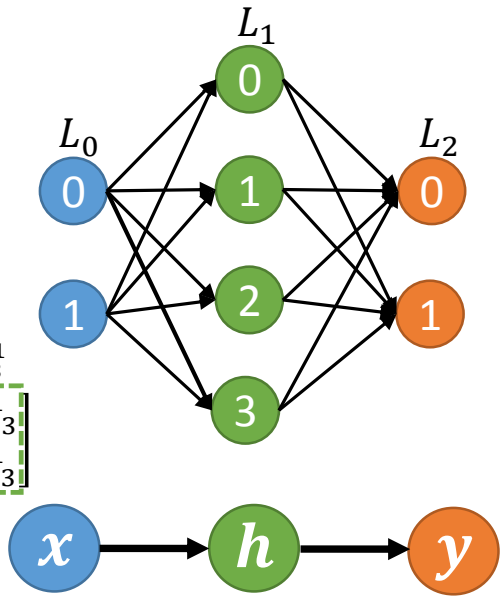
# Backpropagation [2|4|2] Cheatsheet

**Función de activación (logsig)**

$$f(net) = \frac{1}{1 + e^{-net}}$$

**Derivada de la función de activación**

$$\frac{df(net)}{dnet} = f(net)(1 - f(net))$$




Número de neurona de destino (capa $L$)

Número de neurona de origen (capa $L-1$)

$$W^L: w_{ij}^L$$

$$W^1 = \begin{matrix} N_0^1 & N_1^1 & N_2^1 & N_3^1 \end{matrix} \begin{bmatrix} w_{00}^1 & w_{01}^1 & w_{02}^1 & w_{03}^1 \\ w_{10}^1 & w_{11}^1 & w_{12}^1 & w_{13}^1 \end{bmatrix}$$

$$W^2 = \begin{matrix} N_0^2 & N_1^2 \end{matrix} \begin{bmatrix} w_{00}^2 & w_{01}^2 \\ w_{10}^2 & w_{11}^2 \\ w_{20}^2 & w_{21}^2 \\ w_{30}^2 & w_{31}^2 \end{bmatrix}$$

$$\boldsymbol{h = f\left(W^{1^T} \cdot x + b^1\right)}$$

$$\boldsymbol{y = f\left(W^{2^T} \cdot h + b^2\right)}$$

$$\boldsymbol{net^1} = \begin{matrix} N_0^1 \\ N_1^1 \\ N_2^1 \\ N_3^1 \end{matrix} \begin{bmatrix} w_{00}^1 & w_{10}^1 \\ w_{01}^1 & w_{11}^1 \\ w_{02}^1 & w_{12}^1 \\ w_{03}^1 & w_{13}^1 \end{bmatrix} \begin{bmatrix} x_0 \\ x_1 \end{bmatrix} + \begin{bmatrix} b_0^1 \\ b_1^1 \\ b_2^1 \\ b_3^1 \end{bmatrix} = \begin{bmatrix} w_{00}^1 x_0 + w_{10}^1 x_0 + b_0^1 \\ w_{01}^1 x_0 + w_{11}^1 x_0 + b_1^1 \\ w_{02}^1 x_0 + w_{12}^1 x_0 + b_2^1 \\ w_{03}^1 x_0 + w_{13}^1 x_0 + b_3^1 \end{bmatrix}$$

$$\boldsymbol{net^2} = \begin{matrix} N_0^2 \\ N_1^2 \end{matrix} \begin{bmatrix} w_{00}^2 & w_{10}^2 & w_{20}^2 & w_{30}^2 \\ w_{01}^2 & w_{11}^2 & w_{21}^2 & w_{31}^2 \end{bmatrix} \begin{bmatrix} h_0 \\ h_1 \\ h_1 \\ h_3 \end{bmatrix} + \begin{bmatrix} b_0^2 \\ b_1^2 \end{bmatrix}$$

$\boldsymbol{t}$: arreglo *targets* ($k$ elementos)

$$S_j^L = \begin{cases} ((t_k)_i - y_i)\dfrac{df(net_i^2)}{dnet_i^2} & , \quad L = 2 \\ (W^2 \cdot S^2)_j \dfrac{df(net_i^1)}{dnet_i^1} & , \quad L = 1 \end{cases}$$

**Regla Delta generalizada**

$$w_{ij}^{2(nuevo)} = w_{ij}^{2(viejo)} + \alpha S_j^2 y_i$$

$$w_{ij}^{1(nuevo)} = w_{ij}^{1(viejo)} + \alpha S_j^1 p_{ki}$$

$P$: matriz de patrones de entrenamiento ($k$x2)

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