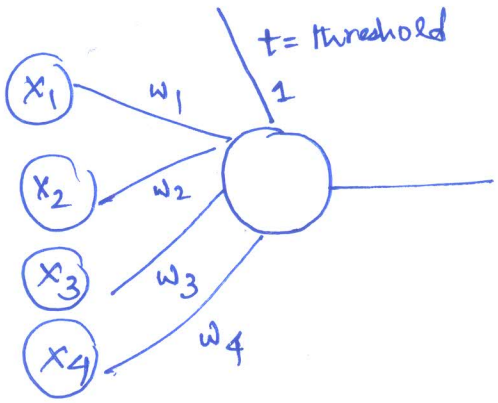
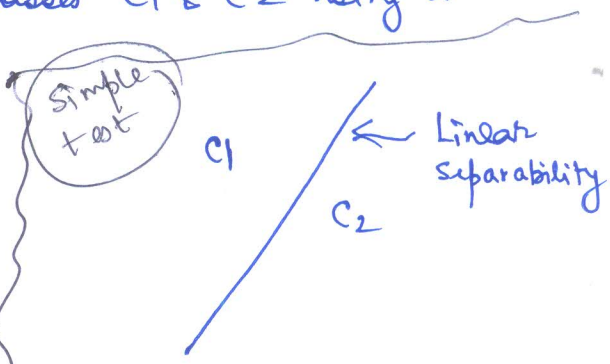
Consider the 2-class classification task that consists of the following:

C1 : [-1, -1], [-1, 1], [1, -1]

C2 : [1, 1]

Find the decision boundary b/w the two classes C1 & C2 using a single perceptron.





Consider the line $x+2y=4$
& the points (0,1), (1,0), (1,1)
(3,2), (4,3), (0,2)
Plug in the points & check if;
$x+2y-4<0$
& $x+2y-4>0$

options given:

(i) $x_1 - x_2 - 0.5 = 0$

(ii) $-x_1 + x_2 - 0.5 = 0$

(iii) $0.5(x_1+x_2) - 1.5 = 0$

(iv) $x_1 + x_2 - 0.5 = 0$

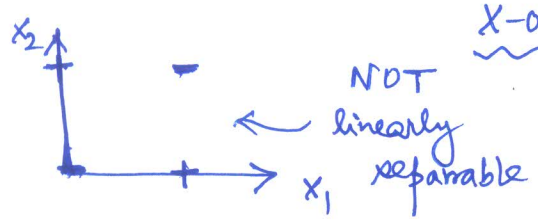
(i) $\underbrace{[1\ -1\ -0.5]}_{w_i}$; $\underbrace{[-1, -1, 1]}_{x}$ (bias)

$$[t, -1, -0.5]\begin{bmatrix}-1\\-1\\1\end{bmatrix} = -1+1-0.5 < 0$$

$$[1, -1, -0.5]\begin{bmatrix}-1\\1\\1\end{bmatrix} = -1-1-0.5 < 0 \quad \Rightarrow \text{not working}$$

$$[1, -1, -0.5]\begin{bmatrix}1\\-1\\1\end{bmatrix} = 1+1-0.5 > 0$$

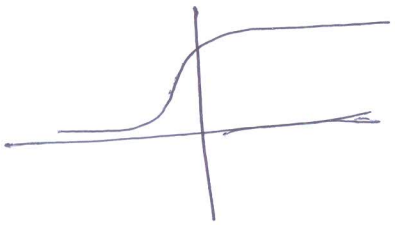
X-OR example:



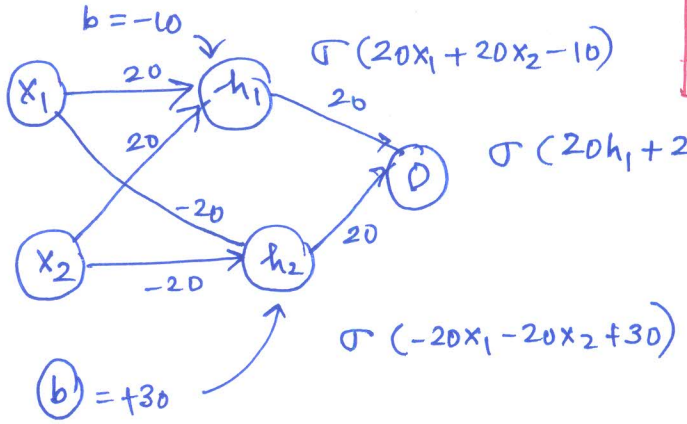
← Limitation of perceptron

0	0	0
1	1	1
1	0	1
1	1	0

Let's build a NN:



i/p



$(0,0)$: $O(h_1) = \sigma(20*0 + 20*0 - 10) \approx 0$
$O(h_2) = \sigma(-20*0 - 20*0 + 30) \approx 1$
} hidden layers $\Rightarrow \sigma(20*0 + 20*1 - 30) \approx 0$

$(1,1)$: $h_1 = \sigma(20*1 + 20*1 - 10) \approx 1$
$h_2 = \sigma(-20*1 + 20*1 + 30) \approx 0$
$\Rightarrow \sigma(20*1 + 20*0 - 30) \approx 0$

$(0,1)$: $h_1 = \sigma(20*0 + 20*1 - 10) \approx 1$
$h_2 = \sigma(-20*0 + 20*1 + 30) \approx 1$
$\Rightarrow \sigma(20*1 + 20*1 - 30) \approx 1$

$(1,0)$: $h_1 = \sigma(20*1 + 20*0 - 10) \approx 1$
$h_2 = \sigma(-20*1 + 20*0 + 30) \approx 1$
$\Rightarrow \sigma(20*1 + 20*1 - 30) \approx 1$

$h_1 \Rightarrow$ ~~logical OR~~
$h_2 \Rightarrow$

] logistic unit has an associated hyperplane. $\Rightarrow$ two hyperplanes in space ✓