

ECE 457/557 Digital Image Processing
Fall 2018
Project #1
Coding due Tuesday 11 September 2018
Literature due Thursday 6 September 2018

In this project you will explore and implement a connected components algorithm. You may use whichever programming language you prefer to accomplish this task.

- a) Implement the N_4 connected components algorithm discussed in class. You should write code to label each black pixel with a number indicating to which N_4 connected component it belongs. You should not use a built-in connected components algorithm. From this you should be able to determine the number of connected components in the image. You should also determine the coordinates defining the bounding box of each connected component.
- b) Download the picture `isri_5g.gif`. This is a bilevel image, so black should be 1 and white 0. Some software loads the image backwards – check your foreground and background pixel values. Text should be foreground.

To display your connected component clusters, you should create a new image that is a gray (or color) image. Set the pixels that are off/0/white to white, and the black pixels each to a unique ‘color’ corresponding to the component identification number. Use random not sequential colors. Draw a bounding box around each of the components.

- c) Load the image `skull.gif`. Turn this into a binary image using a threshold of 128 (display such that the background is 0=white, and treat black as “on”). Rerun the connected components algorithm. How does the algorithm treat this image different than the text image? What is characteristically different between the CCs for the two images?
- d) EE557 only: Expand your algorithm to find N_8 connected components and rerun it. Point out the major differences in results from N_4 and N_8 . Compare the number of times the backtracking algorithm runs for each case.
- e) EE557 only: (i) Find in the literature an alternate algorithm for finding connected components. Describe this algorithm, how it compares to the algorithm given in class, and what advantages and shortcomings it has over the algorithm given in class. (ii) Also find an article that describes an application using connected components.

To hand in:

A short summary of your project goals and results, including the number of connected components should be turned in (paper or email). This should follow the writing guidelines, and should contain full sentences and paragraphs. The length is determined by the content you have to show. Submit your report via BlackBoard. Include your well documented code. Save the ‘colored’ image as png, bmp, tif or gif – not jpg.

EE557: For Part (e) prepare a slide presentation 4-8 slides excluding title page and citation summarizing the two articles. It should describe how the algorithm works including a list of strengths and weaknesses. It should also describe the application, how connected components was used in it and why you think connected components was or was not a good choice for this application. Include the PPT/pdf file in your BlackBoard submission. You should be prepared to orally describe this to the class on the day the literature part of this project is due. **Make sure to include the full citation for the article.**

Notes: In the past students have found the following Matlab commands helpful for this project: `unique, find, label2rgb, colormap([1 1 1; rand(max(k),3)]);hold on, plot.`

To view the gray scale image use `colormap([0:255] '* [1 1 1]/255);`

Student Name:_____

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Project #1 - Grading Rubric**

Connected Components

- _____ N_4 code is implemented and running correctly
- _____ ISRI connected components are color coded and boxed.
- _____ Skull connected components are color coded and boxed.
- _____ Discussion of differences between ISRI & Skull connected components and results.
- _____ Results are presented in a well formatted report (intro/body/conclusion, figures w/ labels)
- _____ Good presentation (sentence structure, flow of thoughts, referencing of equations and figures).
- _____ Good grammar,
- _____ Suitable depth of investigation
- _____ Suitable insight exhibited in comments.

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- _____ N_8 code is implemented and running correctly, backtracking working, results shown as for N_4 .
- _____ Discussion comparing N_4 and N_8 results
- _____ Literature article found and properly cited.
- _____ Slides are informative and clear.
- _____ Suitable depth of analysis and insight exhibited in comments
- _____ Oral presentation is informative and clear.

_____ **Grade**