APPLIED MATHEMATICS : HONS AM 793 Image processing

ASSIGNMENT 5: MORPHOLOGICAL FILTERING (2022)

For this assignment you must write a short report in any word processor of your choice (MSWord, Latex, ...) where you explain your methods and show your results. All input and output images must be shown (preferably so that they can be compared on the same page). PLEASE print you images fairly large. The SunLearn grading system has no magnification option, and small images make it difficult to assess your work.

Add the code in an Appendix.

1(a) The image `diatoms.jpg` contains diatoms in various shapes and sizes. Apply suitable thresholding in order to separate the diatoms from the background. It may be profitable to do some preprocessing (smoothing or point transformation) in order to improve the thresholding result since some of the diatoms with dark interiors do not segment out well. (See the General hint below.)

1(b) Apply suitable morphological filtering with suitable structuring elements to the binary image to separate out various shapes. One may, for example, separate out the following: (1) round diatoms, (2) elongated diatoms, (3) star shaped ones, (4) triangular ones. You may choose any types or combinations. More successful separation of more classes will earn more marks. Also display your results in full colour (i.e. multiply the relevant binary image with each of the colour panels and assemble).

2 The image `treemolerat.jpg` contains a tree diagram. (a) Apply some morphological filtering so that the text is removed and only the vertical and horizontal tree structure remains. Then apply a suitable thinning algorithm (with pruning if necessary) so that the tree structure is only one pixel wide. Then apply some hit-miss transformations so that (1) all end points are identified, (2) all corners are identified and (3) all branch points are identified. Also do a count of each of these points. Present your results in a sensible format showing where corners appear and where branch points appear. (b) Apply morphological filtering (with reconstruction) so that only the Latin and English names of the species remain. (c) Apply morphological filtering (with reconstruction) so that only the branch point labels and the numbers remain.

General Hint: When shapes have holes in them, it is often beneficial to remove the holes. One way to do this, is to do region growing on the inverse image, starting with seed points in the four corners of the binary image.