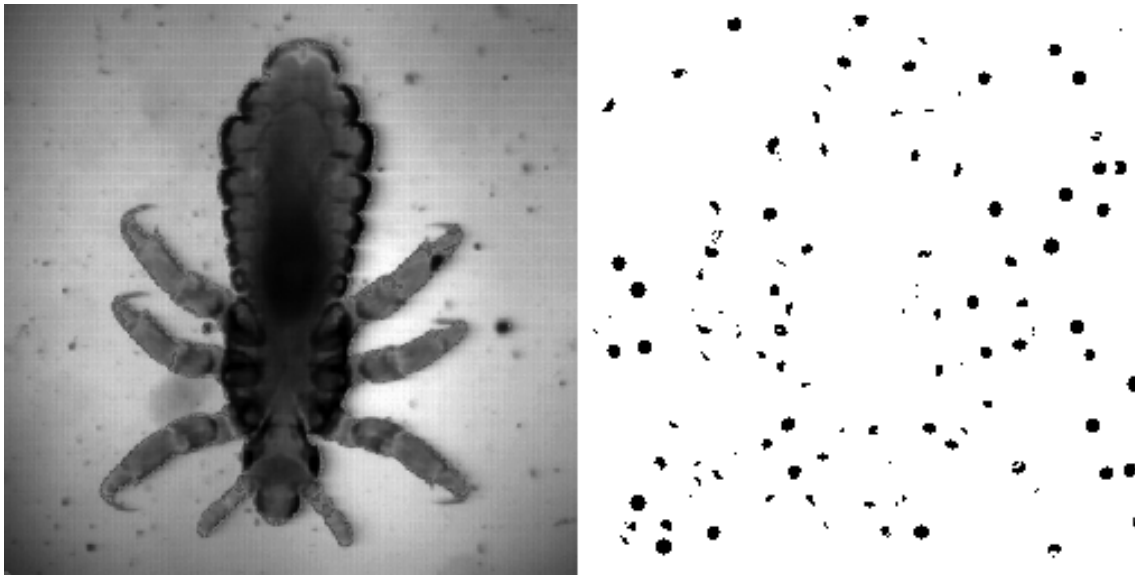


Rolling Ball filters

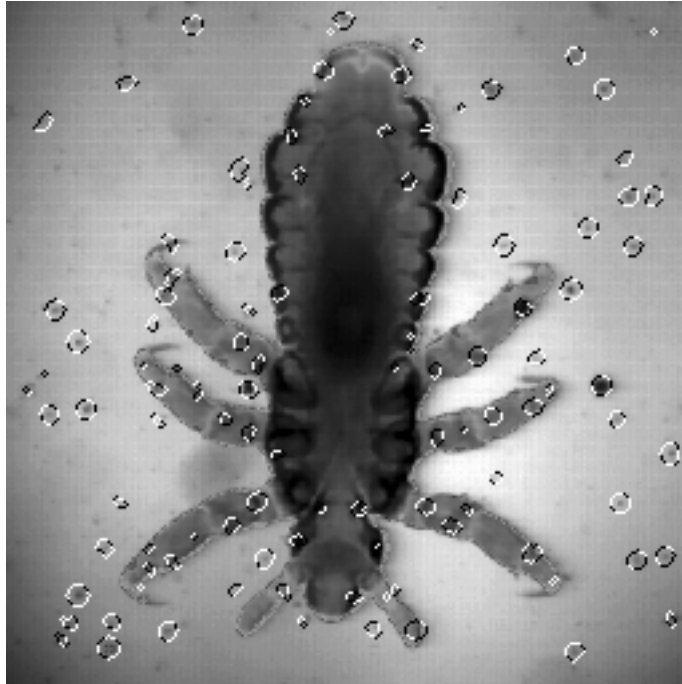
The rank-based top-hat filter is quite effective for finding small features, but the rolling ball filter does not always do a very good job of visually eliminating them. The rolling ball replaces features that are darker (or brighter) than the surrounding neighborhood with the average value of brightness from the outer ("brim") region. When the background is not uniform, or the interior region ("crown") is large, or the feature not sharply defined, this can leave a visual residue. A much cleaner removal of unwanted small features can be accomplished using a simple action that follows the steps outlined here.

First, the top-hat filter is used to create a binary image of the features to be eliminated, in the usual way. In the example ("bug") an inner radius of 4 pixels, an outer radius of 6 pixels, and a threshold value of 118 (crown height of 10 for the top hat) were used to locate the dust and dirt particles on the slide.



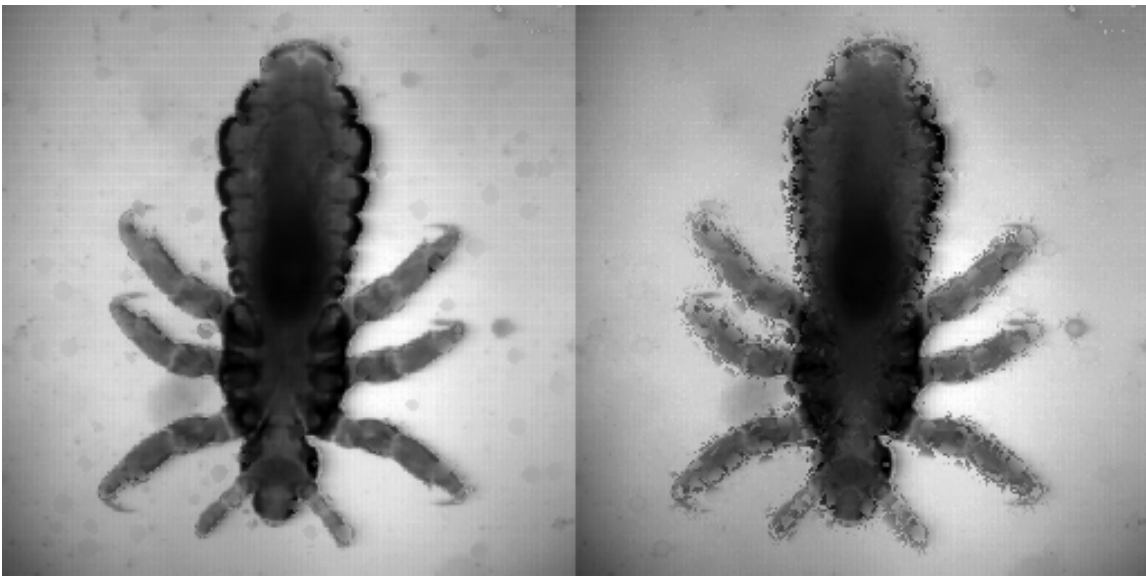
(left) The original "bug" image. (right) The result of a top hat, after thresholding.

This image was dilated by one pixel using EDM based (isotropic) dilation, inverted and copied onto the clipboard. The original image was recalled and the "QuickMask" editing mode in Photoshop selected. Pasting in the clipboard contents, and converting back to "standard" editing mode, produces a set of selection ROIs surrounding all of the dust particles.



Regions defined as described in text.

Selecting **IP•Graphics->Fill Region->From Edges** smoothly interpolates the pixel values within the selections from the values around the edges, producing a final result with very good appearance. This avoids the visually distracting effects of placing the average value in the center, especially for regions along the edge of the original bug, as shown below. The entire sequence is easily made into an action.



(left) Final result from the above procedure. (right) Result from using a rolling ball filter.