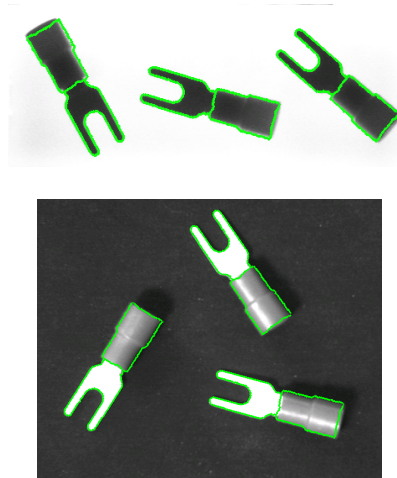
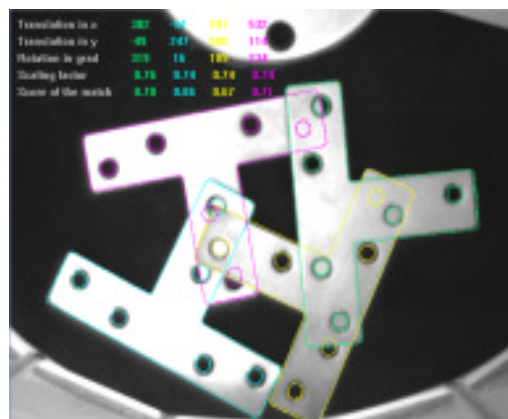


Searching for objects of a known shape is an essential task in machine vision. Be it for robot guidance, assembly inspection or part sorting, looking for one or several occurrences of a pattern is very often required.

In industrial situations, the visual appearance of objects changes over the processing stages or together with the viewing conditions. For instance, after annealing in an oven, colors and contrast can change and get inverted. And moving the camera can result in an object of a different size and orientation. Loose items can be randomly placed and can even overlay.



Varying aspect due to illumination and viewing effects



Parts in bulk

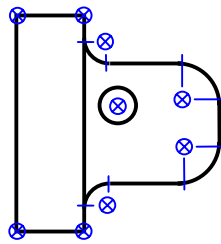
To correctly deal with such large and irregular variations, one must rely on the shape of objects rather than on the local gray-level intensity. For this reason, an imaging-independent method known as geometric model matching is preferred to normalized gray-level correlation.

Main features

Underlying technology

Traditional pattern matchers work by gray-level comparisons on the whole object area. Geometric pattern matchers mainly detect edge pixels and describe the outlines.

The geometric model matcher goes one step further: it thoroughly analyzes the shape of the objects to extract reliable salient points. It can be shown that the more compact and robust representation is made of so called "curvature centers", i.e. location of sharp corners or smooth bends.



Curvature centers

Training

Model building is automatically achieved from a sample image. After the edges are detected and fitted with sub-pixel accuracy, a built-in process turns the shape of the object into a list of its curvature centers.

In specific cases such as with areas of varying contents, the model can be edited to remove unnecessary or unreliable salient points.

Searching

The search engine is able to recognize an arbitrary number of object instances. The search is totally insensitive to contrast, by design. The rotation and scale ranges can be freely set.

After matching, a conformity score is returned that quantifies the resemblance between the model and every instance found.

Accuracy, robustness and speed

The geometric model matcher is a state-of-the-art location tool that is both fast and accurate thanks to the compactness of the representation. It is fully rotation and scale invariant, allowing to find objects regardless their pose and viewing distance.

It is insensitive to nonlinear contrast changes and can work independently of the lighting and surface conditions. It tolerates blur, clutter and even part overlap. This means that it remains usable in the hardest cases and most complex environments.