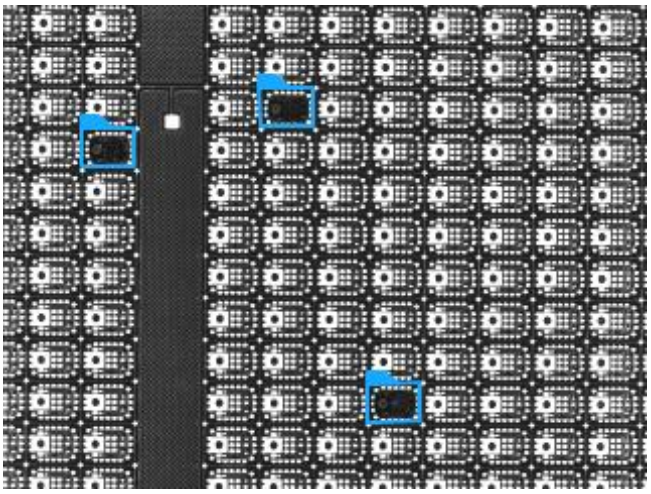
The object model is created with an intuitive user interface, where you mark the expected objects and its characteristic edges.



Detecting missing elements

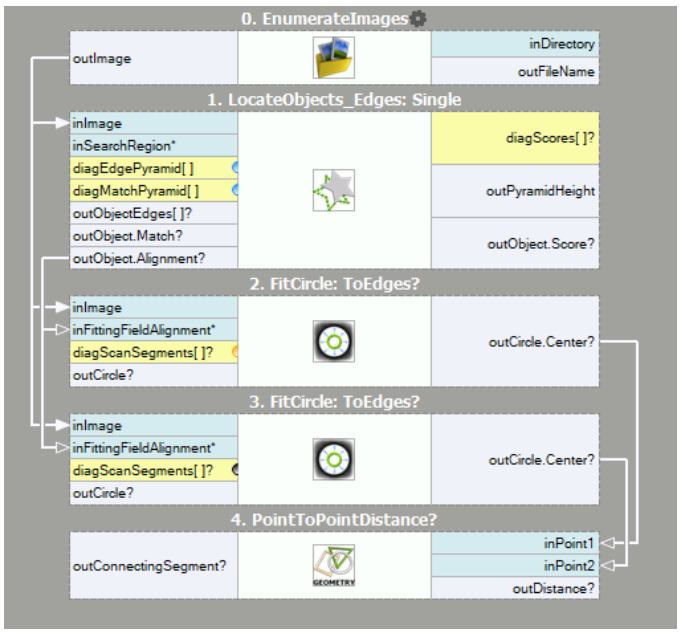
Template Matching, here the one based on Normalized Cross Correlation (the classical method, grey-based), can also be used to verify object presence.

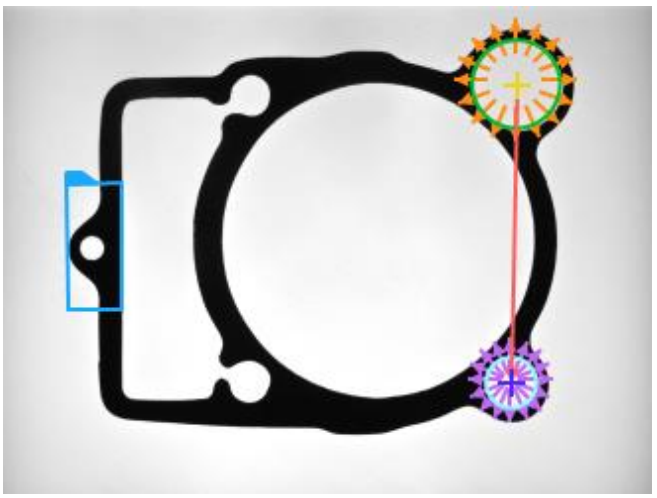




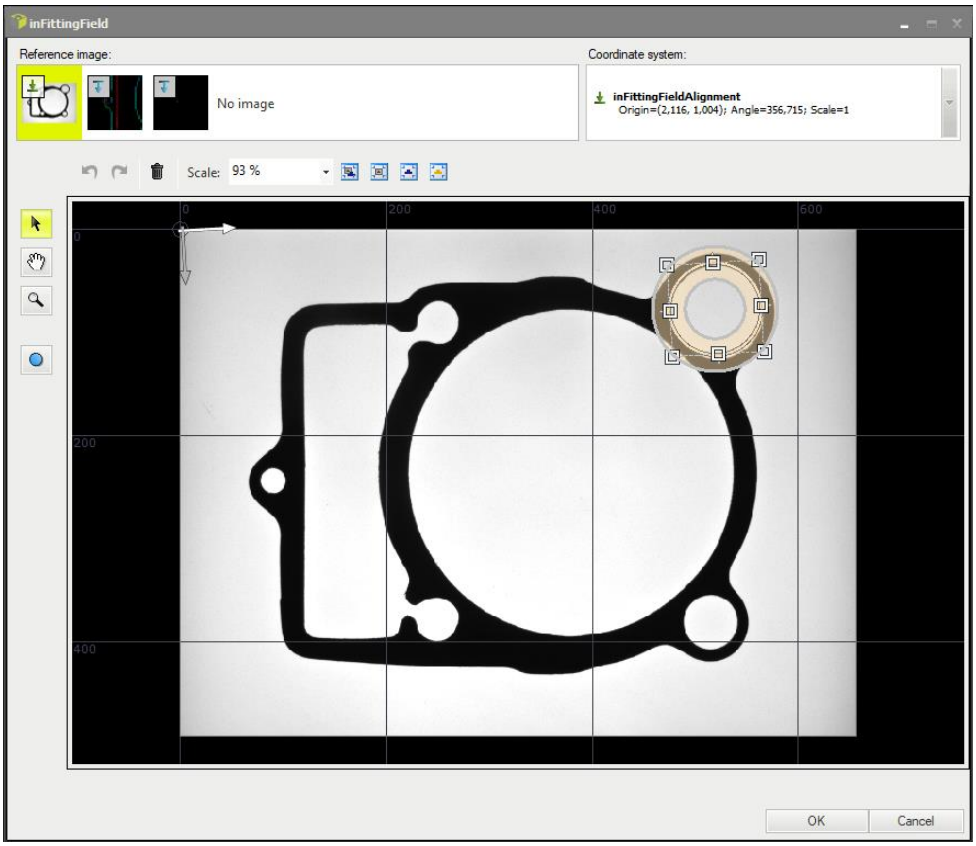
Measuring distance between two holes

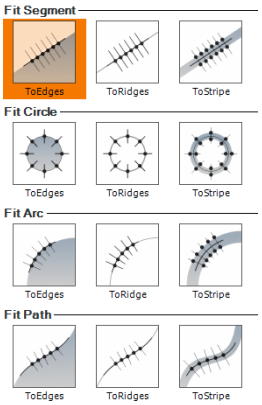
Measurement applications most often consist of, as in this example, a Template Matching filter followed by shape fitting and geometrical tools. Object alignment is linked between the filters so that measurements are adjusted to the position of the object.





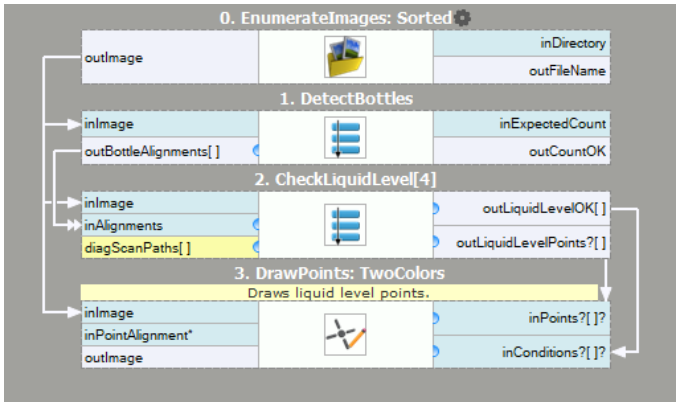
Again, there are graphical editors for all shape fitting models.

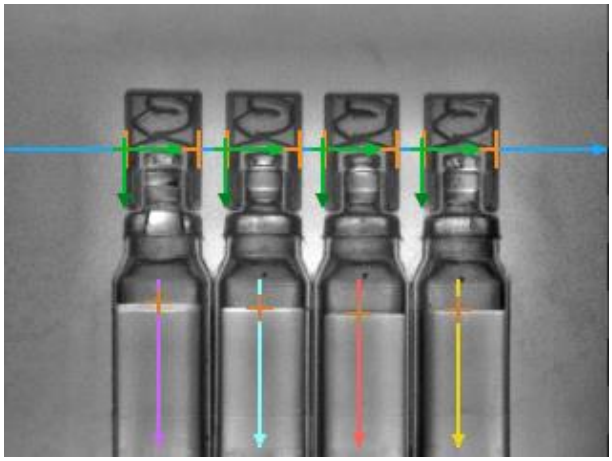




Measuring multiple objects

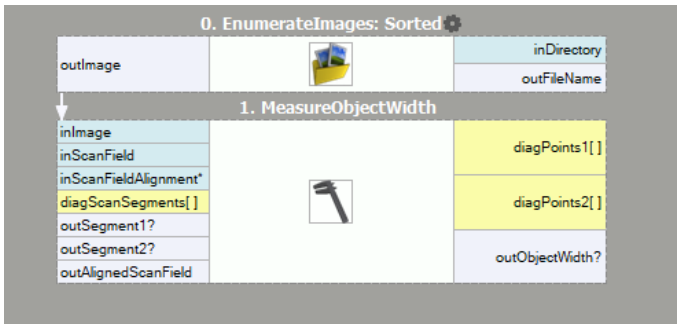
Performing a series of measurements on multiple objects is also not a problem. We can detect multiple bottles, e.g. with 1D Edge Detection, and create a series of coordinate systems accordingly. Then we define the measurement once and it works with all the objects automatically. Here, we measure the liquid level of each bottle.

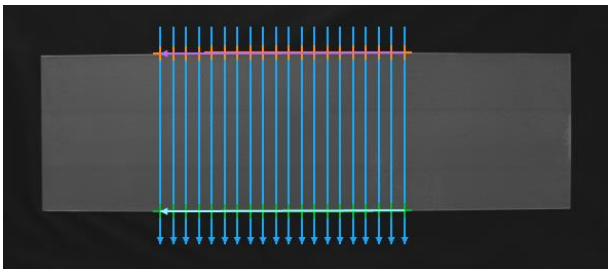




Verifying width of a metal sheet

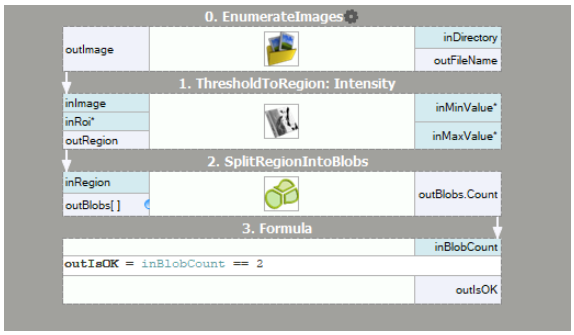
One of the most typical measurement tasks considers the distance between two opposite edges. This can be done with a single filter optimized for maximum sub-pixel precision.

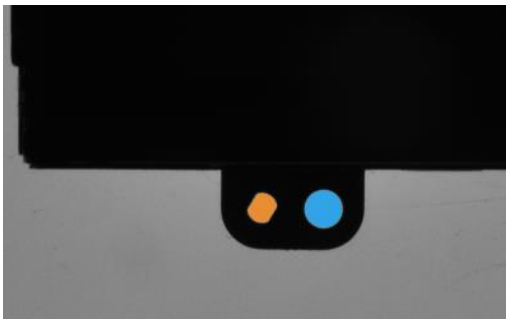




Checking if there are exactly two holes

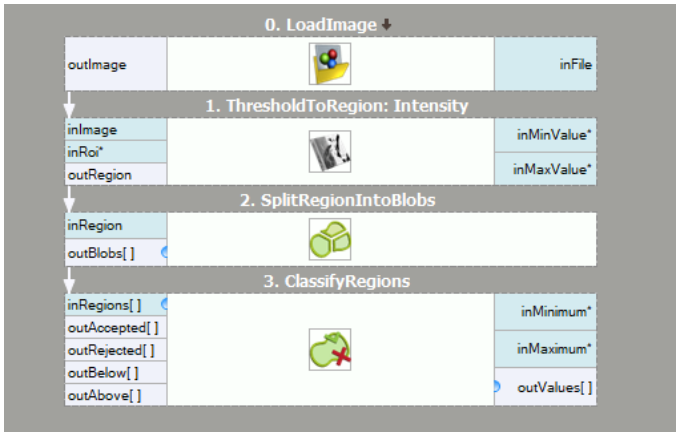
The most simple blob analysis application requires just two filters – one for separating bright or dark region from the background, the second for splitting it into individual objects. A formula is used to verify the quantity.





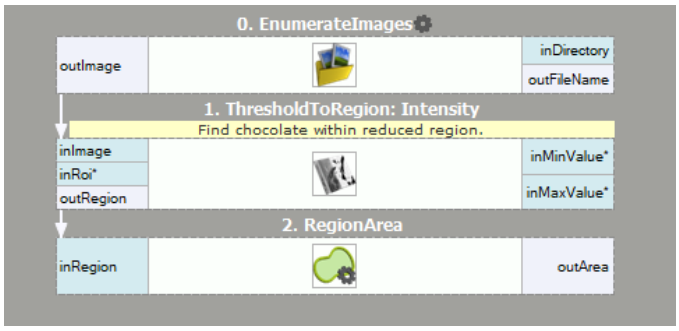
Counting objects of particular type

When there are several types of objects and we are interested in only one of them, we classify the objects using appropriate region features. Here, the orange objects are selected with the classifying filter.



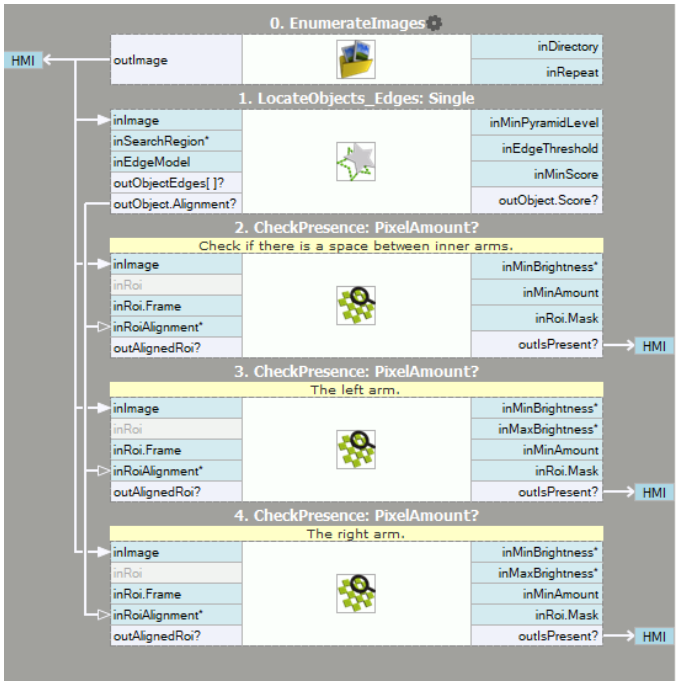
Measuring region area

Another possible application of region analysis techniques is measuring the area of a region. Here, we measure the chocolate coverage of a wafer.



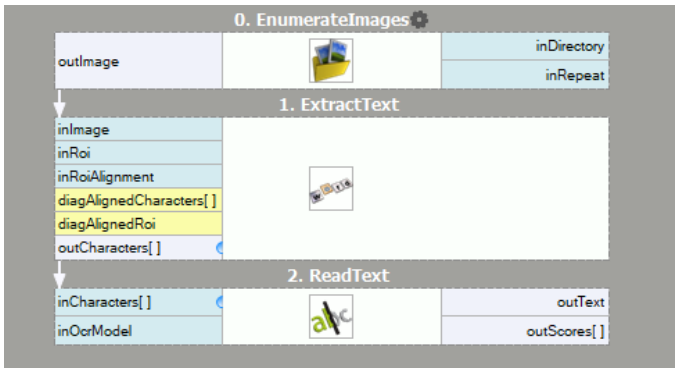
Checking presence of object parts

There is a ready-made tool for quick presence verification. It offers three methods that cover all typical applications: (1) by the average pixel intensity or contrast, (2) by the amount of pixels fulfilling some criteria or (3) by the amount of edges.



Reading text from LCD display

Optical character recognition requires exactly two steps: one for character extraction, another for recognition. Ready-made tools are available with appropriate graphical editors, also for interactive training of a custom font model.



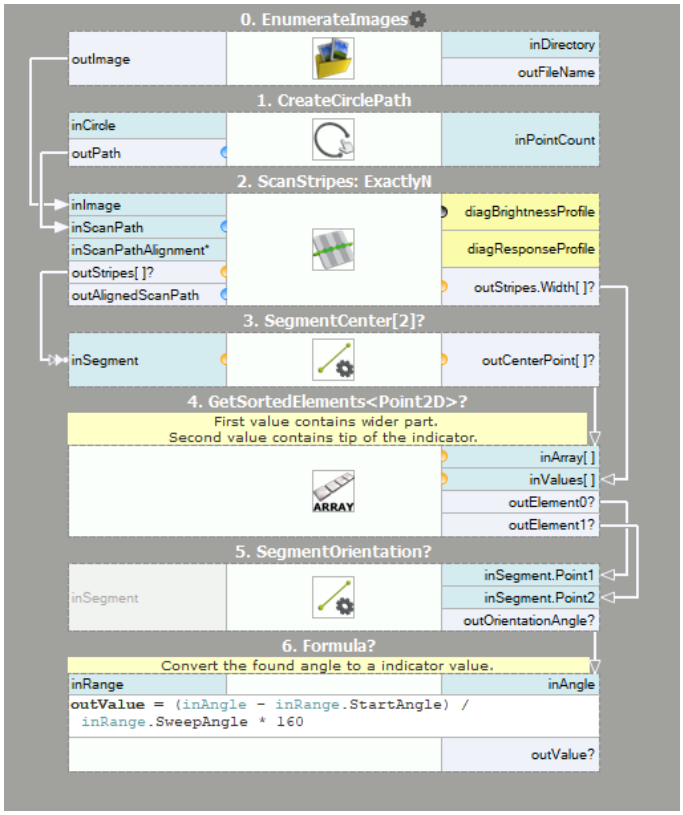
For character training there is an intuitive graphical editor where the user investigates the extracted character regions and specifies the actual character values.

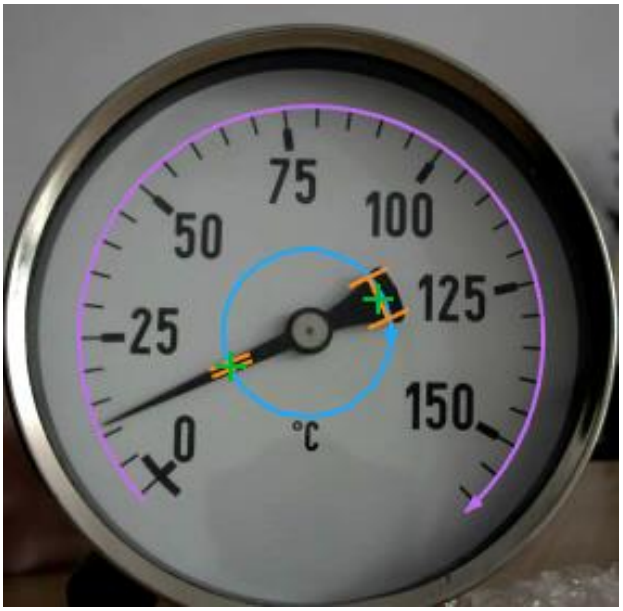
LEVEL-2 APPLICATIONS: INTERMEDIATE

Ready-made tools are intended to be used instantly and realize a single complete step of the application. Very often, however, machine vision engineers are challenged with project-specific tasks, which require more conscious use of carefully selected filters. In this section we present application examples where, besides the ready-made tools, some pre- or post-processing filters are used to achieve the required results.

Reading indication of a gauge

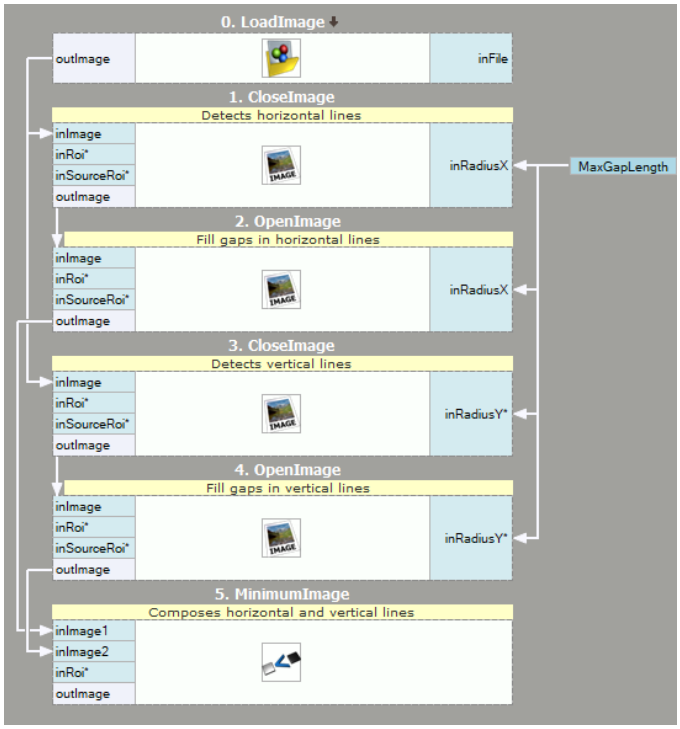
In this gauge reading application the 1D Edge Detection tools have to be complemented with geometrical and mathematical filters to translate the detected edges into proper numerical value.

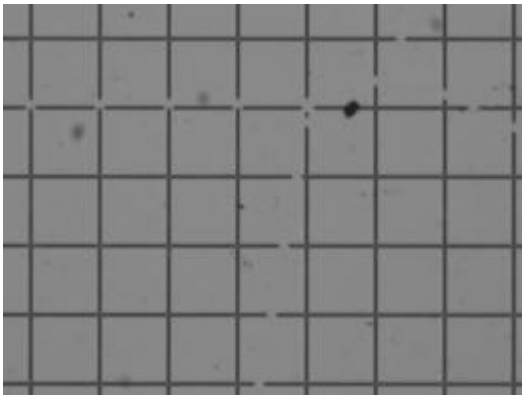


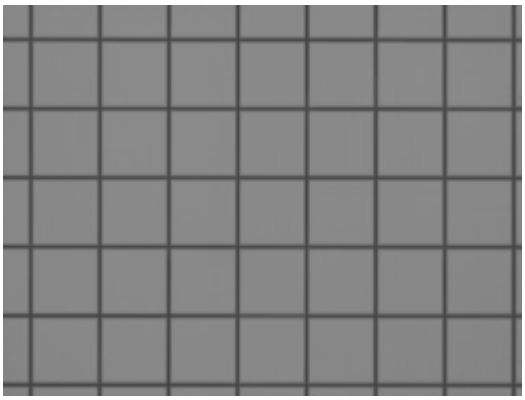


Background reconstruction

Image processing operators can be used to reconstruct the ideal background image. In the below example the task is to inspect a regular mesh. We use carefully crafted morphological operators to reconstruct the perfect mesh. This makes it possible to analyze defect types in the further part of the program.

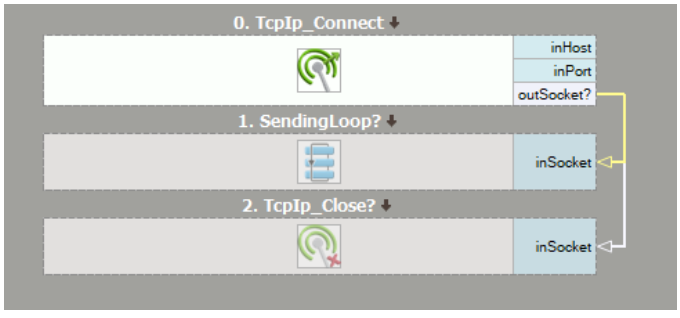


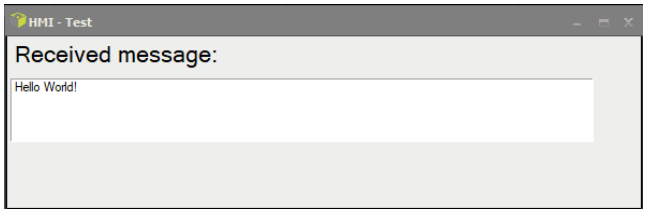




Receiving data through TCP/IP

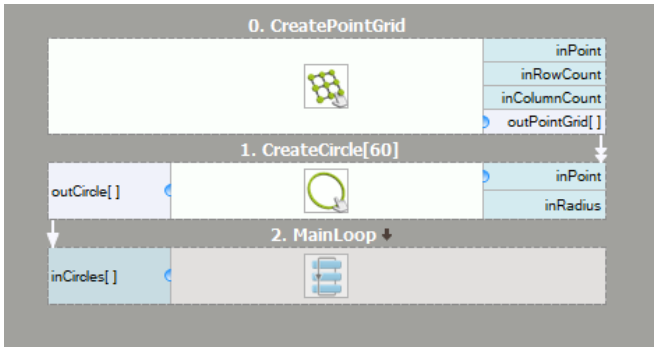
With TCP/IP communication it is possible to send or receive data from other computer in the local network or from another process on the same computer (localhost). Below we present a simple scenario where we receive a single text message and display it in the HMI.

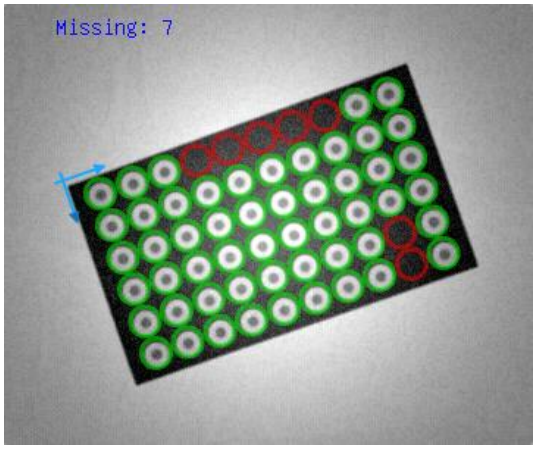




Checking presence in a grid

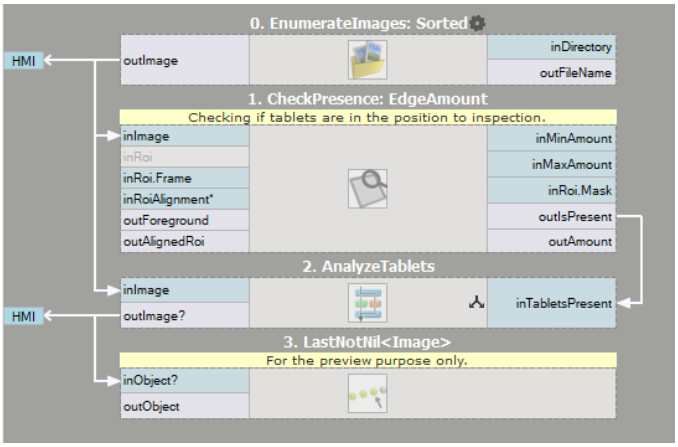
In case of a regular grid in which presence of an object has to be verified for each cell, we can use additional filters for preparing the grid of reference circular regions-of-interest. The main part of the program has been included in one macrofilter “MainLoop” where all necessary calculations are performed.

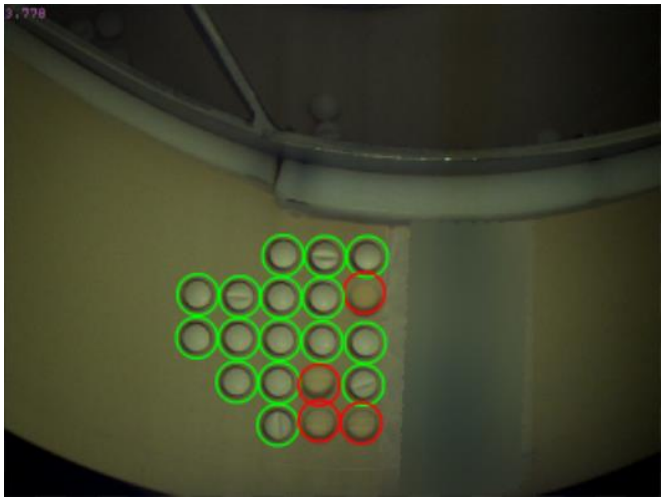




Checking presence of tablets

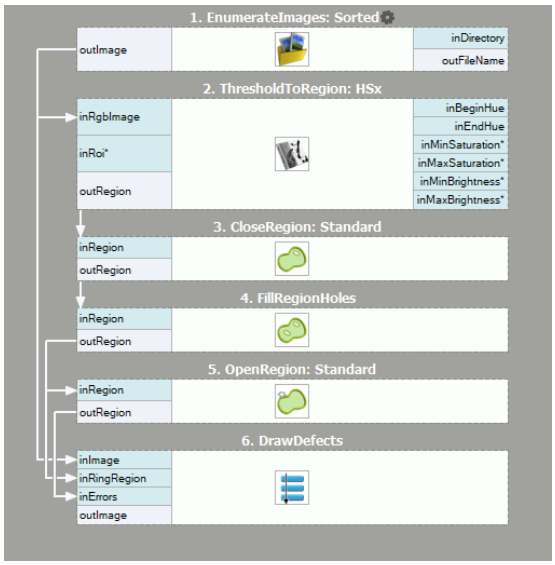
When we need to verify object presence, but the expected object locations are variable, we can use a combination of object location and presence checking tools. In the below example we detect slots where tablets are expected and in the second step we verify if each slot is filled. We resize the detected circles to improve readability in the HMI.





Verification of rubber assembly

A sequence of three simple morphological operators can be used to precisely find the region of incorrectly assembled part – here on an example of protective rubber around an electronic device.



LEVEL-3 APPLICATIONS: ADVANCED

Advanced applications require the user to devise a custom algorithm by connecting low-level filters and/or ready-made tools in a non-standard way. The most important feature of the software in this context is its comprehensive range of primitive and auxiliary operators that allow for arbitrary data transformations.

Statistical analysis of particles

In some applications, due to partial visibility, it is not possible to accurately measure each individual object. We can, however, perform statistical analysis with non-standard use of ready-made tools. Here, we detect fertilizer particles and check if they are not too small or too large.