T-61.5070 COMPUTER VISION, Exercise 3/08

Motivation

The purpose of this exercise is to be acquainted with data structures and the most usual geometric corrections.

1. Demonstrate how hierarchical search and matching work on the given example.

TEMPLATE

0	0	0	0	0	0
0	0	0	0	5	0
0	0	5	9	0	0
0	0	5	9	0	0
0	9	0	0	0	0
0	0	0	0	0	0

IMAGE

0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	9	0	0	0	0	0
0	0	0	0	5	9	0	0	0	0	0	0
0	0	0	0	5	9	0	5	5	0	0	0
0	0	0	9	0	0	0	5	5	0	0	0
0	0	0	0	0	0	0	5	5	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	9	9	9	0	0	0	0	0	0
0	0	0	0	9	9	9	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	9	9	9	9	9	0	0
0	0	0	0	0	0	0	0	0	0	0	0

2. Suggest an algorithm that can find an intersection between two regions represented as quadtrees. The intersection should be represented as a quadtree. Give an example!

3. Given the two binary images (below), choose appropriate control points and correct the coordinate system of the image 2 to the coordinate system of the image 1 using

   (a) an affine transform,

   (b) a 2D polynomial warp of 2nd order ($N = 2$).

Scale: 1 tick = 10 units

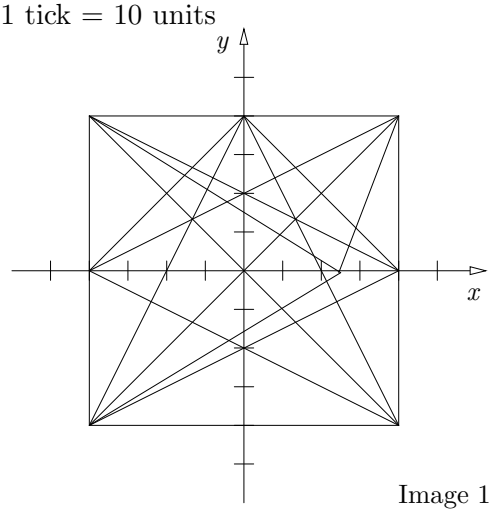

Image 1

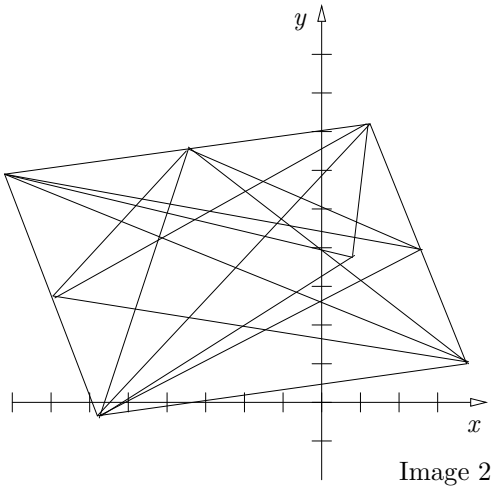

Image 2

4. (a) Using both analytical justification as well as graphical examples, show why the bilinear interpolation technique,

$$f(x', y') = (1-a)(1-b)f(x,y)+a(1-b)f(x+1,y)+(1-a)bf(x,y+1)+abf(x+1,y+1),$$

   does not necessarily fit a plane to the interpolated intensity region.

   (b) What are the conditions on the local image intensities such that the bilinear interpolation technique results in fitting a plane to the image intensities?