

Support Vector Machine

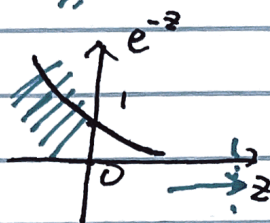
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$$\tilde{f}(a) = \sum_{i=1}^n a_i - \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n a_i a_j y_i y_j \underbrace{K(x_i, x_j)}_{\text{primitive similarity}}$$

Lagrangian multipliers

$\Phi(x_i) \rightarrow$ higher dimensional space

$\Phi(x_j) \rightarrow$ "



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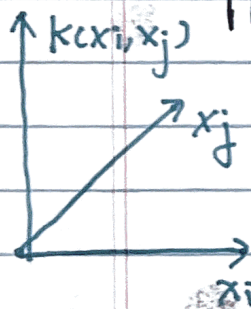
$$K(x_i, x_j) = e^{-z^2} ; z = \frac{\|x_i - x_j\|_2^2}{2\sigma^2}$$

$$x_j = x_i ; z = \frac{0}{2\sigma^2} = 0 ; K(x_i, x_j) = 1$$

z when $x_i - x_j = \infty$

$$x_i \neq x_j \Rightarrow x_i - x_j = -\infty \quad z = \frac{\infty}{2\sigma^2} \Rightarrow z \text{ approaches } \infty$$

$\Rightarrow e^{-z^2}$ approaches 0 $\Rightarrow x_i, x_j$ are very dissimilar



$$\begin{array}{ll} x_i = -3 & x_i = 1 \\ x_j = 3 & x_j = 1 \end{array}$$

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$$\theta_0 + \theta_1 \cdot K(x, l_1) + \theta_2 K(x, l_2) + \theta_3 \cdot K(x, l_3) \geq 0$$

$$K(x_i, x_j) = \exp\left(-\frac{\|x_i - x_j\|_2^2}{2\sigma^2}\right)$$

$$-0.5 + K(x, l_1) + K(x, l_2) + 0 \cdot K(x, l_3) \geq 0.$$

$$\Rightarrow -0.5 + 1 + (0.25) + 0 \cdot 0 = +0.5 + 0.25 = 0.75 \geq 0. \Rightarrow \text{predict +.}$$

$$-0.5 + 0 + (0.25) + 0 \cdot 1 = -0.5 + 0.25 = -0.25 \leq 0 \Rightarrow \text{predicting -}$$