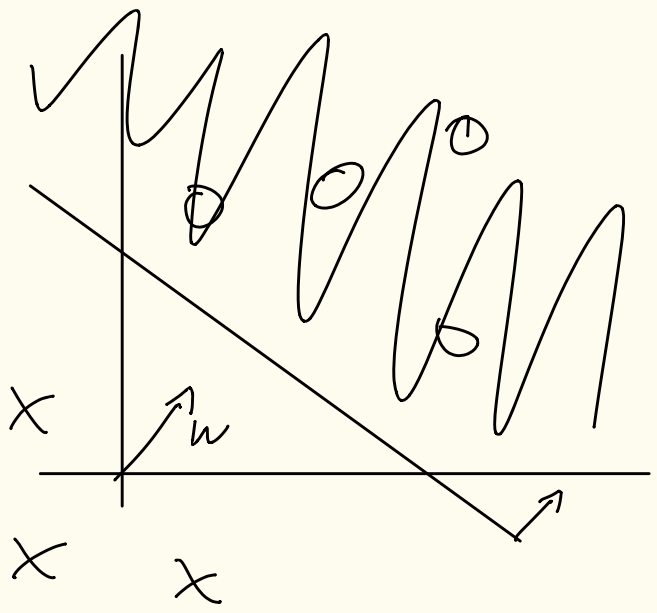
Perceptron

$$\underset{q}{\operatorname{argmin}} \sum_x \sum_k p(x,k)\, W(k, q(x))$$

$T = \{(x_1,k_1), \ldots, (x_n,k_n)\}$ ← on loss

$$R_{emp} = \frac{1}{N} \sum_i W(k_i, q(x_i))$$

overfitting



$w \cdot x_i + b > 0$ if $k_i = 1$

$w \cdot x_i + b < 0$ if $k_i = -1$

↓

$k_i(w \cdot x_i + b) > 0$ $\quad V = \begin{bmatrix} | \\ w \\ | \\ b \end{bmatrix}$ $\quad z = \begin{bmatrix} 1 \\ x \\ | \\ 1 \end{bmatrix}$

$k_i V \cdot z_i > 0$

$\operatorname{argmax}_V 1$ s.t.

Perceptron

1. $V = \vec{0}$
2. find $\overline{z_i}$: $V \cdot \overline{z_i} \leq 0$
3. $V += \overline{z_i}$

$$T = \left\{ \left(\begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix}, 1 \right), \left(\begin{bmatrix} 4 \\ 3 \\ 1 \end{bmatrix}, 1 \right), \left(\begin{bmatrix} 4 \\ 4 \\ 1 \end{bmatrix}, 1 \right), \left(\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, -1 \right), \left(\begin{bmatrix} -1 \\ -2 \\ -1 \end{bmatrix}, -1 \right), \left(\begin{bmatrix} -2 \\ -1 \\ -1 \end{bmatrix}, -1 \right) \right\}$$

V	$\overline{z}$
[0 0 0]	[3 4 1]
[3 4 1]	[-1 -1 -1]
[2 3 0]	[-1 -1 -1]
[1 2 -1]	[-1 -1 -1]

[0 1 -2] [-1 -2 -1]

[-1 -1 -3] [3 4 1]

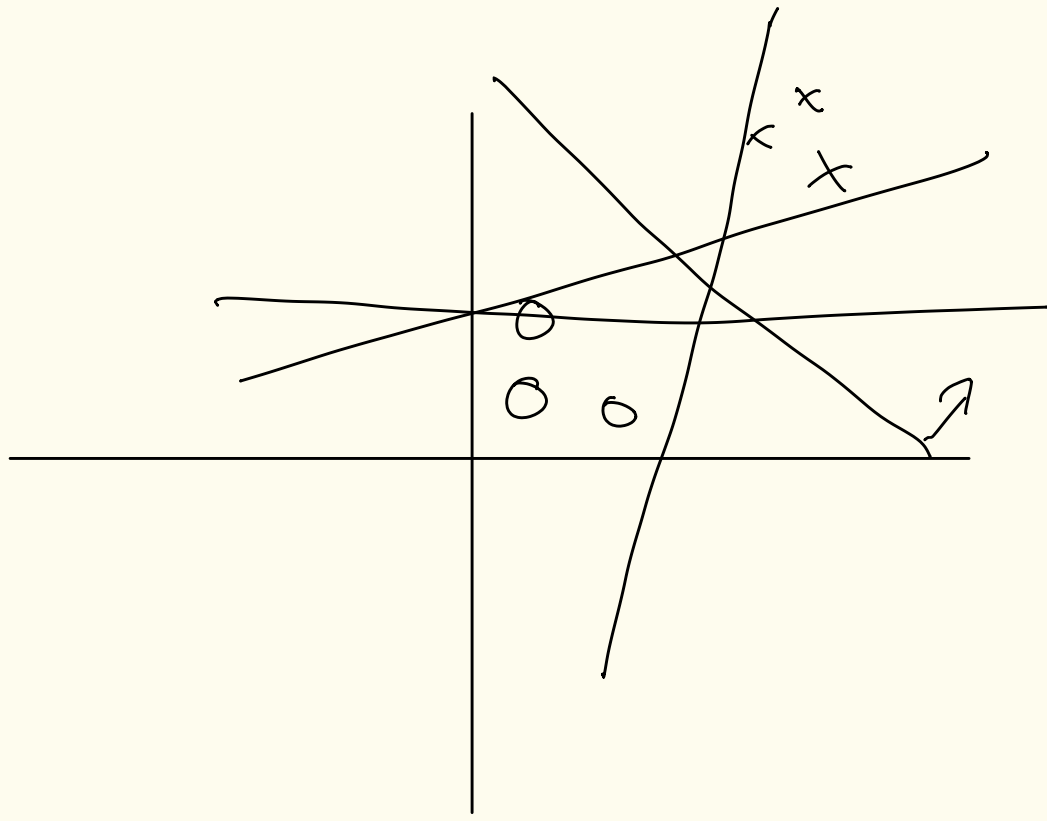
[2 3 -2] [-1 -1 -1]

[1 2 -3] [-1 -1 -1]

[0 1 -4] [4 3 1]

[4 4 -3] [-1 -1 -1]

[3 3 -4] [-1 -1 -1]

[2 2 -5] [-1 -2 -1]

[1 0 -6]