IYTE EE 431 Intro. to Image & Video Processing
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Homework 1 Due Nov 3 2021

(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 a single pdf file in this format: 123345654hw1.pdf. This number 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. Each group should submit a single file at or before deadline)**

1. Develop a strategy for storing an image given over a hexagonal tessellation into a 2D array (I.e. by describing the position of each cell using indices i,j).Then show how to:

a. Compute Euclidian distances

b. Determine 6-adjacency

given only the indices (in the new data structure) of 2 arbitrary pixels. You may assume each side length of a hexagonal cell is ***a*** units.

2. 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 32 possible states for the 5 binary variables). Also give an example on a simple image.

3. Determine the value of $|P|^2/A$ (perimeter squared, divided by area) for a regular polygon having N sides and show that it is always greater than the value of $|P|^2/A$ that corresponds to a circle.

4. Consider two points that are **d** units apart from each other. If we use a (circular) disk shaped structuring element to make these points connected to each other, what is the minimum radius of the disk (in terms of d) which is used as a closing operator? Justify your answer as clearly as possible?

5. Find the parameters of a forward affine transformation that rotates the input image by 45 degrees clockwise around image center (NR/2,NC/2) and alters the aspect ratio of the rotated image from 4:3 to 16:9 (width:height).

6. Write a computer program that reads a pgm format image file and applies gamma correction to the input image using a gamma value specified at the command line. You can simply modify the file example1.c which is part of SGimproV1.2b.zip. Submit c code attached to the rest of your solutions.

Note: $v_{corrected} = \left(\frac{v_{uncorrected}}{v_{max}}\right)^{\gamma} . v_{max}$ and v_{max} is the maximum gray value in the image.