

WEEK 4

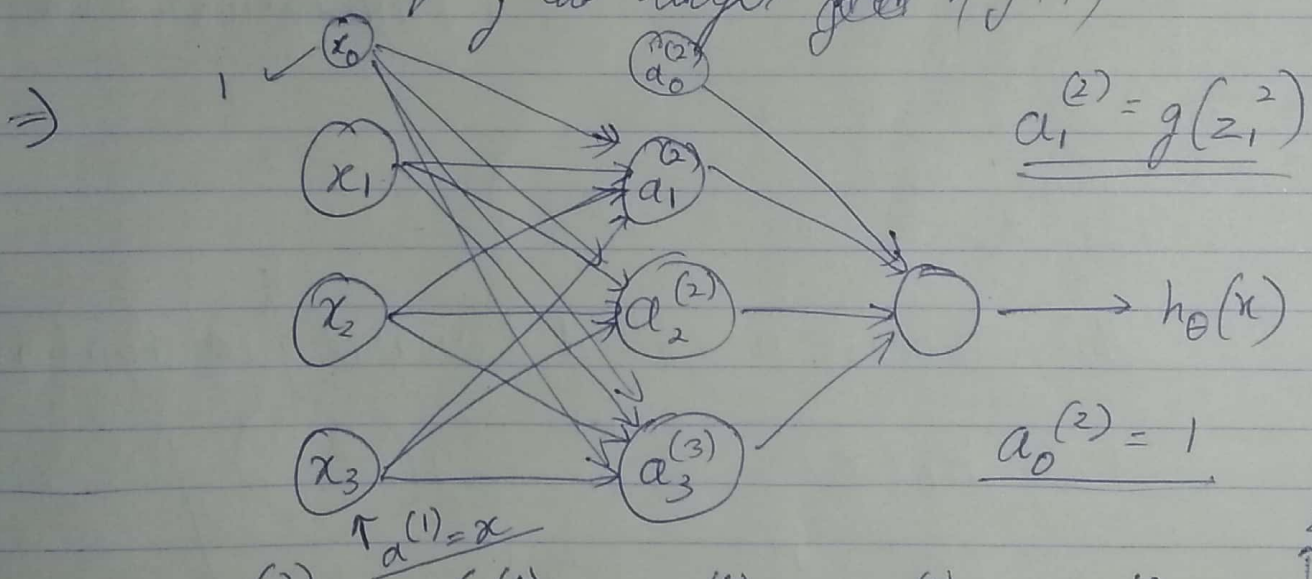
⇒ When n is very big, linear & logistic regression models cannot be used.
 ∴ We use neural networks.

⇒ x_0 node is called bias unit, its value is 1

⇒ Terms —

$a_i^{(j)}$ ⇒ activation of unit i in layer j → neuron

$\theta^{(j)}$ ⇒ matrix of weights controlling function mapping from layer j to layer $j+1$



$$a_1^{(2)} = g(\theta_{10}^{(1)} x_0 + \theta_{11}^{(1)} x_1 + \theta_{12}^{(1)} x_2 + \theta_{13}^{(1)} x_3)$$

$$a_2^{(2)} = g(\theta_{20}^{(1)} x_0 + \theta_{21}^{(1)} x_1 + \theta_{22}^{(1)} x_2 + \theta_{23}^{(1)} x_3)$$

$$a_3^{(2)} = g(\theta_{30}^{(1)} x_0 + \theta_{31}^{(1)} x_1 + \theta_{32}^{(1)} x_2 + \theta_{33}^{(1)} x_3)$$

$$h_{\theta}(x) = a_1^{(3)} = g(\theta_{10}^{(2)} a_0^{(2)} + \theta_{11}^{(2)} a_1^{(2)} + \theta_{12}^{(2)} a_2^{(2)} + \theta_{13}^{(2)} a_3^{(2)})$$

\Rightarrow If the network has s_j units in layer j and s_{j+1} units in layer $j+1$, then $\theta^{(j)}$ will be of dimension $s_{j+1} \times (s_j + 1)$
 \therefore the earlier example's matrix will be 3×4

$$\Rightarrow x = \begin{bmatrix} x_0 \\ x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad z^{(2)} \Rightarrow \begin{bmatrix} z_1^{(2)} \\ z_2^{(2)} \\ z_3^{(2)} \end{bmatrix}$$

$$\Rightarrow z^{(2)} = \theta^{(1)} x \quad (\text{as evident})$$

$$\Rightarrow a^{(2)} = g(z^{(2)}) \quad (\text{Feed Forwarding})$$

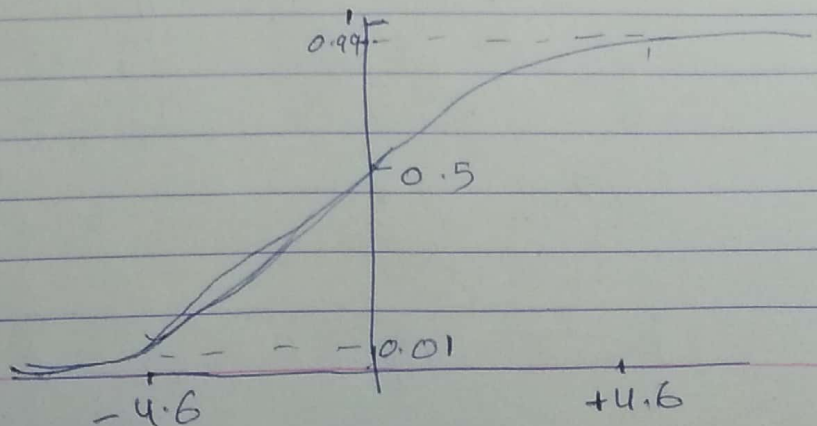
$$\Rightarrow z^{(3)} = \theta^{(2)} a^{(2)}$$

$$\Rightarrow h_\theta(x) = a^3 = g(z^{(3)})$$

This process is called Forward propagation

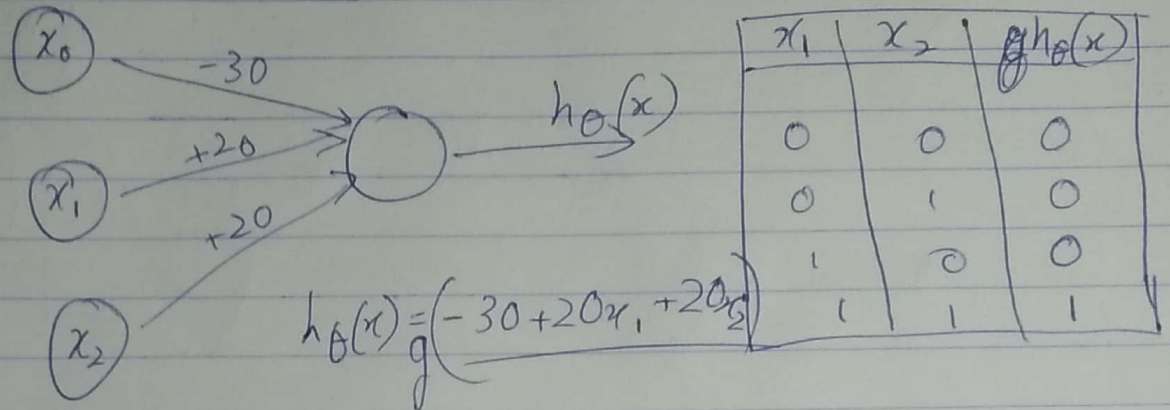
$$\therefore \begin{aligned} h_\theta(x) &= a^{(j+1)} = g(z^{(j+1)}) \\ z^{(j+1)} &= \theta^{(j)} a^{(j)} \end{aligned}$$

\Rightarrow Sigmoid $f^n \Rightarrow$

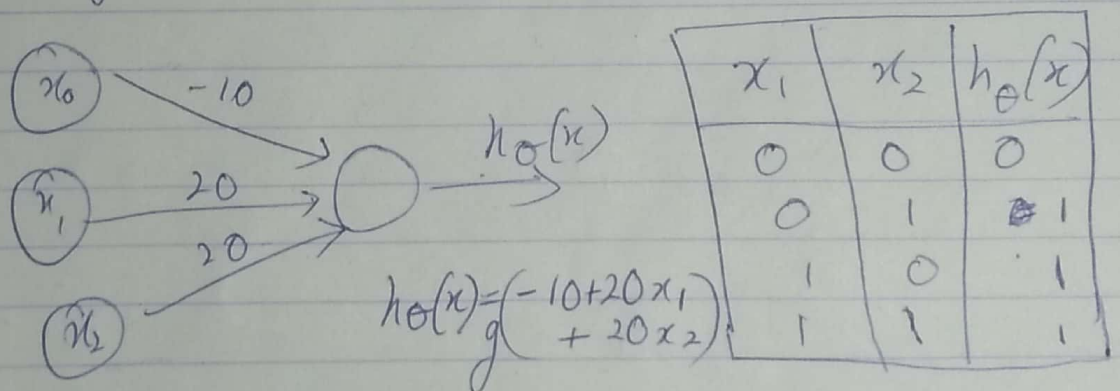


⇒ AND gate

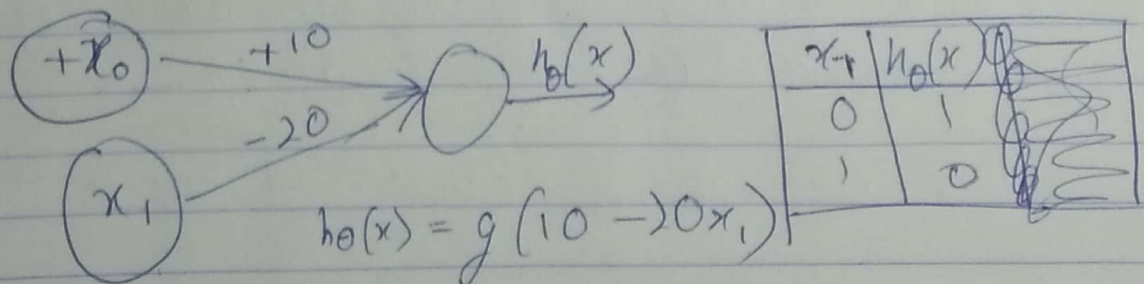
using
(Sigmoid f^n)



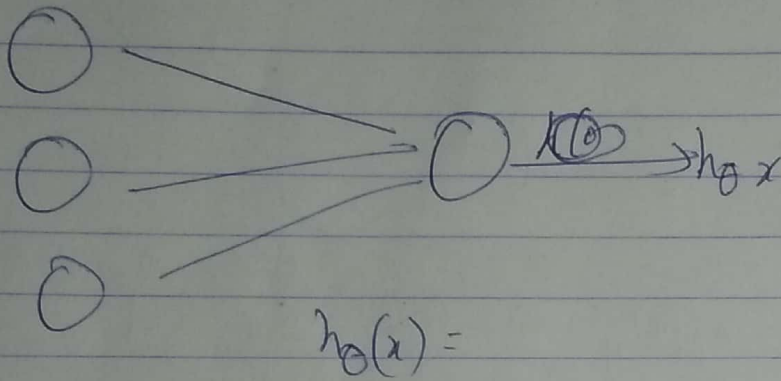
⇒ OR gate



⇒ NOT gate

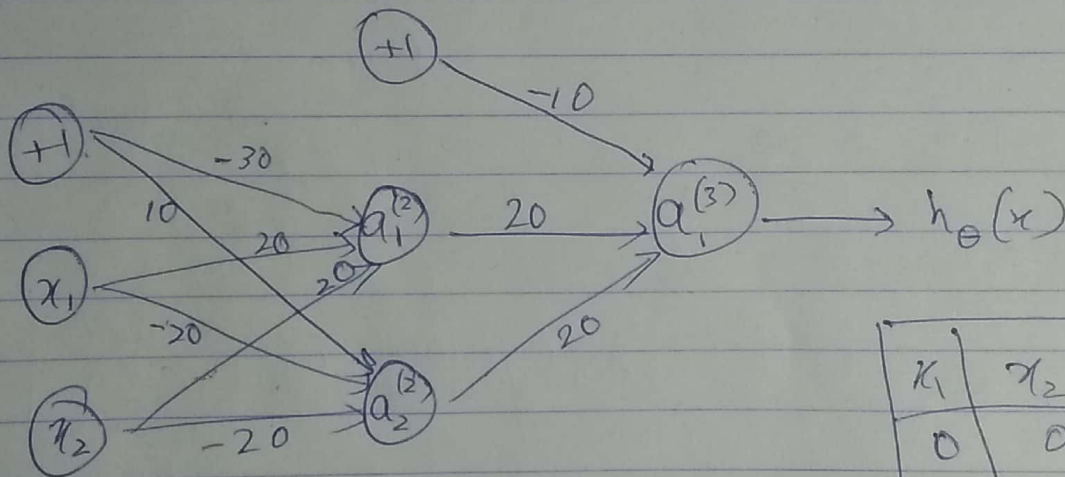


$\Rightarrow (\text{NOT } x_1) \text{ AND } (\text{NOT } x_2)$



x_1	x_2	$h_0(x)$
0	0	1
0	1	0
1	0	0
1	1	0

\Rightarrow XNOR gate



x_1	x_2	$h_0(x)$
0	0	0
1	0	1
0	1	1
1	1	0

\Rightarrow hand writing digit recognition comes under multi class classification.

There are 10 classes of digits.