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Surface Segmentation

Purpose

The Segmentation tool separates surface data into "segments," based on the tool's parameters. Segments can be touching and overlapping to a certain degree. The Segmentation tool is especially useful in the food industry, for example to identify food items that are too small or too big, or items that are damaged.

For each segment, the tool returns the X and Y position of its center, its length and width, and its area, as well as several more global measurements, such as maximum / minimum width or length, etc. For a complete list, see below.
The Segmentation tool can also be used as a second stage of processing after part detection. For example, part detection could be used to detect a tray (containing parts), and the Segmentation tool could then separate the parts within the tray. For information on part detection, see Part Detection Tool Manual. ~~For a comparison of part detection, Surface Blob, and Surface Segmentation, see Isolating Parts from Surface Data.~~

This manual is a version of Gocator User Manual reference for Surface Segmentation Tool and over the long term should stay in sync with the released manual.

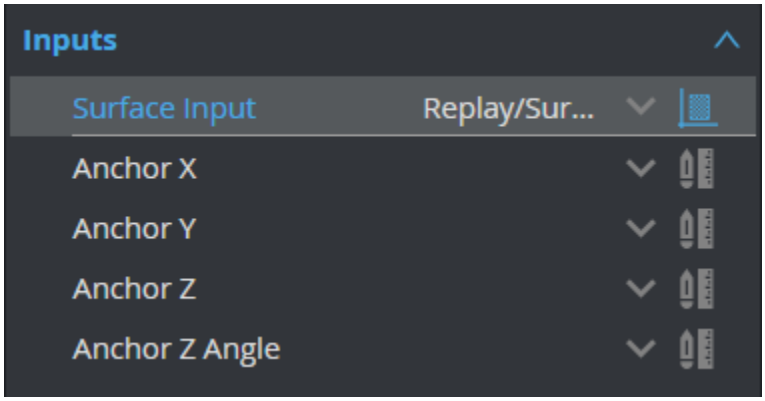
Note The Segmentation tool cannot handle large overlaps.

Note The Segmentation tool does not perform template matching.

Note To reduce processing time, consider using the decimation filter. For more information on this filter, see the Surface Filter Tool Manual

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Inputs



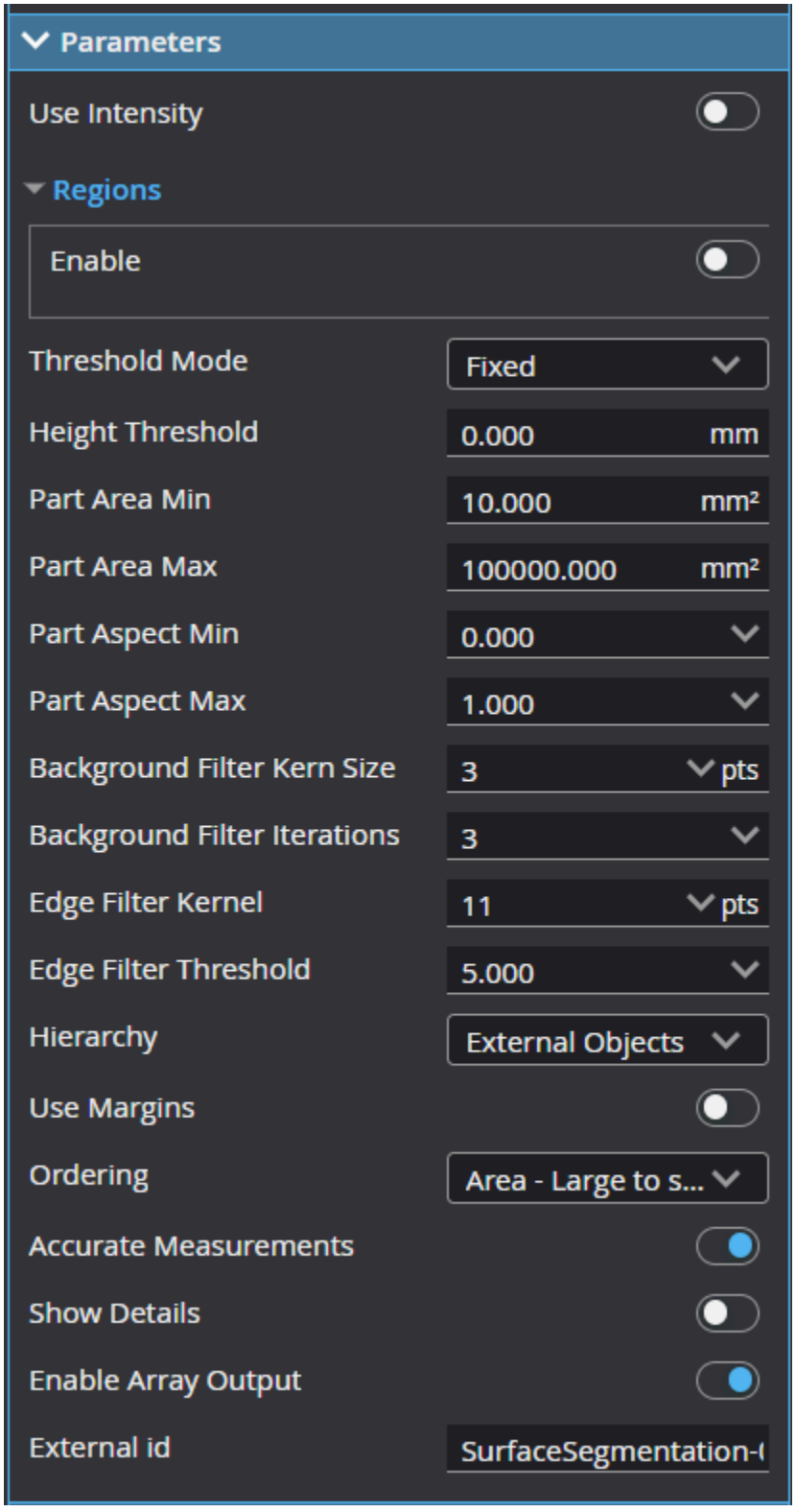
Name	Description
Surface Input	The surface data (uniform) that the tool will apply measurements to.
Anchor X Anchor Y Anchor Z Anchor Z Angle	Lets you choose the X, Y, Z, or Z Angle measurement of another tool to use as a positional and rotational anchor for this tool.

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Parameters

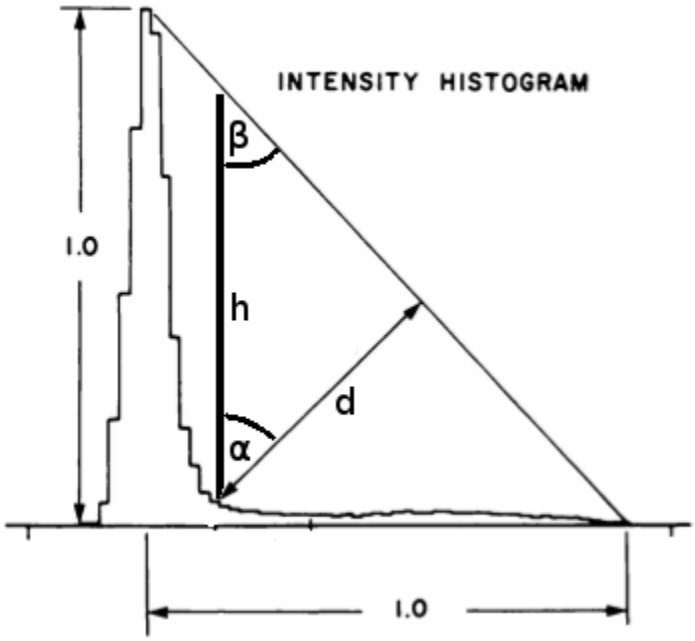
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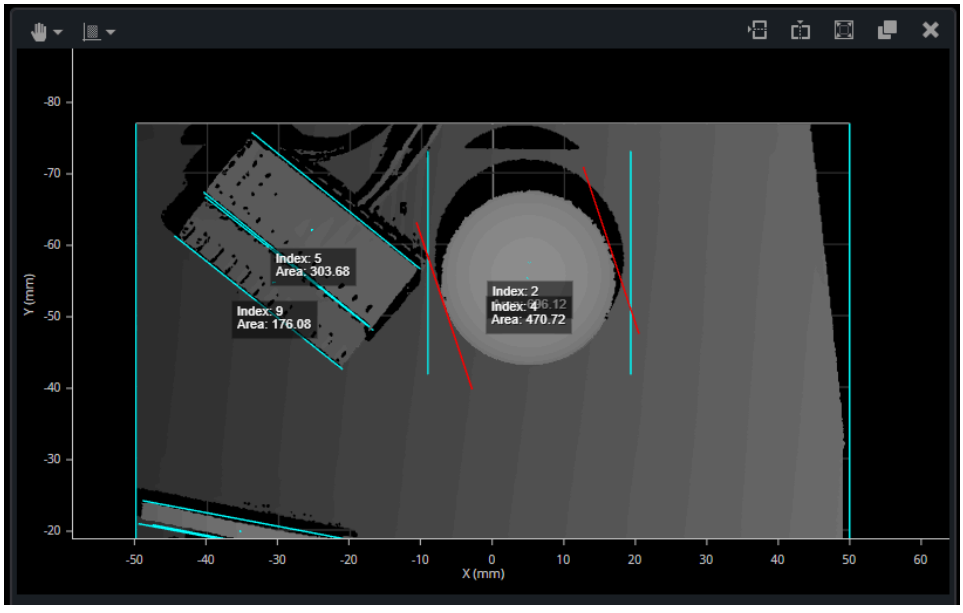
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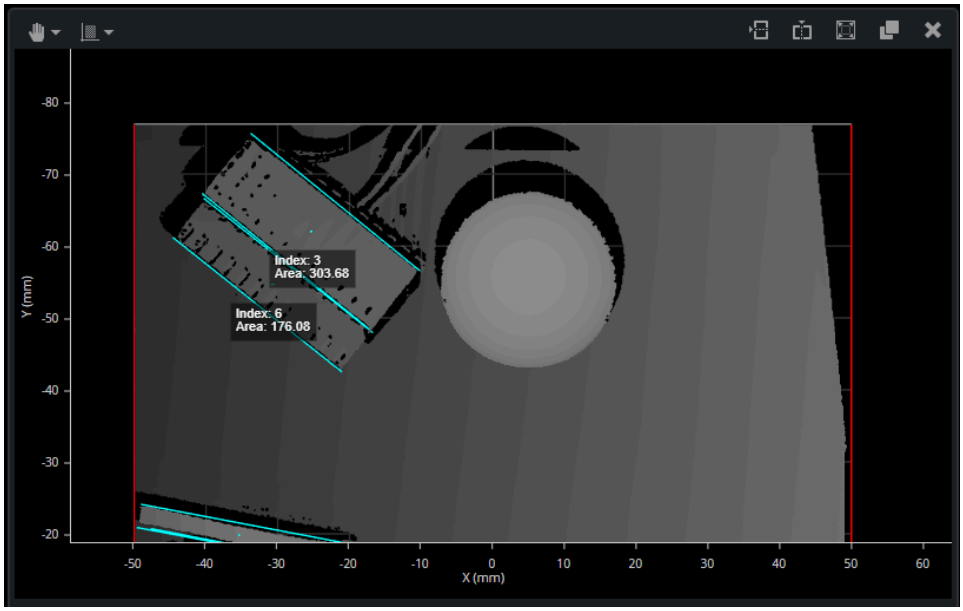


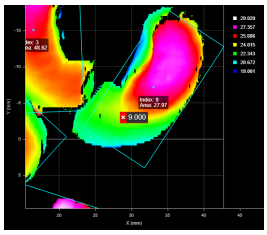
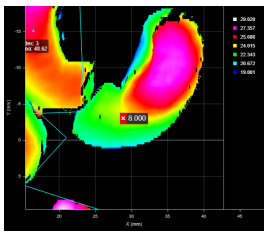
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Name	Description
Use Intensity	Causes the tool to use intensity.
Region	A set of flexible regions (will link to an explanation of flexible regions)
	Otsu: Determines the threshold that maximizes the between-class variance. Best for images with histograms with 2 distinct peaks. **Triangle**: Determines the threshold based on the maximum distance to the histogram from the triangle generated from the peak histogram bin to the farthest smallest bin (see next figure).  **Fixed**: Uses the Height Threshold value to threshold the surface/intensity.
Height Threshold	The high and low threshold for intensity pixels to be considered part of a segment. Values are between 0 and 255.
Part Area Min / Max	The minimum and maximum areas in square millimeters for a part of the scan data to be identified as a segment.
Part Aspect Min / Max	The minimum and maximum aspect ratios (minimum axis length in mm) / (maximum axis length in mm) of the best fit ellipse to the segment

	contour points for a segment to qualify to be added to the list of found segments.
Background Filter Kern Size Background Filter Iterations	These settings perform background separation. The greater each of these values is, the more separation will be achieved. You must find a balance that removes noise adequately without degrading the segment find quality.
Part Edge Filter Kern Size	Use this value to adjust the “granularity” of the part edge detection.
Part Edge Filter Threshold	Controls the separation of the parts, increasing the gap between the parts so that they can be detected more easily.
Hierarchy	Use this setting to detect segments when they are surrounded by background data. Choose one of the following: **All Objects**, **External Objects, Holes orAll Contours**. **All Objects** This option lets you segment parts with surrounding background data. For example, in the following image, with **All Objects** selected, the sphere is correctly segmented from the surrounding background. 

	Note that this option may result in "over-segmentation": the tool may segment a part into two segments. **External Objects** In the following image, with **External Objects**, the sphere is not identified as a segment because of the surrounding background. It is treated as part of a large segment that includes all of the background.  Holes: Use this option to get holes inside objects. All Contours: Use this option to get all detected contours.
Use Margins	When enabled, discards parts that are too close to the edge of the scanning area or the region, based on the left, right, top, and bottom values. The tool filters the parts using the center point. In the following, a part's center point is close to the edge of the XY scan area; the right margin is set to 0, so the part is not discarded. (Total part count is 9.)

	 In the following, the right margin has been set to 10 mm. Because the center point of the part is now within the margin, the tool discards the part. (Total part count is reduced to 8.) 
Ordering	Orders the measurements, features, and surface data of the individual parts output by the tool. Choose one of the following: ● Area - Large to small ● Area - Small to large ● Position - X increasing ● Position - X decreasing ● Position - Y increasing ● Position - Y decreasing ● Position - Z increasing ● Position - Z decreasing
Show Details	Toggles whether the tool displays the index and area of each individual part.
Enable Array Output	If checked, the blob outputs will show as arrays.
Number of Part Outputs	Determines the number of parts the tool outputs as measurements, features (center points of parts), and surface data. Currently limited to 200 parts.

Outputs

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Type	Name	Description
Measurement	Count	Returns the total number of segments identified, based on the tool's parameters.
Measurement	Min Dimension Max Dimension	The minimum and maximum dimensions among all of the identified segments.
Measurement	Mean Width Mean Length	The mean width and length of the segments, respectively.
Measurement	Min Area Max Area	The minimum and maximum area among all of the identified segments.
Measurement	Sum Area	The sum of the areas of the segments.
Measurement	Mean Area	The mean area of the segments.
Measurement	Min Height Max Height	The minimum and maximum heights among all of the identified segments.
Measurement	Mean Height	The mean height of the segments.
Surface	Diagnostics	Surface data you can use to evaluate the impact of the tool's kern size and iteration settings, which the tool uses to separate potential segments.
Measurement	X Center {n} Y Center {n}	The X and Y positions of the center of a part segmented from the surface. The **Number of Part Outputs** setting determines the number of measurements listed in the **Measurements** tab.
Measurement	Length {n} Width {n}	The length and width of a part segmented from the surface. These are always the major and minor axis of a part, respectively. The **Number of Part Outputs** setting determines the number of measurements listed in the **Measurements** tab.
Measurement	Area {n}	The area of a part segmented from the surface.

		The area is calculated using the contour of the part and resampling. For this reason, areas calculated using the Surface Volume tool will produce different measurements; for more information, see Area.
Point Feature	Center Point {n}	The point representing the center of a segmented part.
Surface	Part Surface {n}	Surface data corresponding to each segmented part.

Major Revisions

Gocator Classic to GoPxL

- "Use Intensity" parameter is always shown, even if input has no intensity.
- Order of outputs is different than in classic:
    - Diagnostics output is right after the statistics measurements
    - Each part outputs are together, including all it's measurements, feature and surface.