Image Analysis

Exercise 4

2.10.2003

1. Prove that (0°, 45°, 90°, 135°)-limited *polygon segmentation* produces blocks that consist of at most 8 line segments.

2. Suppose that we have the following image, which will be multiplied by a unknown constant *c*. Propose a growing rule for region growing so that it would be invariant on the multiplication in the case of this particular image. In other words, you have to first define the criterion, and then somebody gives the constant, and your method should be able to segment the given object no matter what was the constant.

10	20	10	20	10	20	10	20
20	10	20	10	20	10	20	10
10	20	10	**25**	**25**	20	10	20
20	10	**24**	**24**	**24**	**24**	20	10
10	20	**23**	**23**	**23**	**23**	10	20
20	10	20	**22**	**22**	10	20	10
10	20	10	20	10	20	10	20
20	10	20	10	20	10	20	10

3. Calculate a global threshold value for the image (below left) using *iterative thresholding*. Is the segmentation result different if the threshold value were calculated only using pixels whose Sobel response (below right) ≥ 40?

10	11	12	13	14	15	16	17
11	12	13	14	15	16	17	18
12	13	**24**	**25**	**26**	**27**	18	19
13	14	**25**	**26**	**27**	**28**	19	20
14	15	**26**	**27**	**28**	19	20	21
15	16	**27**	**28**	19	20	21	22
16	17	18	19	20	21	22	23
17	18	19	20	21	22	23	24

16	16	16	16	16	16	16	16
16	36	56	56	56	40	20	16
16	56	76	56	56	60	40	16
16	56	56	16	4	44	24	16
16	56	56	4	44	44	4	16
16	40	60	44	44	4	16	16
16	20	40	24	4	16	16	16
16	16	16	16	16	16	16	16

4. *Local thresholding* can be applied by calculating the threshold for each pixel separately. The threshold for each pixel is calculated by analyzing the surrounding 3×3 window, and taking the average of the maximum and minimum values inside the window: $T = (x_{max}+x_{imn}) / 2$. Calculate the threshold values for the pixels. For which pixels the threshold was not calculated correctly? Why?

5. The iterative thresholding algorithm was defined for the case of one threshold only. Generalize the algorithm for the case, in which there is two thresholds to be calculated, T_1 and T_2.

10	11	12	13	14	15	16	17
11	12	13	14	15	16	17	18
12	13	**24**	**25**	**26**	**27**	18	19
13	14	**25**	**26**	**27**	**28**	19	20
14	15	**26**	**27**	**28**	19	20	21
15	16	**27**	**28**	19	20	21	22
16	17	18	19	20	21	22	23
17	18	19	20	21	22	23	24