8/Nov/2021

eg Implement the AND function for bipolar input and target using the perceptron algorithm?

Soln AND

x_1	x_2	t
0	0	0
1	0	0
0	1	0
1	1	1

Bipolar : $\{-1, +1\}$

input

target

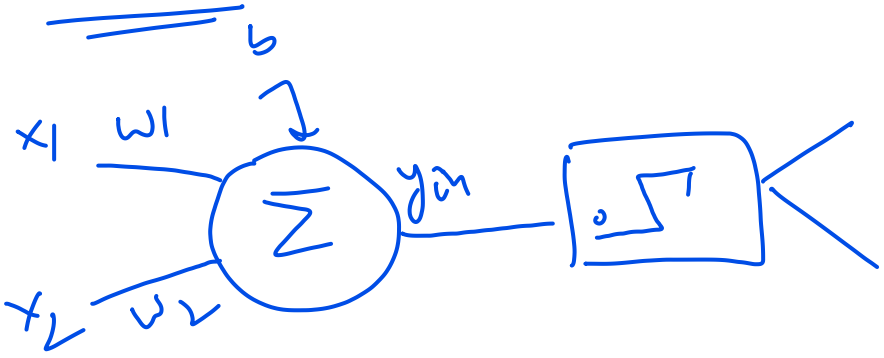
AND

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

Step 1 :- $w_1 = 0$ $b = 0$ $\theta = 0$

$w_2 = 0$ $\alpha = 1$

Step 2 :- $y_{in} = w_1 x_1 + w_2 x_2 + b$



	x_1	x_2	t	y_{in}	y	Δw_1	Δw_2	Δb	w_1	w_2	b
									0	0	0
I1	1	1	1	0	0	1	1	1	1	1	1
I2	1	-1	-1	1	1	-1	1	-1	0	2	0
I3	-1	1	-1	2	1	1	-1	-1	1	1	-1
I4	-1	-1	-1	-3	-1	0	0	0	1	1	-1

For I1

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

$= 0 + 0 x_1 + 0 x_2$

$= 0$

Step 3

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

$$= f(0) = 0$$

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

$y_{in} > \theta$

check target ~~&~~ predicted o/p

$$w_i^{new} = w_i^{old} + \underbrace{\alpha \cdot t \cdot x_i}_{\Delta w_i}$$

for ~~w1~~ w_1

$$\Delta w_1 = \alpha \cdot t \cdot x_1$$

$$= 1 \times 1 \times 1$$

$$= 1$$

$$\Delta w_2 = \alpha \cdot t \cdot x_2$$

$$= 1 \times 1 \times 1 = 1$$

$$\Delta b = \alpha \cdot t$$

$$= 1 \times 1 = 1$$

$$w_1^{new} = w_1^{old} + \Delta w_1$$

$$= 0 + 1$$

$$= 1$$

$$w_2^{new} = w_2^{old} + \Delta w_2$$

$$= 0 + 1$$

$$= 1$$

$$b^{new} = b^{old} + \Delta b$$

$$= 0 + 1$$

$$= 1$$

for I2 $x_1 = 1$, $x_2 = -1$, $t = -1$

$w_1 = 1$, $w_2 = 1$, $b = 1$

~~$y_{in} = x_1$~~

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

$$= 1 \times 1 + -1 \times 1 + 1$$

$$= 2 - 1 = 1$$

$$y = f(y_{in}) = f(1) = 1$$

if $t \neq y$ $(-1 \neq 1)$

$$\Delta w_1 = \alpha \cdot t \cdot x_1$$

$$= 1 \times (-1) \times (1)$$

$$= -1$$

$$\Delta w_2 = \alpha \cdot t \cdot x_2$$

$$= 1 \times (-1) \times (-1)$$

$$= 1$$

$$w_1^{new} = w_1^{old} + \Delta w_1$$

$$= 1 + (-1)$$

$$= 0$$

$$w_2^{new} = w_2^{old} + \Delta w_2$$

$$= 1 + 1$$

$$= 2$$

$$b^{new} = b^{old} + \alpha \cdot t$$

$$= 1 + 1 \times (-1$$

$$= 0$$

Iteration 1

Iteration 2

$w_1 = 1, \quad w_2 = 1, \quad b = -1$

x_1	x_2	t	y_{in}	y	Δw_1	Δw_2	Δb	w_1	w_2	b
1	1	+1	1	1	0	0	0	1	1	−1
1	−1	−1	−1	−1	0	0	0	1	1	−1
−1	1	−1	−1	−1	0	0	0	1	1	−1
−1	−1	−1	−3	−1	0	0	0	1	1	−1