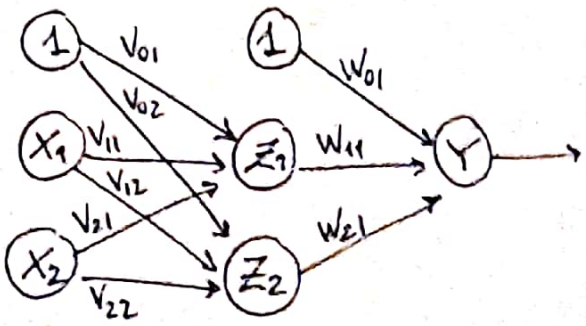
# 6. BACKPROPAGATION




$V_{01} = 2$ $\quad W_{01} = -0'8$

$V_{02} = -0'1$ $\quad W_{11} = -4'5$

$V_{11} = -2$ $\quad W_{21} = 5'3$

$V_{12} = 4'3$

$V_{21} = 9'2$

$V_{22} = 8'8$

Paso 3: activación neuronas entrada

$x_1 = 0$ , $x_2 = 1$

Paso 4: respuesta capa oculta

$$z\_in_1 = v_{01} + \sum_{i=1}^{2} x_i v_{i1} = 2 + 0 + 1.9'2 = 11'2 \Rightarrow z_1 = \sigma(11'2) \simeq 1$$

$$z\_in_2 = v_{02} + \sum_{i=1}^{2} x_i v_{i2} = -0'1 + 0 + 1.8'8 = 8'7 \Rightarrow z_1 = \sigma(8'7) \simeq 1$$

Paso 5: respuesta neurona salida

$$y\_in = w_{01} + \sum_{i=1}^{2} z_i w_{i1} = -0'8 + 1.(-4'5) + 1.5'3 = 0 \Rightarrow y = \sigma(0) = 0'5$$

Paso 6: retropopagación a capa oculta

$$\delta = (t - y)\,\sigma'(y\_in) = (1 - 0'50).\ 0'25 = 1/8$$

$$\Delta w_{j1} = \alpha . \delta . z_j \rightarrow \begin{cases} \Delta w_{01} = 0'25.\ 1/8\ . = 1/32 \\ \Delta w_{11} = 0'25.\ 1/8\ .\ 1 = 1/32 \\ \Delta w_{21} = 0'25.\ 1/8\ .\ 1 = 1/32 \end{cases}$$

Paso 7: retropropagación a capa entrada

$$\delta\_in_j = \delta . w_{j1} \rightarrow \begin{cases} \delta\_in_1 = 1/8\ .(-4'5) = -0'563 \\ \delta\_in_2 = 1/8\ .\ 5'3 = 0'663 \end{cases}$$

$$\delta_j = \delta\_in_j .\ \sigma'(z\_in_j) \rightarrow \begin{cases} \delta_1 = -0'563 \cdot 0 = 0 \\ \delta_2 = 0'663 \cdot 0 = 0 \end{cases}$$

$$\Delta v_{ij} = \alpha\, \delta_j x_i \Longrightarrow \begin{array}{ll} \Delta v_{01} = 0 & \Delta v_{12} = 0 \\ \Delta v_{02} = 0 & \Delta v_{21} = 0 \\ \Delta v_{11} = 0 & \Delta v_{22} = 0 \end{array}$$

Paso 8: actualización de pesos:

$$W_{j1} = W_{j1} + \Delta W_{j1}$$

$$\boxed{\begin{aligned} W_{01} &= -0'8 + 1/32 = -0'77 \\ W_{11} &= -4'5 + 1/32 = -4'47 \\ W_{12} &= 5'3 + 1/32 = 5'33 \end{aligned}}$$

$$V_{ij} = V_{ij} + \underbrace{\Delta V_{ij}}_{=0 \ \forall i,j}$$

$$\Rightarrow \boxed{V_{ij} = V_{ij}}$$