Machine Learning
Blatt 11

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Nr.1

Skalarprodukt

Symmetrie

$$k(x,y) =< x,y >= \sum_{i=1}^{n} x_i \cdot y_i = \sum_{i=1}^{n} y_i \cdot x_i =< y,x >= k(y,x)$$

zz. $\forall c_1,\dots,c_m \in \mathbb{R} : \sum_{i,j=1}^{m} c_i c_j k(x_i,x_j) \geq 0$

$$\sum_{i,j=1}^{m} c_i c_j k(x_i,x_j) = \sum_{i,j=1}^{m} \left(c_i c_j \sum_{k=1}^{n} (x_{ik}, x_{j_k}) \right) = \sum_{k=1}^{n} \sum_{i=1}^{m} \sum_{j=1}^{m} (c_i x_{ik} \cdot c_j x_{j_k})$$

$$= \sum_{k=1}^{n} \left(\sum_{i=1}^{m} c_i x_{ik} \cdot \sum_{j=1}^{m} c_j x_{j_k} \right) = \sum_{k=1}^{n} \left(\sum_{i=1}^{m} c_i x_{ik} \right)^2 \geq 0$$

$\Rightarrow \quad < x,y >$ ist ein Kernel.

q.e.d.

Polynomieller Kernel

$$k(x,y) = (\sum_{i=1}^{n} x_i y_i)^2 = \sum_{i=1}^{n} x_i y_i \cdot \sum_{i=1}^{n} x_i y_i =< x,y > \cdot < x,y >$$

$\Rightarrow$ Kernel, da Produkt 2er Kernel (wie oben gezeigt).

q.e.d.