LEHRSTUHL FÜR MENSCH-MASCHINE-KOMMUNIKATION

Pattern Recognition

Tutorial No. 9
27.6.2014

Exercise 20

Construct a polynomial classifier, 2nd order, which solves the following task: All 2-dimensional vectors outside a circle with the radius **r**, centred at point (a,b), are members of class Ω_1, all other vectors are members of class Ω_2.

a) Compute the weight matrix W of this polynomial classifier.
b) Check the ability of the classifier with the following patterns: $\vec{y}_1^T = [a, b]$, $\vec{y}_2^T = [a, 2b]$

Exercise 21

The XOR-problem with the following segmentation

$$\Omega_1 = \left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \right\} \quad \Omega_2 = \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \right\}$$

shall be solved using a polynomial classifier.

a) First a linear approach should be examined, using a polynomial structure vector $\vec{y}^T = [y_1, y_2]$. Can the XOR-problem be solved this way?
b) Compute the weight matrix **W**, when using a polynomial structure vector $\vec{y}^T = [y_1, y_2, y_1 \cdot y_2]$ Plot the class boundary. Is the problem solved, using this structure vector?

c) Show the class boundary for the approach $\vec{y}^T = [y_1^2, y_2^2, y_1 \cdot y_2]$.

d) Which changes have to be applied to the approach in b) in order to solve the problem? Plot the final class boundary.