

## Blob Analysis with ProAnalyst® – Water Droplets

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### Abstract

This tutorial describes the ProAnalyst Contour Tracking Toolkit's ability to identify, track, and analyze objects whose shape changes over time. In this example, the surface area, shape, and location of a water drop are analyzed as it falls through the video frame. This method can be used to analyze airbags, blobs, pills, coatings, particles, or other variably shaped objects. Note that this tutorial makes use of features found in the ProAnalyst Professional Edition, as well as the optional Contour Tracking Toolkit.

### Files Needed for This Tutorial

Click [here](#) to download these files.

*testmagdrop1.avi*      *testmagdrop1.pbr*  
*testmagdrop1.imp*      *Blob\_Tracking.mpj*

### Step 1 – Image Filtering

Create a new ProAnalyst Project and add the *testmagdrop1.avi* movie. When you open the Measurement Window, you will notice that the water drop is not visually distinct from the spout [Figure 1]. The first task is to apply a series of image processing filters with the goal of isolating the water drop from the rest of the image.

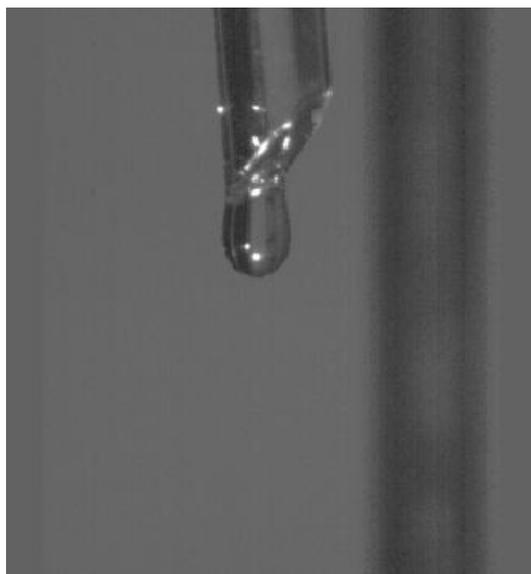


Figure 1:

Open the **Image Processing** control panel by clicking the icon. Image filters are calculated in the order they are applied. As you proceed through this tutorial, feel free to experiment with an alternate sequence of image filters to determine their effect on the overall goal of isolating the water drop.

### Discriminating the Spout and Water Drop

The first step in the enhancement of the outline of the spout and water drop from the background will be the application of an edge detector.

Click the Add button in the Image Filter List frame to launch the Select Filters to Add dialog. Expand the Convolve list and check the box next to Edge Detector (5x5 Laplacian High Pass) [ Figure 2 ]. Press the OK button to confirm your selection and apply the filter to the image.

The Laplacian High Pass filter is able to accurately highlight the edges of the spout and water drop. The tradeoff, however, is the filter tends to generate a large amount of pixel noise in the image [ Figure 3 ].

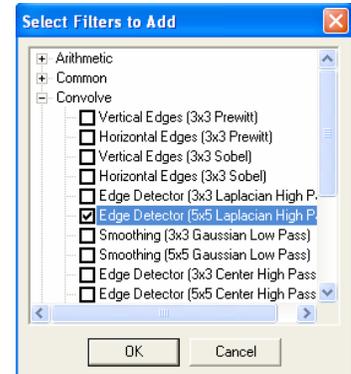


Figure 2:

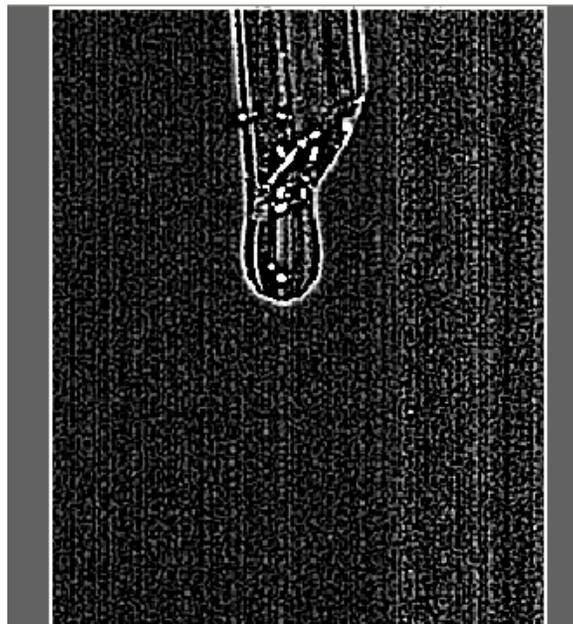


Figure 3:

To offset the background noise generated by the Laplace filter, apply a **Convolve: Smoothing (5x5 Gaussian Low Pass)** filter. There will still be some noise present in the frame [Figure 4], but from a computational standpoint, it will be easier to minimize.



Figure 4:

Apply a **Common: Despeckle** filter. Unlike the **Edge Detection** and **Smoothing** filters, the **Despeckle** filter allows you to adjust the properties of the filter, thereby altering the effect of it on the image.

Click on the icon in the **Image Filter List** to launch the **Filter Settings** dialog box [ Figure 5 ].

Change the **Minimum # Pixels** value to “24”. The **Threshold** value should be set to “64”. The **Connectivity** value can remain at “8”.

Press the **Apply** button, followed by the **Close** button to confirm your changes.

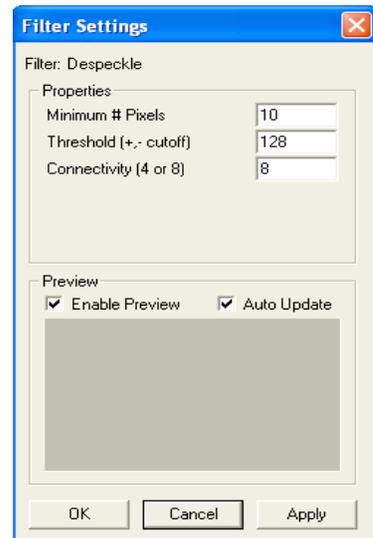


Figure 5:

Your image should now appear as an outline of the spout and water drop against an otherwise black background [ Figure 6 ]. The final step will be the elimination of the spout, effectively isolating the water drop in the image.

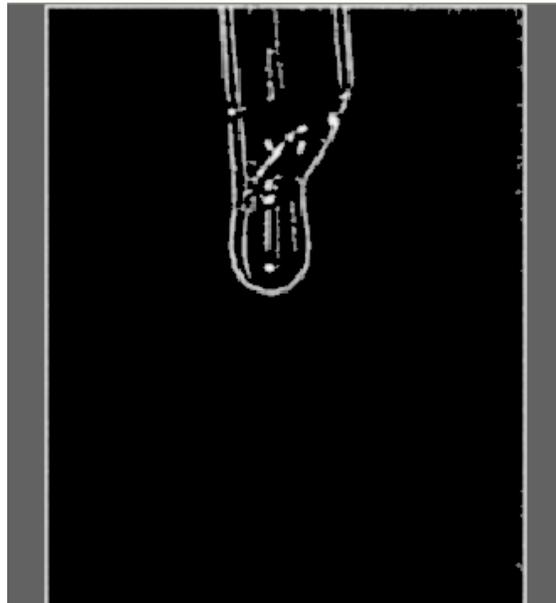


Figure 6:

### Isolating the Water Drop

You will notice that the filters thus far applied to the image have produced an artificial border around the edge of the image. This can be eliminated by applying the Zero Border filter, found under the Common list. This filter provides an unforeseen advantage, in that with the setting of one parameter, the filter can also eliminate the spout from the image.

The Zero Border settings dialog [ Figure 7 ] allows you to specify the number of pixels along each edge affected by the filter. This provides us with an easy method of eliminating the water spout.

Click on the icon in the Image Filter List to launch the Filter Settings dialog box for the Zero Border filter.

Change the values of the Left, Right, and Bottom borders to “3”.

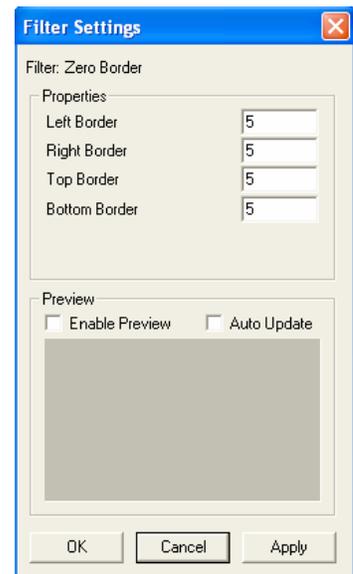


Figure 7:

By setting the size of the Top border to a large enough value, it is possible to eliminate the water spout from the image [ Figure 8 ]. A value of “100” should be sufficient.

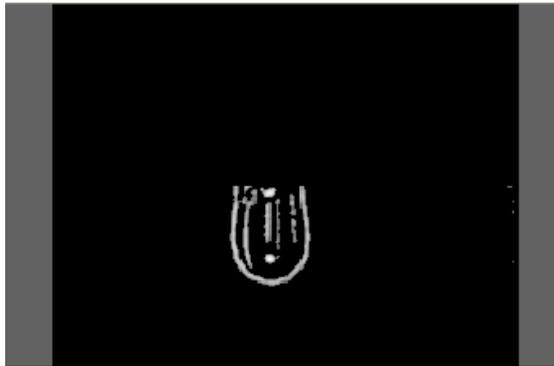


Figure 8:

With the outline of the water drop isolated, it is now a matter of filling the outline so that the automatic tracking functions in ProAnalyst identify it as one object. The **Close Connection** filter, located under the **Morphology** list, is capable of connecting neighboring regions of pixels by performing a series of dilation and erosion operations on the image.

Apply the **Close Connection** filter and open its **Filter Settings** dialog box [Figure 9].

Adjust the **Number of Iterations** value until the water drop resembles one solid region [ Figure 10 ].

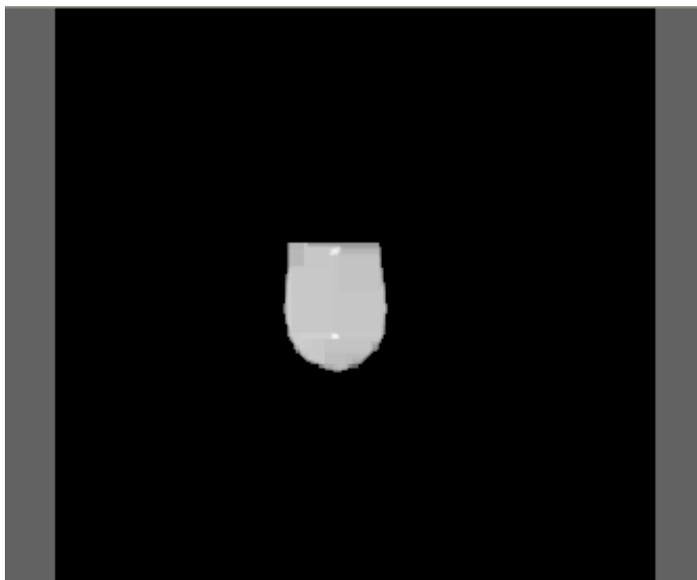


Figure 10:

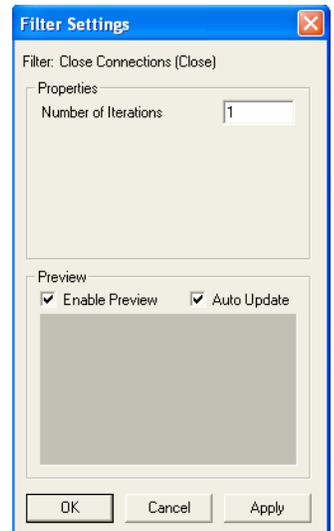


Figure 9:

The final step in filtering the water drop for analysis is the application of an image threshold filter. The threshold will set any pixels above a certain value to 255 (white). Pixels below that value will be set to zero (black).

Apply the **Threshold (Binary)** filter from the **Common** filter list to the image. The default filter settings will be acceptable. The final result will be a series of black-and-white frames displaying the shape and motion of the water drop [ Figure 11 ].

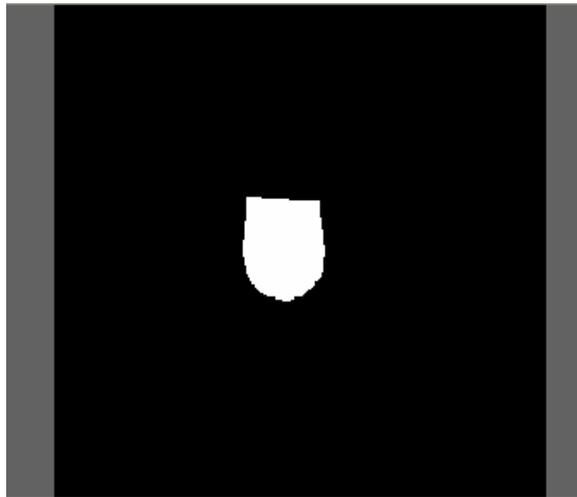


Figure 11:

## Step 2 – Contour Tracking

With the water drop isolated from the rest of the image, it is now possible to apply an automatic contour track to determine the drop's shape, location, and surface area.

Open the Contour Tracking palette [ Figure 12 ] by clicking the icon, and then click the Enable button to activate the control panel.

The Contour Tracking control panel allows you to track the contour of an object based on a number of parameters, including object size, intensity, and last position. Click the icon to open the Contour 1 Settings window [Figure 13].

For this example, two parameters will need to be changed. First, select parameter from “-1” to “300”. Leave the other parameters button to confirm the parameter changes.

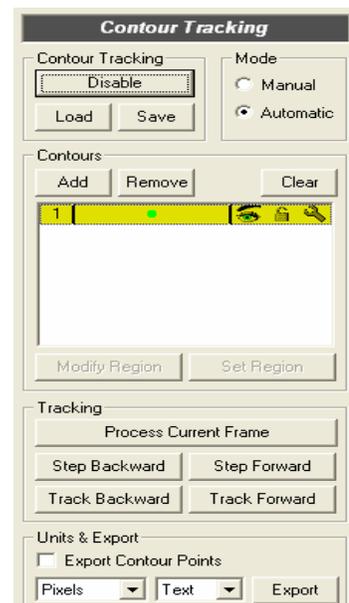


Figure 12:

To begin tracking the contour of the water drop, press the Process Current Frame button. You will see the water drop perfectly outlined in the frame [ Figure 14 ].

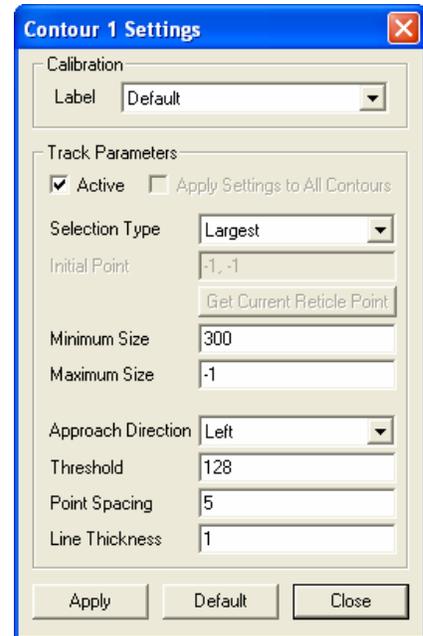


Figure 13:

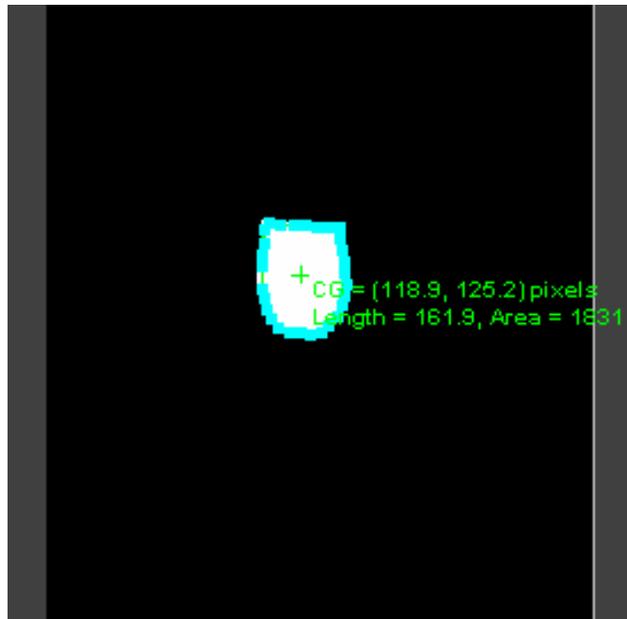
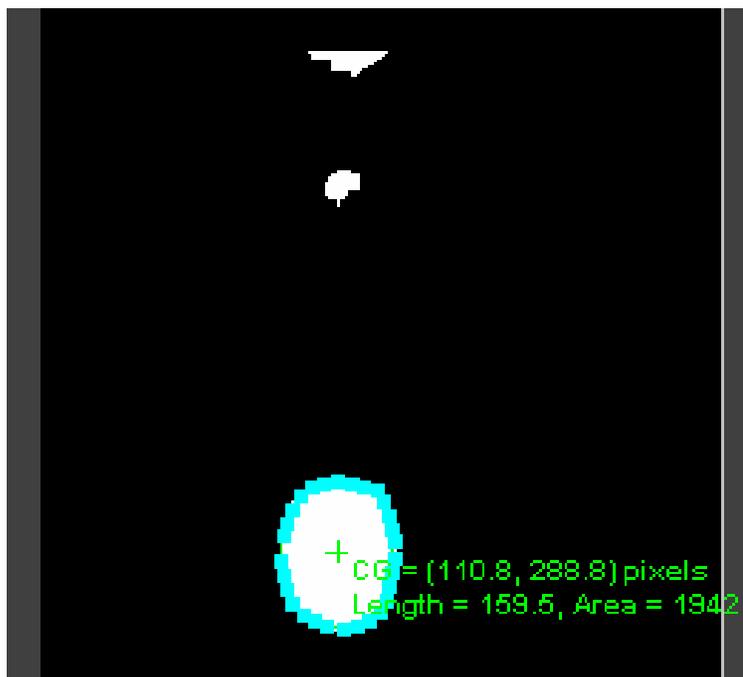


Figure 14:

Press the Track Forward button. ProAnalyst will now automatically track the ater drop until it moves off the bottom of the frame.

You will notice that some frames contain particles that were not detected or tracked by ProAnalyst [ Figure 15 ]. This is due to the Minimum Size parameter you specified earlier. Had that value been left at its default, the next largest object in the frame would have been tracked after the main drop was no longer visible.



**Figure 15:**

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