# Processing Steps for Territory Analysis after Soma and Axon Removal

1. Noise Removal: Despeckling – median filter with radius 1.
2. Create foreground territory image using rolling ball radius 50
   1. If color image, split channels and use green channel
   2. Two pass of rolling ball background subtracter
      1. Light background: true, create background: false
      2. Light background: false, create background: true
   3. Threshold to get binary mask
3. Histogram Equalization of the original despeckled image. Following parameters are used:
   1. Block radius (not block size): 127
   2. Bins: 256
   3. Slope: 3.00
4. If color image, split channels and use green channel
5. Create binary image
   1. Histogram equalization (block size: 63, bins: 255, slope 3.00)
   2. If color image, split channels and use green channel
   3. Create binarized image with black foreground
   4. Dilate followed by erode to close small gaps
   5. Despeckle to remove noise
6. Detect edges using FeatureJ Edges (Canny Edge detection)
   1. Smoothing scale: 1.0
   2. Suppress locally non-maximum gray values: false
7. Apply Hough transform to get Hough space image
   1. Convert image to byte because FeatureJ Edges returns float image
   2. Minimum radius: 10 (Hough space image for this radius is used for later steps)
8. Binarize Hough space image by auto thresholding
9. From the binarized Hough space image remove the objects that are outside the territory from step 2.
10. Detect individual objects (blobs) and remove those that are smaller in size (threshold: pixel count 300). This gives the seed objects of possible Soma.
11. Dilate the soma seeds till the edges and combine the result to remove Soma from the original
    1. Find the target point till which the blobs should be dilated
       1. Calculate blob center
       2. Find edge pixel in 8 directions from the blob center
       3. Select the edge point that is the farthest while still within the distance threshold (35 pixels)
    2. Convert neighborhood pixels to black until it reaches the neighborhood of the target point. Only convert pixels that are within the image (binarized image and binarized edge image are used as guides)
    3. After the target is reached (or target neighborhood to be precise), do a normal dilation for a few rounds to include the edges.
    4. Combine the results and remove blob pixels from the original image to remove Soma
    5. (ALTERNATIVE:) Instead of a, b, c, dilate Soma to junction point as in 12.e.
12. Remove axon
    1. Import potential axon seeds from BICAT annotation result
    2. Remove objects that are on the right part of the bounding box for the territory image
    3. Detect individual objects in the axon image and eliminate all but the largest one to get the axon seed.
    4. Dilate to the junction point
       1. Skeletonize the binary image and detect junctions candidates from the skeleton
       2. Dilate the axon seed using binary image as guide
       3. For each candidate junction encountered, check if it is the actual junction using concentric spheres (circles) method.
       4. If junction encountered on the right of the original seed, stop dilation
       5. To the left of the original seed, keep dilating until there is no change
    5. Mark the dilated axon blob on the original image
13. Perform territory analysis (same as step 2) on the image with soma and axon removed
14. Calculate foreground and background pixel count on the final territory image