CSC 578 Homework 1

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DSC-578 - Homework-1

Exercise 1: Design a two-input peaceptorn that implements boolean function $A \wedge \neg B$. Design two-layer network of perceptron that implement A XOR B.

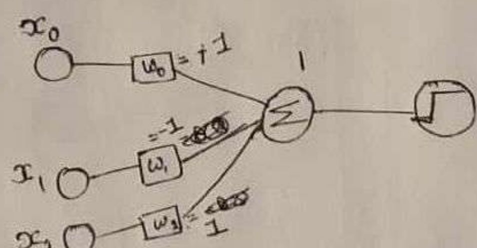
Ans →

So, there is

two inputs x_1 & x_2

& Constant input x_0

Likewise three weights w_0, w_1, w_2.



Rough work

AND Gate

A	B	A∧B
0	0	1
0	1	1
1	0	1
1	1	0

$A \wedge \neg B$

A	B	A∧¬B
1	1	-1
1	-1	1
-1	1	-1
-1	-1	-1

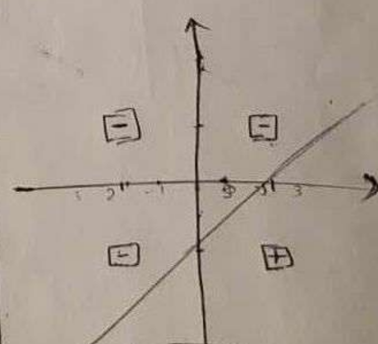


Fig. 1

∴ Fig 1: line intersects at A-Axis & B-Axis at (1, -1)

$$\frac{A-0}{1-0} = \frac{(B-(-1))}{(0-(-1))}$$

$$A/1 = \frac{B+1}{1}$$

$$A = B+1 \Rightarrow 1-A+B = 0$$

* two-layer perceptron (A XOR B):

where $-A \wedge B$

A	B	$A \wedge -B$	$-A \wedge B$	$(A \wedge -B) \vee (-A \wedge B)$
1	1	-1	-1	-1
1	-1	1	-1	1
-1	1	-1	1	1
-1	-1	-1	-1	-1

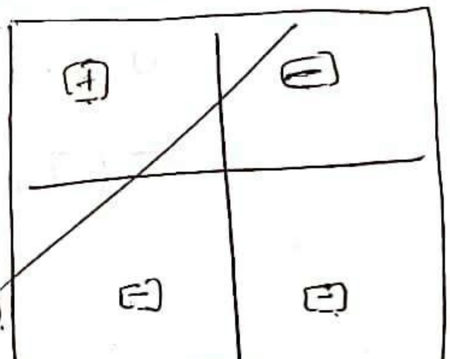


fig 2

* fig 2 line intersects A-Axis & B Axis at (-1,1)

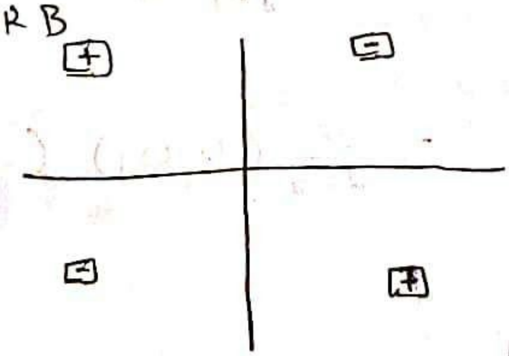
$$\frac{A-0}{-1-0} = \frac{B-1}{0-1}$$

$$\frac{A}{-1} = \frac{B-1}{-1}$$

$A = B-1 \Rightarrow -1-A+B = 0$

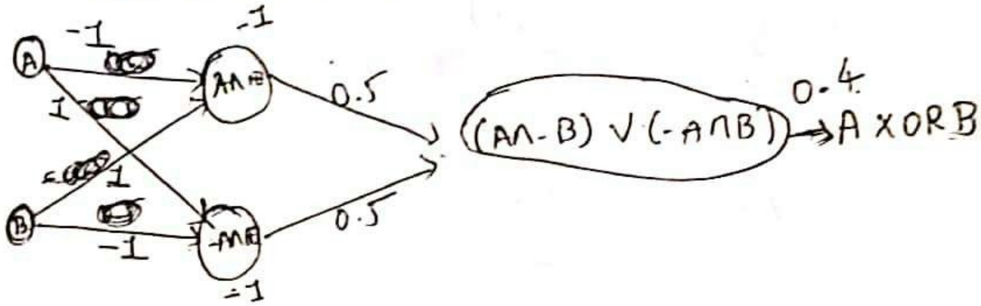
So, $w_0 = -1$
$w_1 = -1$
$w_2 = 1$

* For A XOR B



here you can see that this line are not linear or not separable.

Architecture on next page



Q=2 Derive gradient descent training rule for a single unit with output O, where

$$O = w_0 + w_1 x_1 + w_1 x_1^2 + \dots + w_0 x_n + w_n x_n^2$$

$$E(\vec{w}) = \frac{1}{2} \sum_{d \in D} (t_d - O_d)^2$$

$$= \frac{1}{2} \sum_{d \in D} \frac{\partial}{\partial w_i} (t_d - O_d)^2$$

$$= \sum_{d \in D} (t_d - O_d)$$

$$\frac{\partial}{\partial w_i} \left(t_d - (\vec{w}_0 + w_1 x_1 + w_1 x_1^2 + \dots w_n x_n + w_n x_n^2)\right)$$

$$= \sum_{d \in D} (t_d - O_d)\,(-x_n - x_n^2)$$