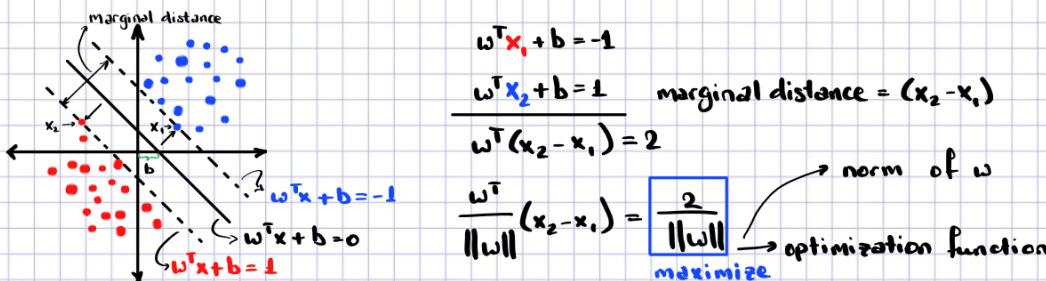
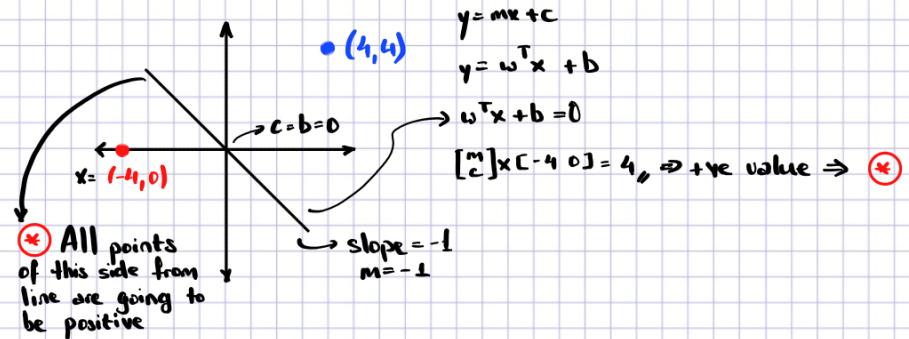
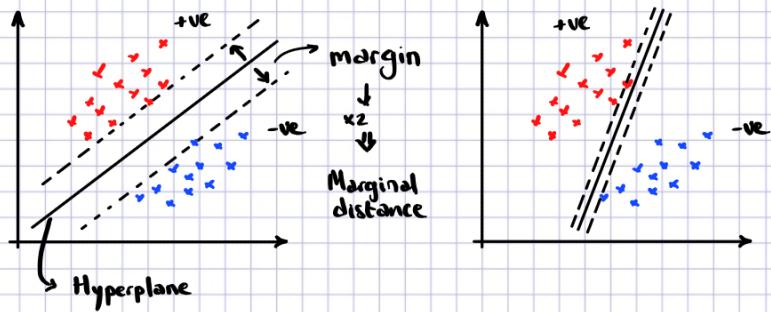


Support Vector Machines

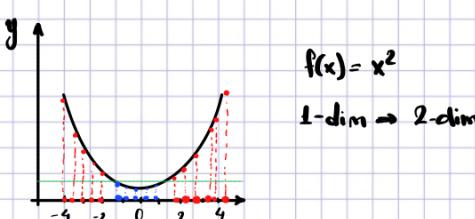
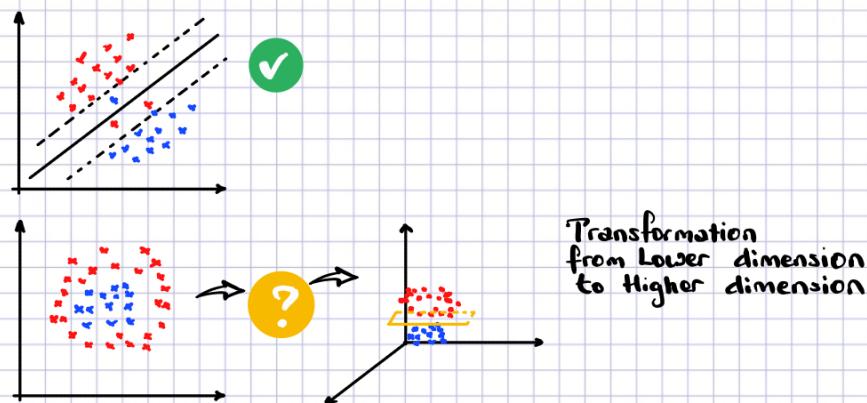


$$(\omega^*, b^*) \max \frac{2}{\|w\|} \quad | \begin{array}{l} +1 \\ -1 \end{array} \quad w^T x + b \geq 1 \\ w^T x + b \leq -1$$

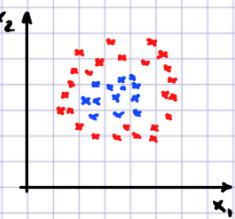
$$(\omega^*, b^*) \max \frac{2}{\|w\|} \quad | \quad y_i \times (w^T x_i + b_i) \geq 1 \quad \text{Cost Function}$$

$$(\omega^*, b^*) = \min \frac{\|w\|}{2} + c \sum_{i=1}^n \xi_i \quad | \quad \begin{array}{l} c = \text{How many errors?} \\ \xi_i = \text{Value of the error} \end{array}$$

SVM Kernels



Polynomial Kernels



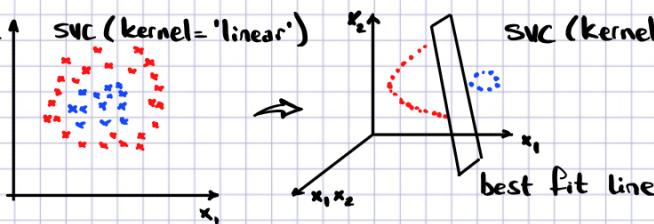
$$x_1 \quad x_2 \quad y \quad y = f(x_1, x_2)$$

$$f(x_1, x_2) = (x_1^T \cdot x_2 + 1)^d$$

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \cdot \begin{bmatrix} x_1 & x_2 \end{bmatrix} = \begin{bmatrix} x_1^2 & x_1 x_2 \\ x_1 x_2 & x_2^2 \end{bmatrix}$$

$$x_1 \quad x_2 \quad y \quad x_1^2 \quad x_2^2 \quad x_1 x_2$$

SVC (kernel='linear') SVC (kernel='poly' or 'rbf' or 'sigmoid')



SVC (kernel='poly' or 'rbf' or 'sigmoid')

best fit line