

Supplementary information for:

"Improved estimation of two-dimensional area of coral colonies from underwater photographs"

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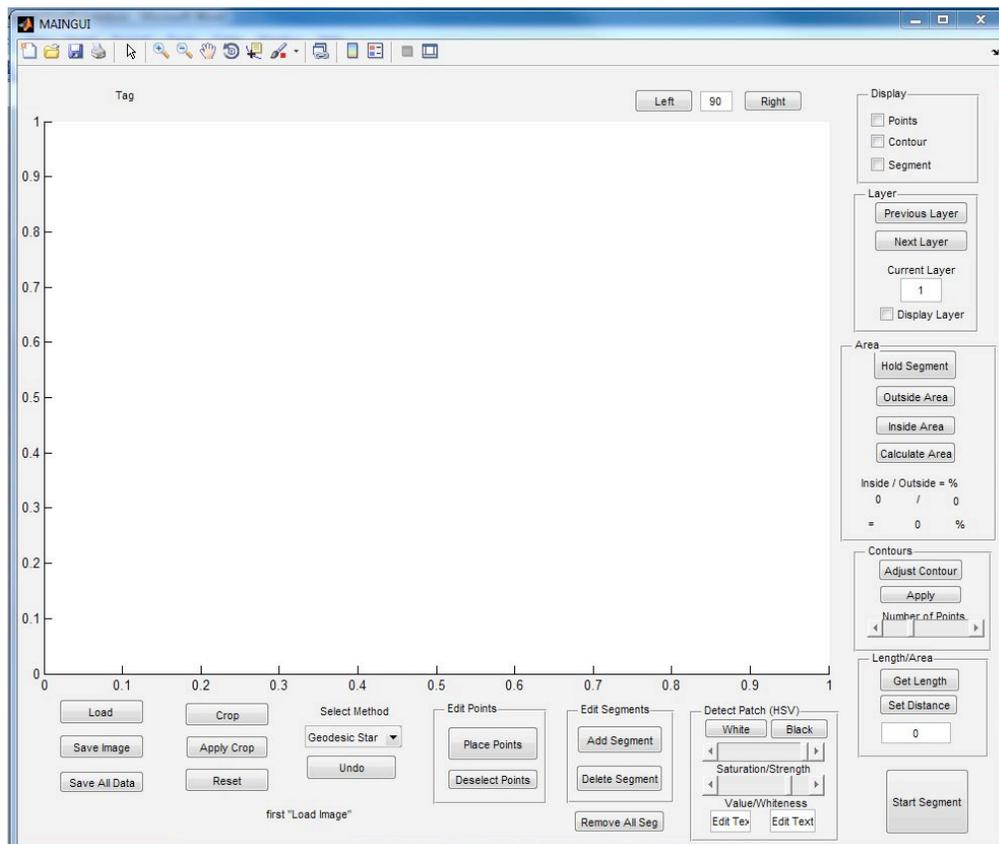
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Image segmentation instructions

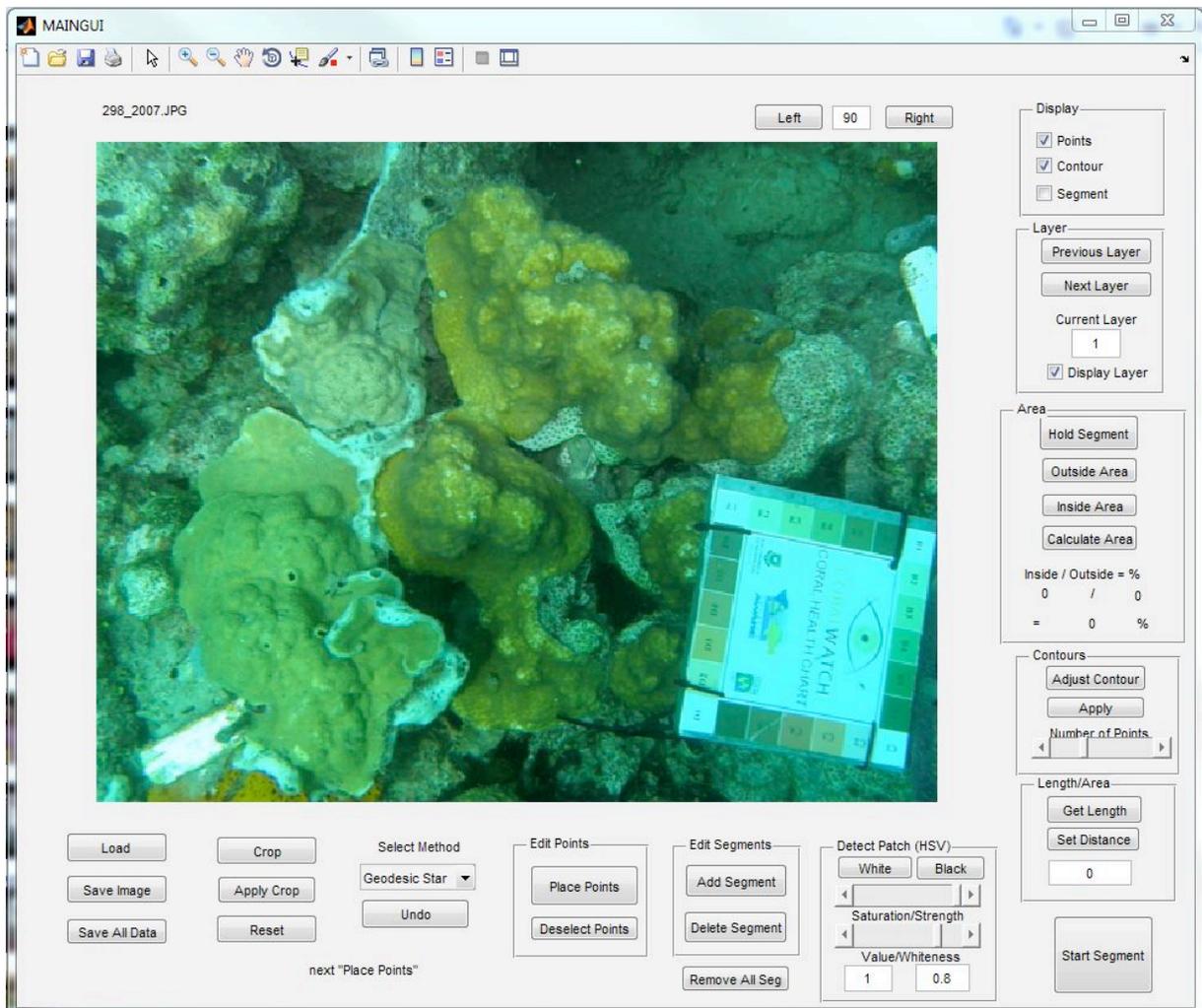
Last edited by B. Neal 29 March 2013

Requirements: Matlab 7.2 (R2006a) or later

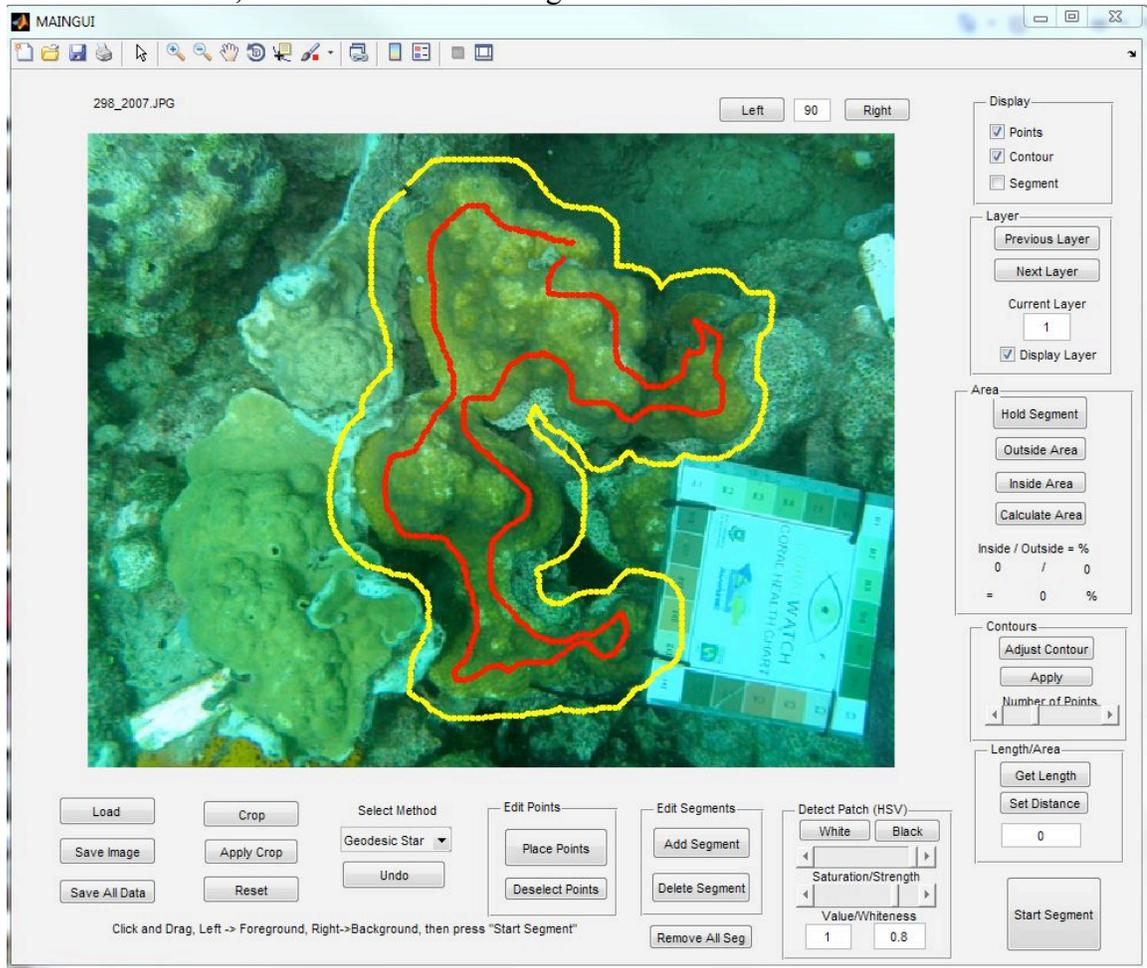
1. Have Matlab installed, and download the accompanying ZIP file entitled "Image segmenting software". Unzip the file, and place the entire folder "growcut_GeoStarConvex" on your desktop, or any other convenient location.
2. Open Matlab, and select the folder listed above in the Current Folder window.
3. In Matlab Command Window type MAINGUI (all caps) and enter. The graphical interface will load on top of the Matlab window, as shown below.



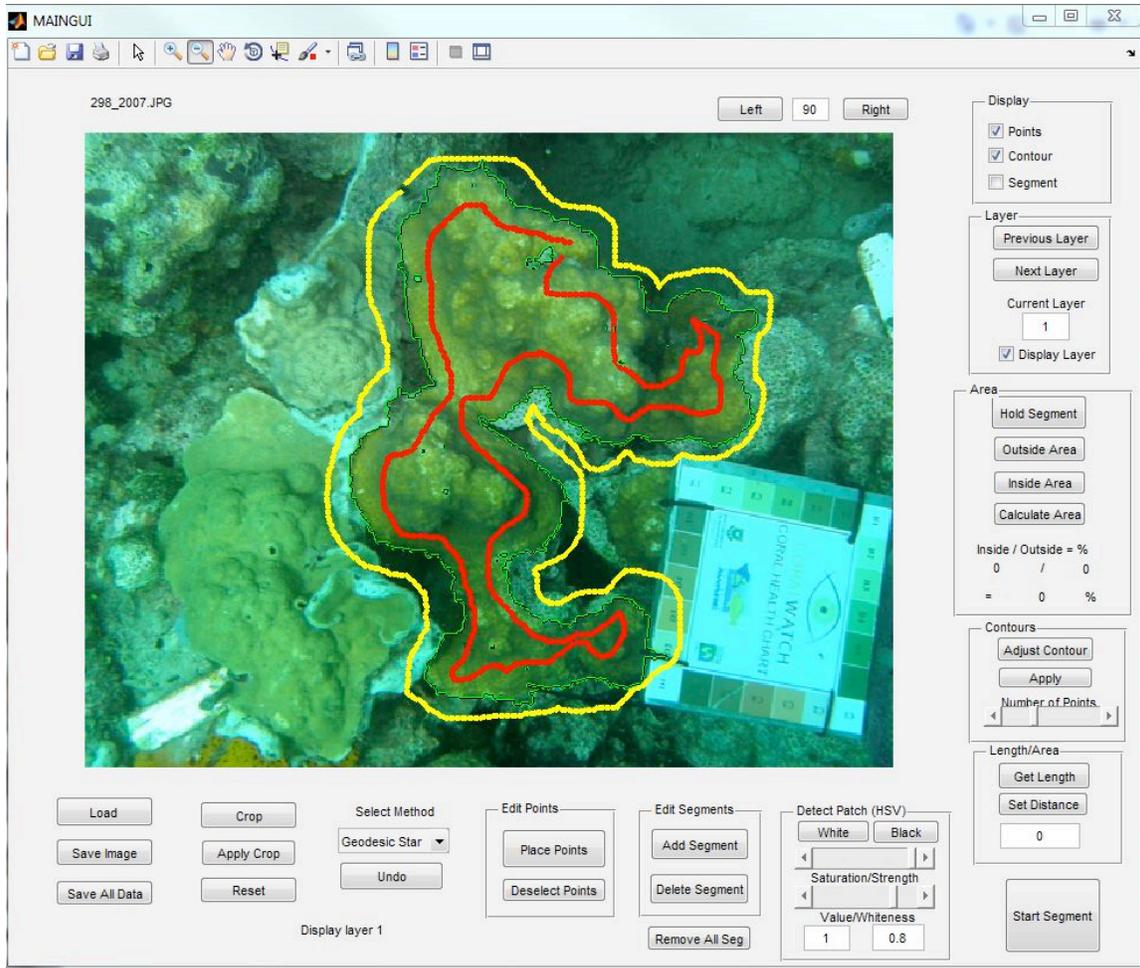
4. Next step is to pick a photo to segment. We find it best to work on one individual coral colony tag sequence or single species at a time. Take time to examine your own series of photos before starting, and think about the layers and definitions appropriate for your project.
5. In the MAINGUI interface, click Load Image button, select the desired image file. JPGs are easiest to load, but other formats, including most raw files, can be loaded, but will take longer. I find it easiest to batch convert selected images prior to loading.
6. Next click on the Crop button and drag the cursor over the area desired. Be sure to include all scale bars or tags needed for scale reference in the cropping. This can be adjusted in all directions by grabbing and moving with the cursor. Note that this crop should be as small as practical to get good resolution.
7. The crop box can be dragged as needed. When the crop box is satisfactory, click Apply Crop. Your window will look like the example below:



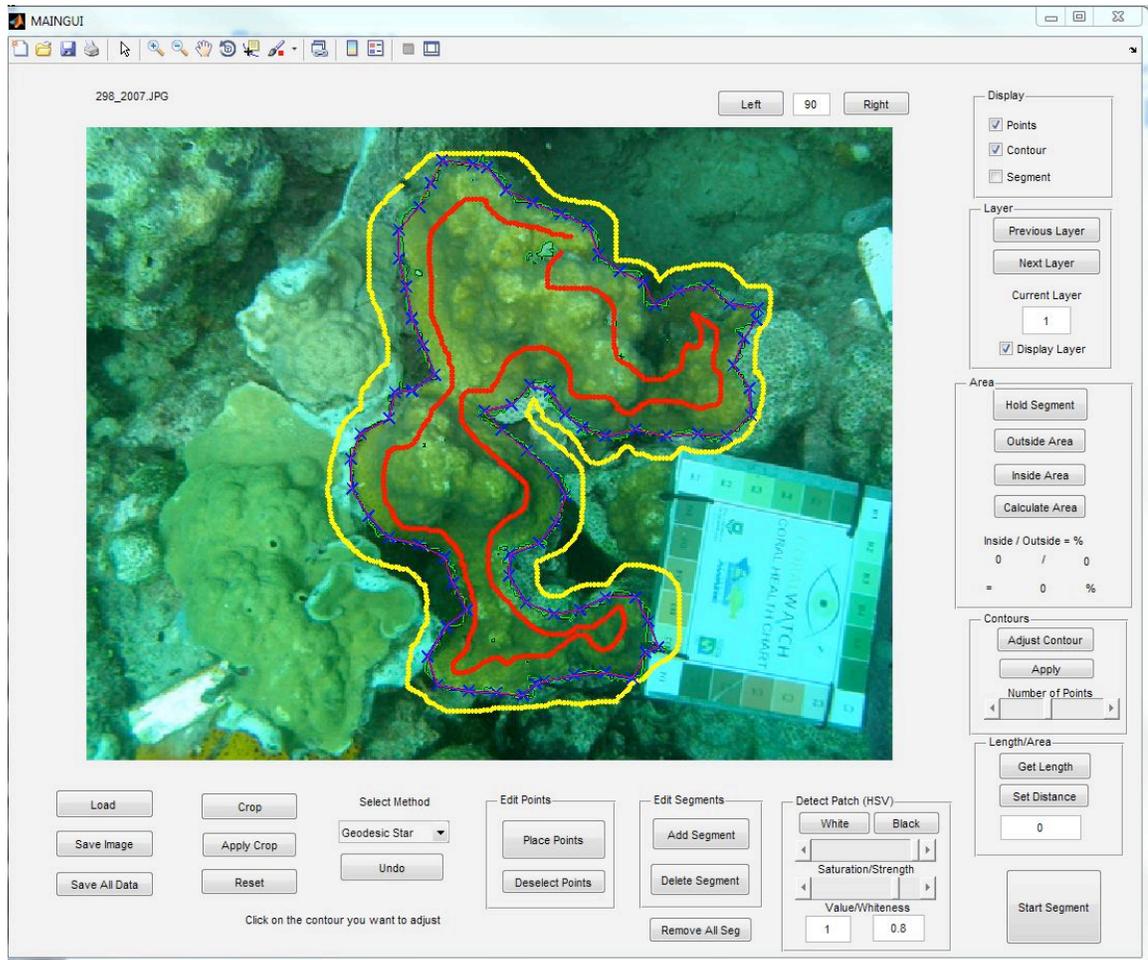
8. Outlining can be done automatically or by hand. To outline automatically press the Place Points button in the Edit Points box. Use the left mouse to place points within the coral colony desired, and the right hand mouse to place points outside the area to be segmented, as shown below. The software has four choices for segmentation algorithm, under the Select Method heading. Geodesic Star is recommended, and is the default setting.



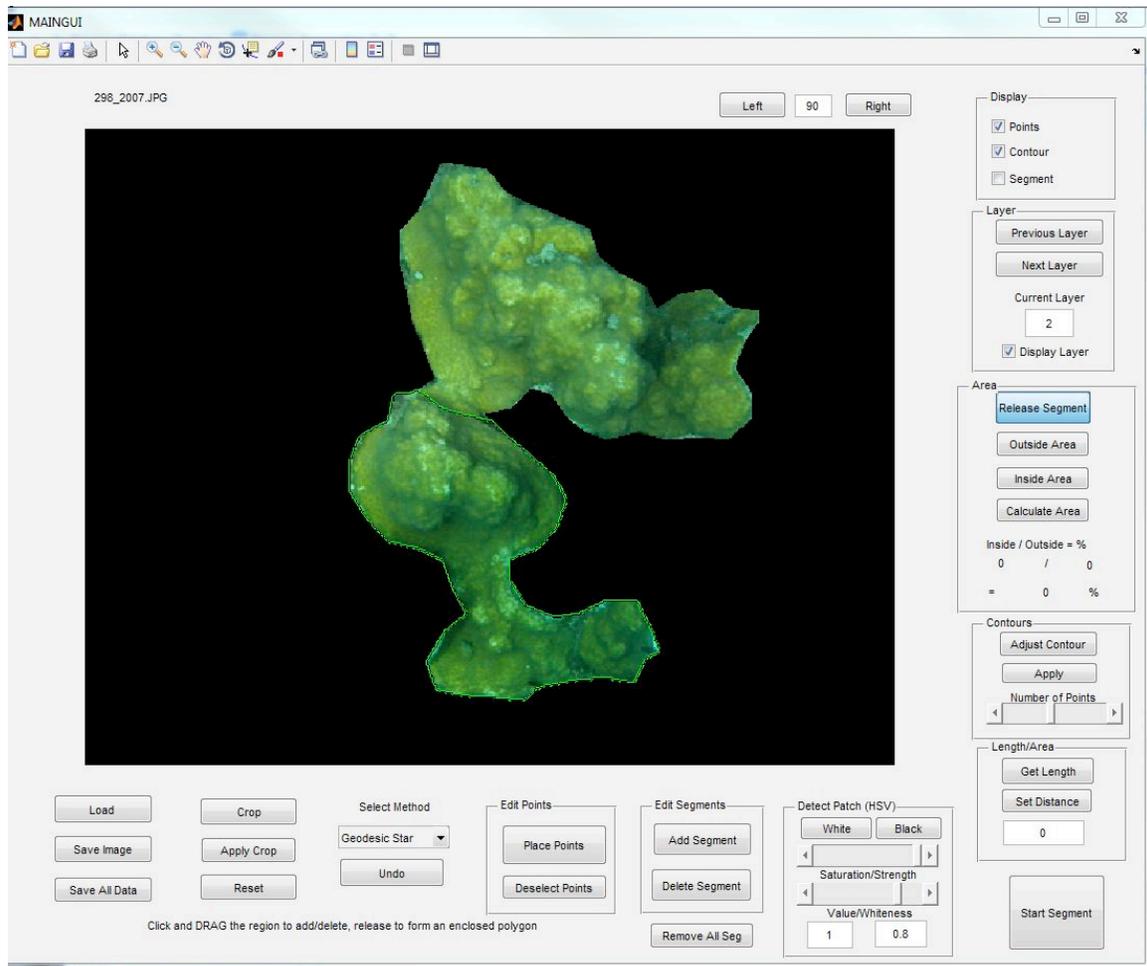
9. To segment the image press Start Segment. A green segment line will appear at the edge of the layer, as seen below. This layer can be examined by pressing Hold Segment button, which will screen the background. The edges can be examined by scrolling in with the Magnification tool, and panning around with the Hand. These tools must be turned on and off as needed.



10. Alternatively, outlining can be done by hand. To outline by hand Use the Add segment button and trace the edges while holding down the left mouse – I find it usually easiest to do this in a number of sections, which automatically meld together if there is overlap. The ends of the segment will close automatically, which speeds up the process considerably.
11. Internal sections can be added or subtracted to the layer using Add Segment or Delete Segment. Remove All Seg will clear the whole layer. Sections of dead tissue within a layer can be delineated in this same fashion.
12. The contour can also be adjusted with the Contours tool (in the Contours box). Click the Adjust Contour button and click on the green line to be adjusted. A red line with blue marks will appear. The number of blue points can be increased with the slider tool, for finer divisions. Each point can now be grab and drag adjusted. When the contour is satisfactory, hit the Apply button and it will be saved. The screen will look like the image below.



13. It can be handy to snap a jpg at any point using the Save Image button. This can be a handy guide selecting the next layers or making changes. If you have two screens you can put it on the second screen.
14. Bleached areas can be delineated automatically with the Detect Patch tool. The saturation threshold can be adjusted, and the level of whiteness can also be adjusted. Playing with these levels can result in rapid identification of bleached areas of a layer.
15. When segment is acceptable, use the Next Layer button in the Layer tool to screen the background and go to the next layer. Separate areas of this layer can now be made. Any lines outside of the layer will be snapped to the edge, and the whole contour can be selected if desired by rapidly outlining the whole previous layer. Second or third Layers can be whatever is desired, such as bleached, partially diseased, parrotfish bitten, are of algae overgrowth, disease areas, dead tissue, etc. The active Layer will be outlined in green, as shown below.



16. When all Layers are complete, hit the Previous Layer button to return to Layer 1, to designate the linear length reference. To do this hit the Get Length button in the Length/Area tool, and then align the length bar which will appear in the middle of the screen to the chosen reference. Note that you can scroll in for greater accuracy in placing the two ends. When it is in place correctly, type the reference length (taken from the graduations on a tape, or from an object of known length) in to the box under Set Distance in the Length Area box. Now hit Set Distance and a box with two readings for each layer will pop up, showing Pixel numbers in that layer as well as square centimeters. If you set up your XL sheet with the same divisions this section can be cut and pasted in directly.

17. Save the final Matlab file with the Save all Data button in the lower left, and save a final JPG if desired.

18. You are now ready to begin examining a new image, starting over with Step 4.