

Machine Learning

# Neural Networks: Representation

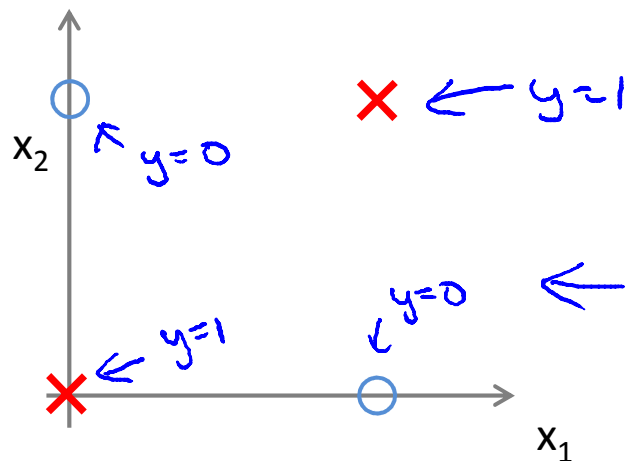
---

## Examples and intuitions I

# Non-linear classification example: XOR/XNOR

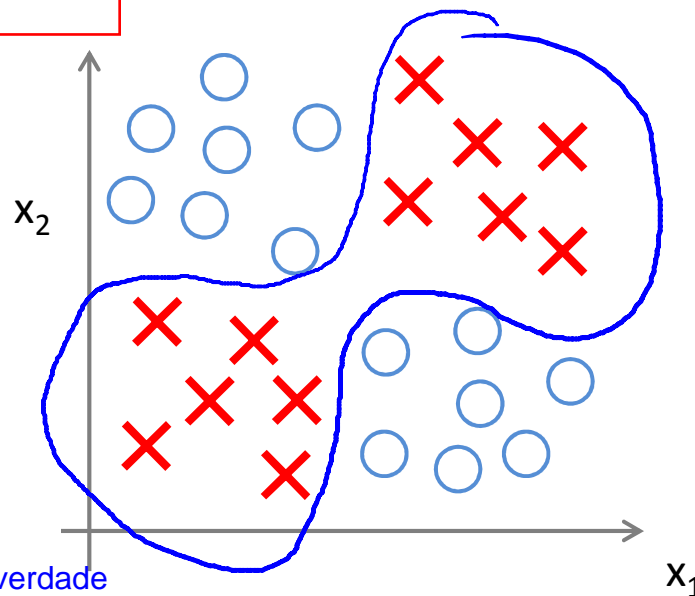
→  $x_1, x_2$  are binary (0 or 1).

o exemplo esq é parecido ao da direita



$$y = x_1 \text{ XOR } x_2 \text{ so e verdade se 2 forem verdade}$$

$$\begin{aligned} & \rightarrow x_1 \text{ XNOR } x_2 \leftarrow \\ & \rightarrow \text{NOT } (x_1 \text{ XOR } x_2) \end{aligned}$$



queremos uma decision boundary que respeite estes dados

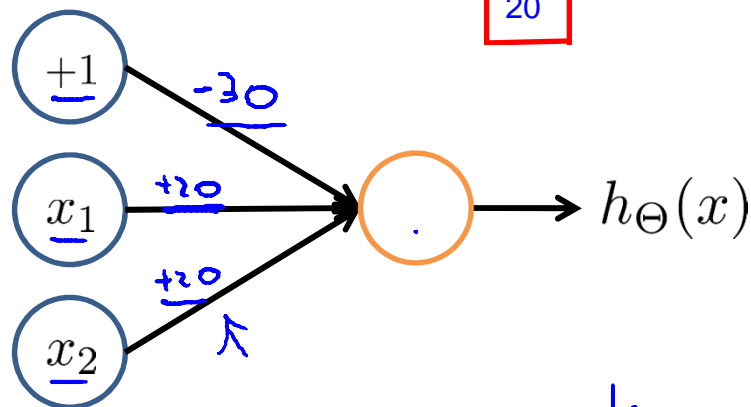
# Simple example: AND

easy

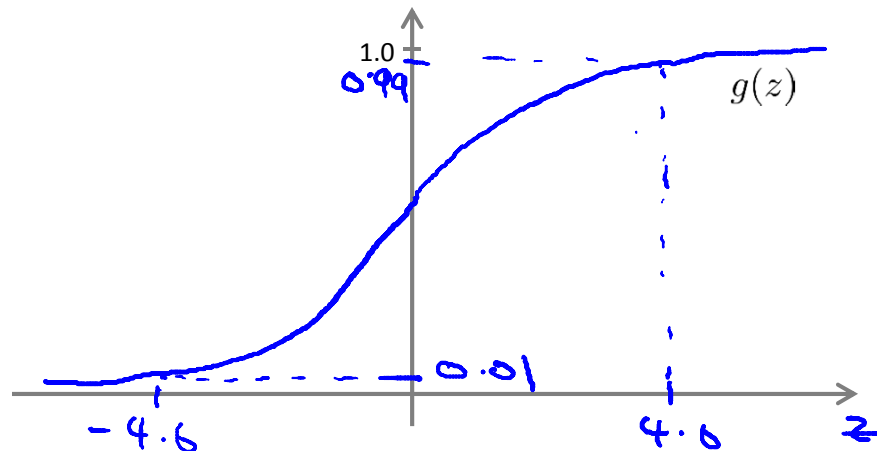
$\rightarrow x_1, x_2 \in \{0, 1\}$

$\rightarrow y = x_1 \text{ AND } x_2$

theta1
-30
20
20



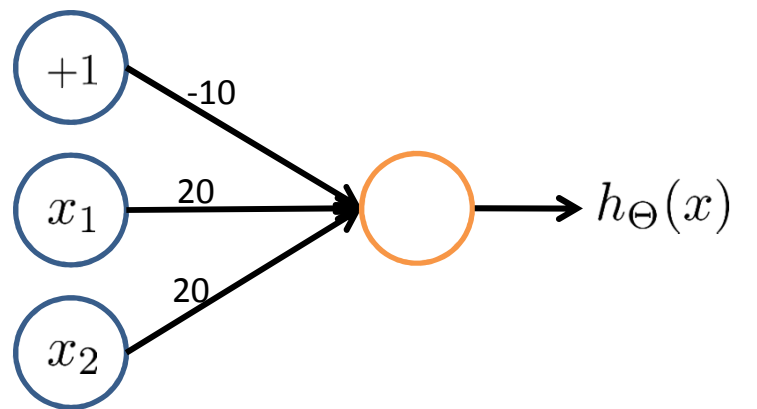
$$\rightarrow h_{\Theta}(x) = g\left(\underbrace{-30}_{\Theta_{10}^{(1)}} + \underbrace{20}_{\Theta_{11}^{(1)}}x_1 + \underbrace{20}_{\Theta_{12}^{(1)}}x_2\right)$$



$x_1$	$x_2$	$h_{\Theta}(x)$
0	0	$g(-30) \approx 0$
$\rightarrow 0$	1	$g(-10) \approx 0$
1	0	$g(-10) \approx 0$
$\rightarrow 1$	1	$g(10) \approx 1$

$h_{\Theta}(x) \approx x_1 \text{ AND } x_2$

## Example: OR function



$$g(-10 + 20x_1 + 20x_2)$$

$x_1$	$x_2$	$h_{\Theta}(x)$
0	0	$g(-10) \approx 0$
0	1	$g(10) \approx 1$
1	0	$\approx 1$
1	1	$\approx 1$

