

IYTE EE 431 Intro. to Image & Video Processing
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Homework 1 Due Nov 2 2022

(To be done by previously assigned teams. Each member of the group should contribute to the solutions equally. Solutions should be submitted to the HW1 folder in the EE431 Teams platform in two files: 123345654hw1.pdf and 123345654hw1.c . This file pdf file should contain your solution for part 1. The C file should be the solution for part 2 and it should use the supplied library. The number “123345654” represents three students whose id number are 123 345 654 in short form. A student with id 210206023 is shortened as 123. Numbers should be combined in ascending order. Another example case of a group with two people discarding the first one would be named “345654”. Each group should submit their files at or before deadline)

1. Consider the connected component (cc) labeling algorithm involving single pass of an operator propagating labels and keeping equivalences.

a b c
d p

where p is the pixel under consideration. Explain in the form of a table what happens in the algorithm for all possible states (There are 16 possible states for the 4 binary variables for the case of p=1). Also give examples on simple images.

2. Write a computer program that applies the second connected component labeling algorithm that was discussed in class. Recall that this algorithm propagates the unique labels in a single top down scan by checking the neighbors at positions “a” “b” “c” “d” for each pixel “p” considering the pattern shown above. It should complete the labeling using an equivalence table.

This program should:

- Use a threshold value “128” to convert the image to a binary image.
- Create unique labels for each foreground pixel positions and store them in a 2D long int array.
- Initialize a data structure to keep and manage an equivalence table.
- Scan the image in a top-down pass and at every pixel position:
 - * Change the label of pixel “p” using the min label from the labels of “a” “b” “c” “d”.
 - * Update the equivalence table using part 1.
- When the top-down pass is complete, assign a single label for equivalent labels and:
 - * Print the number of components on screen.
 - * Assign discriminating gray values for each CC label and show the result on screen. E.g. if there are 10 distinct labels The first label can be assigned as 25 which is (int)(255/10) and the other labels are 50, 75, 100, 125...