$$\left.\begin{aligned} \frac{\partial L}{\partial \underline{w}} &= \phi \\ \frac{\partial L}{\partial b} &= 0 \end{aligned}\right\} \qquad \left.\begin{aligned} \underline{w} &= \sum_{n=1}^{N} a_n t_n \phi(\underline{x}_n) \quad (**) \\ \phi &= \sum_{n=1}^{N} a_n t_n \end{aligned}\right\} \rightarrow L(\underline{w}, b, \underline{a})$$

DUAL REPRESENTATION:

$$\text{MAX}: \quad \tilde{L}(\underline{a}) = \sum_{n=1}^{N} a_n - \frac{1}{2} \sum_{n=1}^{N} \sum_{m=1}^{N} a_n a_m t_n t_m \underbrace{k(\underline{x}_n, \underline{x}_m)}$$

$$k(\underline{x}, \underline{x}') = \phi(\underline{x})^T \phi(\underline{x}')$$

+

CONSTRAINTS: $a_n \geq \phi$

$$\sum_{n=1}^{N} a_n t_n = \phi$$

$(**) \rightarrow \quad y(\underline{x}) = \sum_{n=1}^{N} a_n t_n k(\underline{x}, \underline{x}_n) + b$ CLASSIFICATION

KKT (KARUSH-KUHN-TUCKER) CONDITIONS

$$a_n \geq \phi$$
$$t_n y(x_n) - 1 \geq \phi$$
$$a_n \{ t_n y(x_n) - 1 \} = \phi$$

FOR ANY DATA POINT: $a_n = \phi$ / $t_n y(\underline{x}_n) = 1$

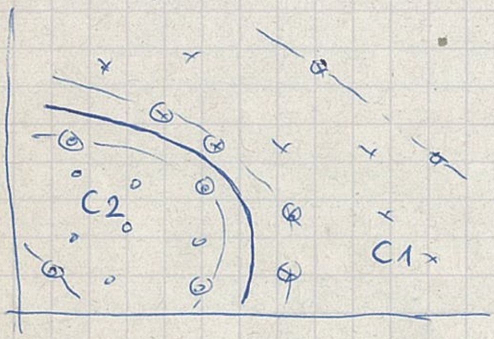
$a_n \neq \phi$ — SUPPORT VECTORS (BOUNDARY POINTS)

SOLUTION FOR b:

$$t_n \left(\sum_{m \in S} a_m t_m k(\underline{x}_n, \underline{x}_m) + b \right) = 1$$

(FIG. 7.2)

$$b = \frac{1}{N_S} \sum_{n \in S} \left(t_n - \sum_{m \in S} a_m t_m k(\underline{x}_n, \underline{x}_m) \right)$$



INPUT SPACE, GAUSSIAN KERNELS