

T-61.5070 COMPUTER VISION, Exercise 9/08

Motivation

The purpose of this exercise is to be acquainted with shape description.

1. Give an example of a case where Euler's number is a proper feature.
2. Determine to the given images
 - (a) the moments m_{00} , m_{01} , m_{10} , m_{11} , m_{20} , m_{02}
 - (b) the center of gravity x_0 and y_0
 - (c) the central moments μ_{00} , μ_{01} , μ_{10} , μ_{11} , μ_{20} , μ_{02}

1	1	1	1	1	0	0	0	1	0
0	0	0	1	0	0	0	1	1	0
0	0	1	0	0	0	1	0	1	0
0	0	0	1	0	1	0	0	1	0
0	0	0	0	1	1	1	1	1	1
1	0	0	0	1	0	0	0	1	0
0	1	1	1	0	0	0	0	1	0

3. Calculate the PCA-transform to the following sample points:

$$\mathbf{x}_1 = \begin{bmatrix} -2 \\ 0 \end{bmatrix} \quad \mathbf{x}_2 = \begin{bmatrix} -1 \\ 2 \end{bmatrix} \quad \mathbf{x}_3 = \begin{bmatrix} 0 \\ 3 \end{bmatrix} \quad \mathbf{x}_4 = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad \mathbf{x}_5 = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad \mathbf{x}_6 = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$$

- (a) Transform the sample points to one dimension. What is the mean square error?
- (b) Calculate the elongatedness of the region that is spanned by the sample points.