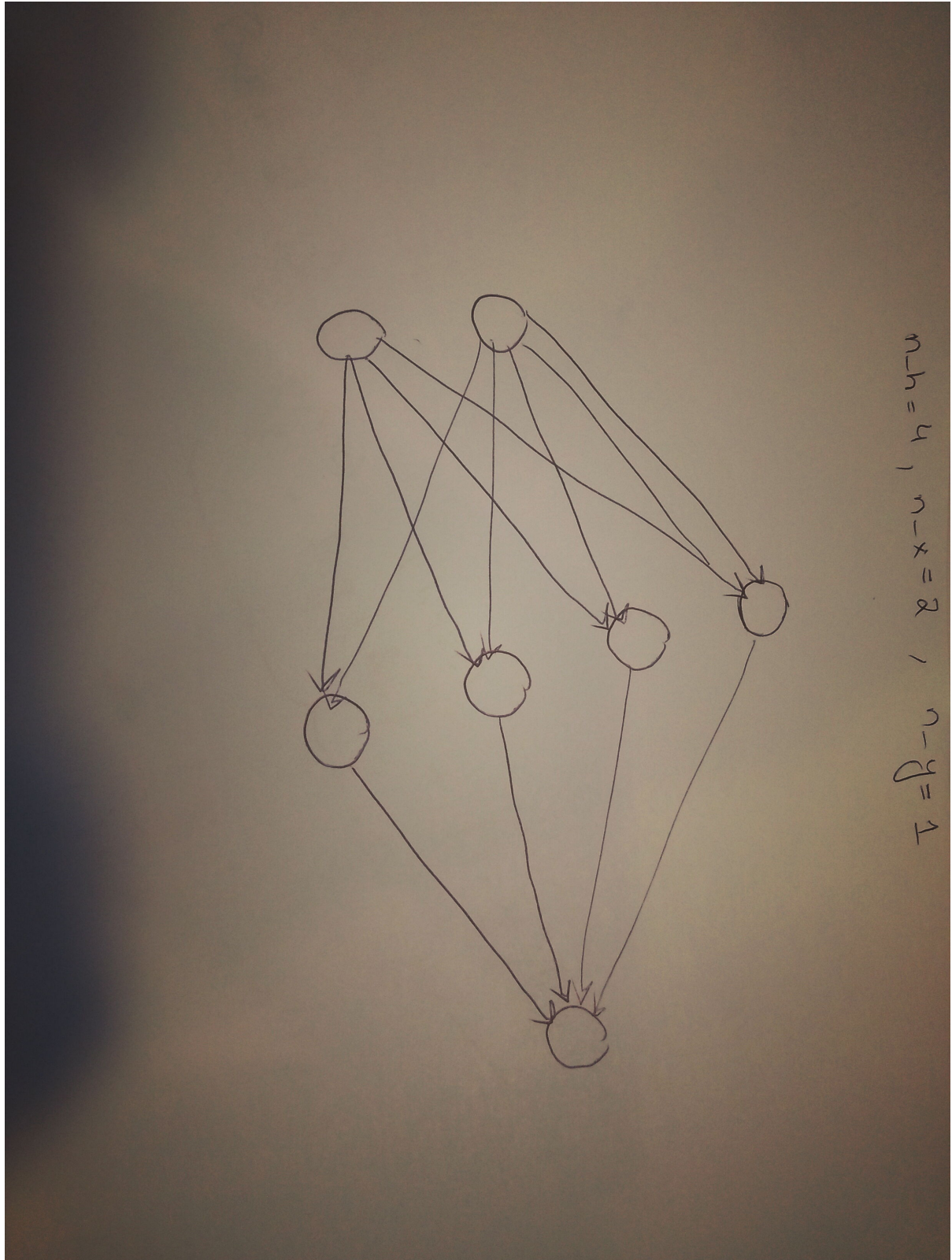


FORWARD/BACK PROPAGATION ON A 2 LAYERED SHALLOW NEURAL NETWORK (PLANAR DATA SET FROM SCIKIT LEARN)



$$w_1 = (4, 2)$$

$$n-x=2, n-h=4, n-y=1$$

$$w_2 = (1, 4)$$

$$x = (2, 400)$$

$$b_1 = (4, 1)$$

$$y = (1, 400)$$

$$b_2 = (1, 1)$$

Forward prop

$$z_1 = w_1 \cdot x + b_1 = (4, 400)$$

$$A_1 = \sigma(z_1) = (4, 400)$$

$$z_2 = w_2 \cdot A_1 + b_2 = (1, 400)$$

$$A_2 = \sigma(z_2) = (1, 400)$$

Back propagation

$$J = -\frac{1}{m} \sum_{i=1}^m \underbrace{y \cdot \log(A_2) + (1-y) \log(1-A_2)}_{(1,400) \quad (1,400) \quad (1,400)}$$

$$\frac{dJ}{dz_2} = \frac{1}{A_2} g'(z_2) - \frac{(y-1)}{(-1+A_2)} g'(z_2)$$

$$\frac{dJ}{dz_2} = \frac{y}{A_2} g'(z_2) - \frac{(1-y)}{(1-A_2)} g'(z_2)$$

$$\frac{(1-A_2) - (1-y)A_2}{A_2(1-A_2)} g'(z_2) \Rightarrow y - A_2 \Rightarrow A_2 y$$

$$dz_2 = A_2 - Y_{(1,400)} - (1,400)$$

$$dw_2 = +\frac{1}{m} \frac{A_2 - Y_{(1,400)}}{(1,400)} \cdot A_{[1]T}^{(4,400)} = (1,4) \checkmark$$

$$db_2 = \frac{1}{m} \sum_{(1,400)} dz_2 \rightarrow (400,4) \rightarrow (1,1)$$

$$dz_1 = dz_2 \cdot w_2 \delta'(z_1)$$

$$\begin{matrix} dz_2 & w_2 & \delta'(z_1) \rightarrow \\ (1,400) & (1,4) & (4,400) \end{matrix}$$

$$dz_1 = w_2 \cdot dz_2 \cdot \delta'(z_1) \quad (4,400)$$

$$\begin{aligned} dw_1 &= dz_1 \cdot X^T \\ db_1 &= \frac{1}{m} \sum_{(4,400)} \delta'(z_1) \text{ keep dimension} \end{aligned}$$