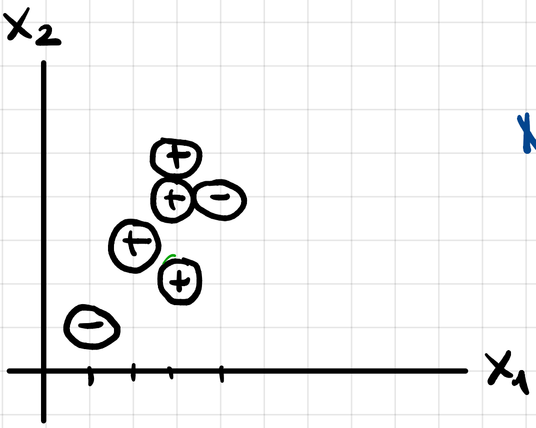
2. APRENDIZAJE SUPERVISADO

	X_1	X_2	C
i_1	1	1	N
i_2	3	2	S
i_3	4	4	N
i_4	3	4	S
i_5	2	3	S
i_6	3	5	S

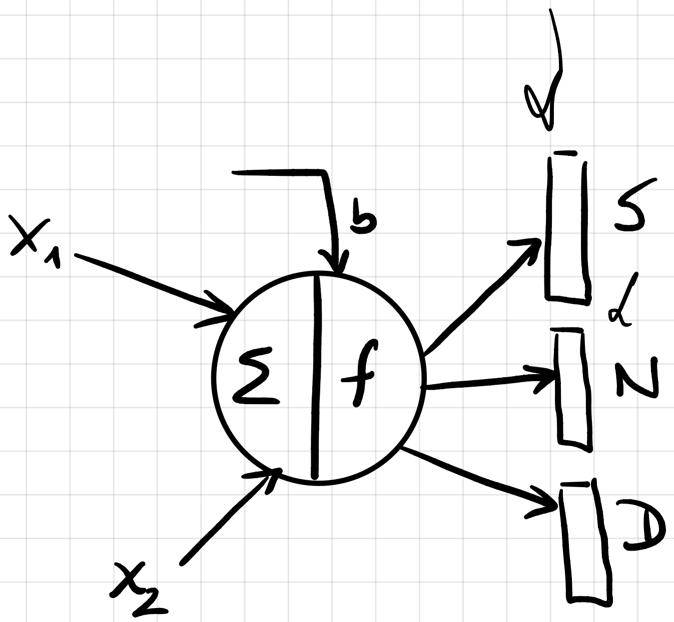
2.1 Linealmente separable?



No tiene pinta....

2.2

	X_1	X_2	C
i_1	1	1	N
i_2	3	2	S
i_3	4	4	N
i_4	3	4	S
i_5	2	3	D
i_6	3	5	D



$\forall w_i \in W = 0$

1. Primer elemento

$$a_1 = \theta^T \cdot X_i^T = \begin{array}{c} w_0 \\ w_1 \\ w_2 \end{array}\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \rightarrow a_1 = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$z_1 = \text{softmax}\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = \left\{ \sum e^j = \boxed{3} \right. \rightarrow \begin{array}{l} S = \frac{1}{3} \\ N = \frac{1}{3} \\ D = \frac{1}{3} \end{array}$$

asumimos que en empate se dice que si

$\hat{y}_1 = S \qquad y = N \rightarrow$ Actualizamos pesos

$$W_0 = W_0 - f(x) \rightarrow (-1, -1, -1)$$
$$W_1 = W_1 + f(x) \rightarrow (1, 1, 1)$$
$$W_2 = W_2$$

2. Segundo elemento

$$a_2 = \theta^T \cdot X_2 = \begin{pmatrix} -1 & -1 & -1 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix}\begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} -6 \\ 6 \\ 0 \end{pmatrix}$$

$$z_2 = \text{softmax}\left(\begin{bmatrix} -6 \\ 6 \\ 0 \end{bmatrix}\right) = \sum e^j = e^{-6} + e^{6} + e^{0} = 404'43$$

$$e^{-6} = 2'478$$
$$\boxed{e^{6} = 403'42} \quad \text{max}$$
$$e^{0} = 1$$

$\hat{y} = N \wedge y = S$

$$W_0 = W_0 + f(x) = (0, 2, 1)$$
$$W_1 = W_1 - f(x) = (-1, -2, -1)$$
$$W_2 = W_2 = (0, 0, 0)$$

3. Tercer elemento

$$a_3 = \theta^T \cdot x_3 = \begin{pmatrix} 0 & 2 & 1 \\ -1 & -2 & -1 \\ 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 4 \\ 4 \end{pmatrix} = \begin{pmatrix} 12 \\ -13 \\ 0 \end{pmatrix}$$

$$z_3 = \text{softmax}\left(\begin{bmatrix} 12 \\ -13 \\ 0 \end{bmatrix} \right) = \sum e^i = 162755$$

$e^{12} =$ grande

$e^{-13} =$ pequeño

$e^{0} = 1$

$\hat{y} = S \wedge y = N$

$$w_0 = w_0 - f(x) = (-1, -2, -3)$$
$$w_1 = w_1 + f(x) = (0, 2, 3)$$
$$w_2 = w_2 = (0, 0, 0)$$

4. Cuarto elemento

$$a_4 = \theta^T \cdot x_4 = \begin{pmatrix} -1 & -2 & -3 \\ 0 & 2 & 3 \\ 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \\ 4 \end{pmatrix} = \begin{pmatrix} -19 \\ 18 \\ 0 \end{pmatrix} \rightarrow \text{Este e}$$

$$z_4 = \text{softmax}\left(\begin{bmatrix} -19 \\ 18 \\ 0 \end{bmatrix} \right) = \sum e^i = \text{MUY ALTO}$$

$\hat{y} = N \wedge y = S$

$$w_0 = w_0 + f(x) \qquad w_0 = (0, 1, 1)$$
$$w_1 = w_1 - f(x) \longrightarrow w_1 = (-1, -1, -1)$$
$$w_2 = w_2 \qquad w_2 = (0, 0, 0)$$

5. Quinto elemento

$$a_5 = \theta^T \cdot i_5 = \begin{pmatrix} 0, & 1, & 1 \\ -1, & -1, & -1 \\ 0, & 0, & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 7 \\ -8 \\ 0 \end{pmatrix}$$

$\hat{y} = S \qquad y = D$

$$\begin{aligned} w_1 &= w_1 - f(x) \\ w_2 &= w_2 \\ w_3 &= w_3 + f(x) \end{aligned} \rightarrow \begin{aligned} &(-1, -2, -3) \\ &(-1, -1, -1) \\ &(1, 3, 4) \end{aligned}$$