$$\hat{c}(x) = \underset{c \in \{c_1, c_2\}}{\operatorname{argmax}} \; p(c \mid x) \Rightarrow \hat{c}(x) = c_1, \text{ iff. } p(c_1 \mid x) \geq p(c_2)$$

$$\Leftrightarrow p(c_1 \mid x) \geq 1 - p(c_1 \mid x) \Rightarrow 2p(c_1 \mid x) \geq 1 \Rightarrow p(c_1 \mid x) \geq \frac{1}{2}.$$

(assuming equal cost for misclassification errors, fp as costly as a fn).

$$h_n = t_n \Leftrightarrow \frac{1}{1 + e^{-w^T x_n}} = 1 \Rightarrow e^{-w^T x_n} = 0 \Rightarrow w^T \underline{\underline{x_n}} = +\infty \Rightarrow$$

$t_n \to 1$

$\hookrightarrow \sigma(w^T x_n)$

$$\|w\| = +\infty$$

$$p(C_k \mid x_n) = \frac{e^{w_k^T x_n - c_n}}{\sum_{j=1}^{K} e^{w_j^T x_n - c_n}} = \frac{e^{w_k^T x_n} / \cancel{e^{c_n}}}{\sum_{j=1}^{K} e^{w_j^T x_n} / \cancel{e^{c_n}}} = \ldots$$

let $c_n = \max\limits_{j=1..K} w_j^T x_n$

K classes

$w_k^T x_n$

$$\underbrace{w_1^T x_n}_{z_1}, \underbrace{w_2^T x_n}_{z_2}, \ldots, \underbrace{w_K^T x_n}_{z_K}$$

$$\vec{z} = [z_1, \ldots, z_K]$$

$$\Big\downarrow \text{softmax}$$

$$\vec{p} = [p_1, \ldots, p_K]$$

$\vec{p} = \text{softmax}(\vec{z})$

$\text{softmax} : \mathbb{R}^K \longrightarrow [0, 1]^K$

$$p_k = \frac{e^{z_k}}{Z(x)}$$

$$Z(x) \hookrightarrow \sum_{j=1}^{K} e^{z_j}.$$

$[-3, +4, -2, +2, +3.5]$ $\quad K = 6$

$[\quad 0.75 \quad \ldots \quad 0.20 \quad]$