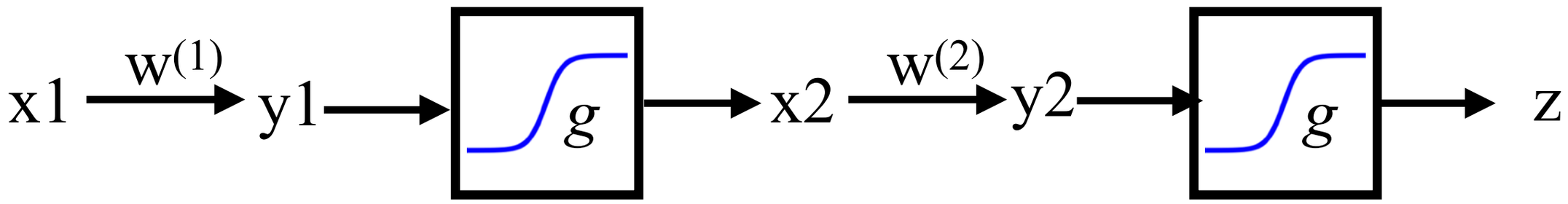
Forward-Feed, Multi-layer Artificial Neural Network

Forward-feed, Two-layer, One-input-one-output ANN

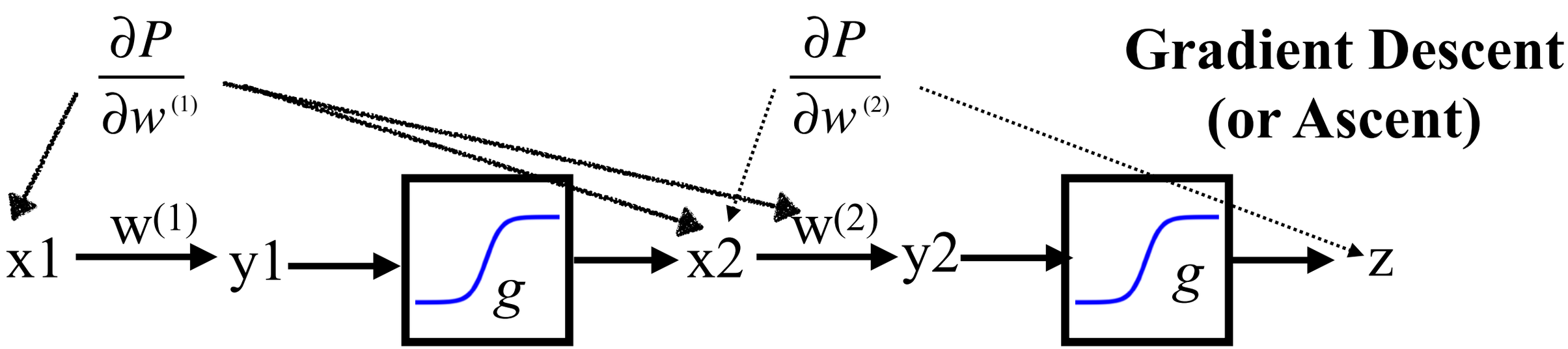
Graphic Representation:



g = “activation function”, “thresholding”

Mathematical statement:

$$z = g(w^{(2)} g(w^{(1)} x_1))$$

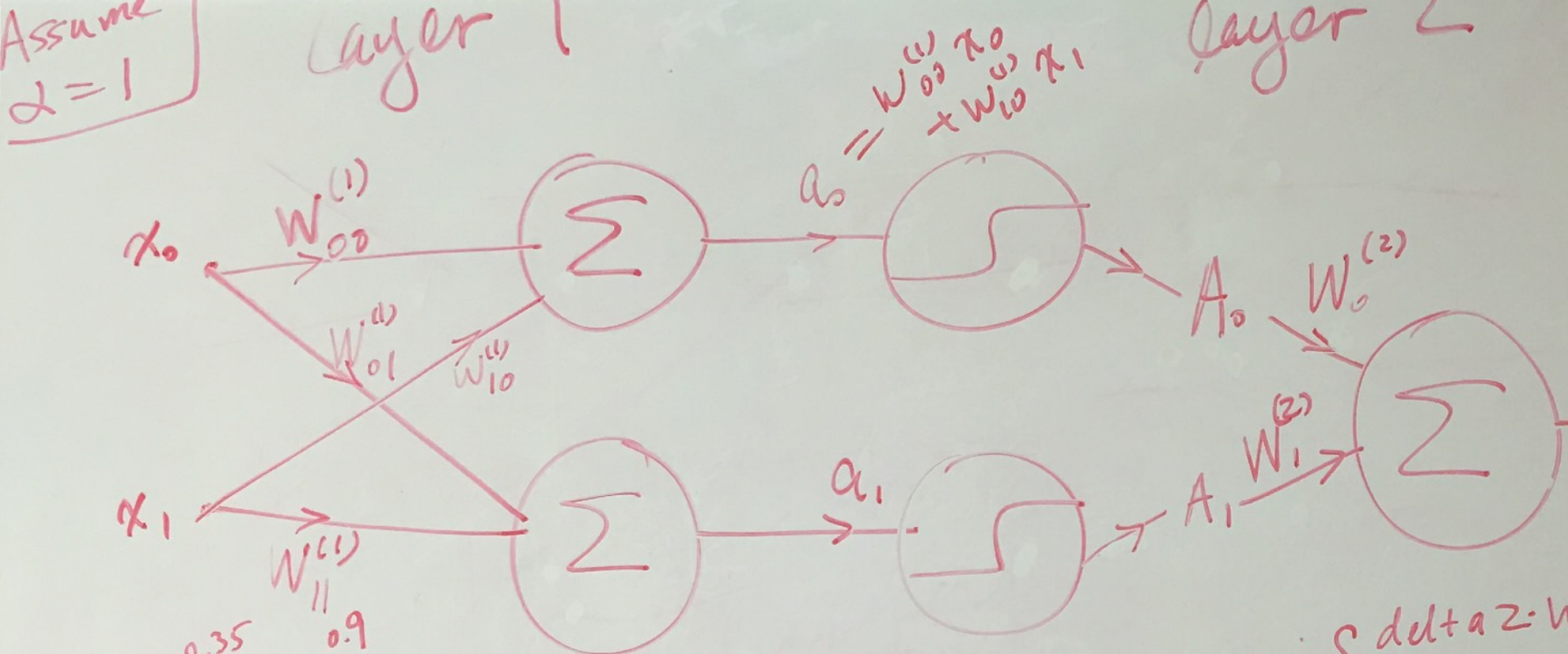


(Referring back to Week5-1 slides)

$$\frac{\partial P}{\partial w^{(2)}} = (d-z)z(1-z)x_2 = (d-z)g'(z)x_2$$

$$\frac{\partial P}{\partial w^{(1)}} = (d-z)g'(z)w^{(2)}g'(x_2)x_1$$

g: activation function, or
the threshold function



This is an outer product

Backpropagation based on:

Forward-feed, two-layer, two-input-one-output ANN:

$$z = g\left(\sum_h w_h^{(2)} g\left(\sum_j w_{j,h}^{(1)} x_j\right)\right)$$

$$\frac{\partial P}{\partial w^{(2)}} = (d-z)z(1-z)x_2 = \underbrace{(d-z)g'(z)}_{\texttt{Delta2}} x_2$$

$$\frac{\partial P}{\partial w^{(1)}} = \overbrace{\underbrace{(d-z)g'(z)}_{\texttt{Delta2}} w^{(2)} g'(x_2)}^{\texttt{Delta1}} x_1$$

Changing Notations

Data: X

x_0	x_1	y
0	0	1
0	1	0
1	0	0
1	1	0

Target: $d \rightarrow y$

$$\text{error} = (d - z) \rightarrow (y - z)$$