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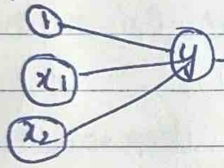
(41) Truth table for 'OR' pair of boolean variables

x_1	x_2	t
1	1	1
1	-1	1
-1	1	1
-1	-1	-1

Perception Network:



$$\rightarrow y = F(y_{in}) = \begin{cases} 1 & y_{in} > 0 \\ 0 & y_{in} = 0 \\ -1 & y_{in} < 0 \end{cases}$$

Let initial weights and constants $b = 0$

$w_1 = w_2 = b = 0$

First input perception $\Rightarrow \begin{bmatrix} x_1 & x_2 & t \\ 1 & 1 & 1 \end{bmatrix}$

$\therefore y_{in} = b + w_1 x_1 + w_2 x_2$

$= 0 + 0(1) + 0(1) = 0$

$y = f(y_{in}) = 0$

since $y \neq t$

we need to update weights

$w_i(new) = w_i(old) + \alpha t x_i$

where α is learning rate,

here $\alpha = 1$

$w_1(new) = 0 + (1)(1)(1)$

$= 1$

$w_2(new) = 0 + (1)(1)(1)$

$= 1$

$b(new) = b(old) + \alpha t$

$= 1$

$w_1 = w_2 = b = 1$

Second input $\rightarrow$ $\begin{array}{ccc} x_1 & x_2 & t \\ \end{array}$ $[1, -1, -1]$

$$\begin{aligned} y_{in} &= b + w_1(x_1) + w_2(x_2) \\ &= 1 + w_1(x_1) + 1(-1) \\ &= 1 + 1(1) + 1(-1) \\ &= 1 \end{aligned}$$

$y_{in} = t$

No need to change weights

so, $w_1 = w_2 = b = 1$

Third input $\rightarrow$ $\begin{array}{ccc} x_1 & x_2 & t \\ \end{array}$ $[-1 \quad 1 \quad +1]$

$$\begin{aligned} y_{in} &= b + w_1(x_1) + w_2(x_2) \\ &= 1 + 1(-1) + 1(1) \\ &= 1 \end{aligned}$$

$y_{in} = t$

No need to change weights

Fourth input $= \begin{array}{ccc} x_1 & x_2 & t \\ \end{array}$ $[-1, -1, -1]$

$$\begin{aligned} y_{in} &= b + w_1(x_1) + w_2(x_2) \\ &= 1 + (1)(-1) + 1(-1) \\ &= -1 \end{aligned}$$

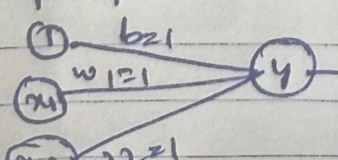
$y_{in} = t$

No need to update weights

The final weights

$w_1 = 1, \; w_2 = 1 \; b = 1$

The perception network becomes,



$$y = f(y_{in}) = \begin{cases} 1 & y_{in} > 0 \\ 0 & y_{in} = 0 \\ -1 & y_{in} < 0 \end{cases}$$