IYTE EE 431 Intro. to Image & Video Processing
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Homework 1 Due Oct 30 2023

(Solutions should be submitted to the HW1 folder in the EE431 Teams platform in two files: NameSurname.pdf and NameSurname.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. If you wish to work in a group of two, you can make a single solution for the group (NameSurname1NameSurname2.pdf and .c.).

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. Consider the CC labeling algorithm that uses memory after a single pass of the operator described in question 1. Develop and describe an algorithm that implements this idea, creating unique labels for each connected component by checking an equivalence table.

3. 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 and 2.
- 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…

Pdf file should contain explanations for each part and sample results for part 3.