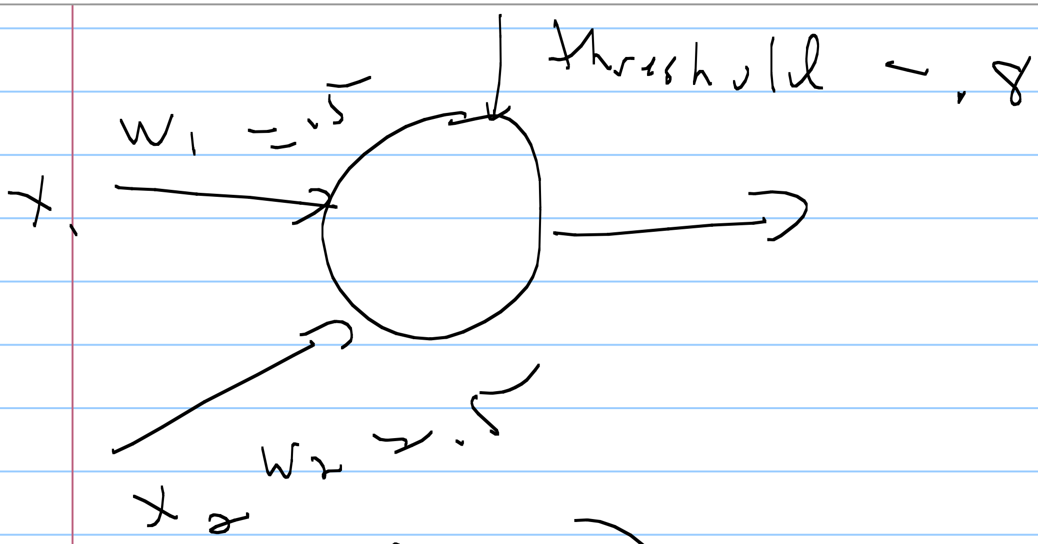
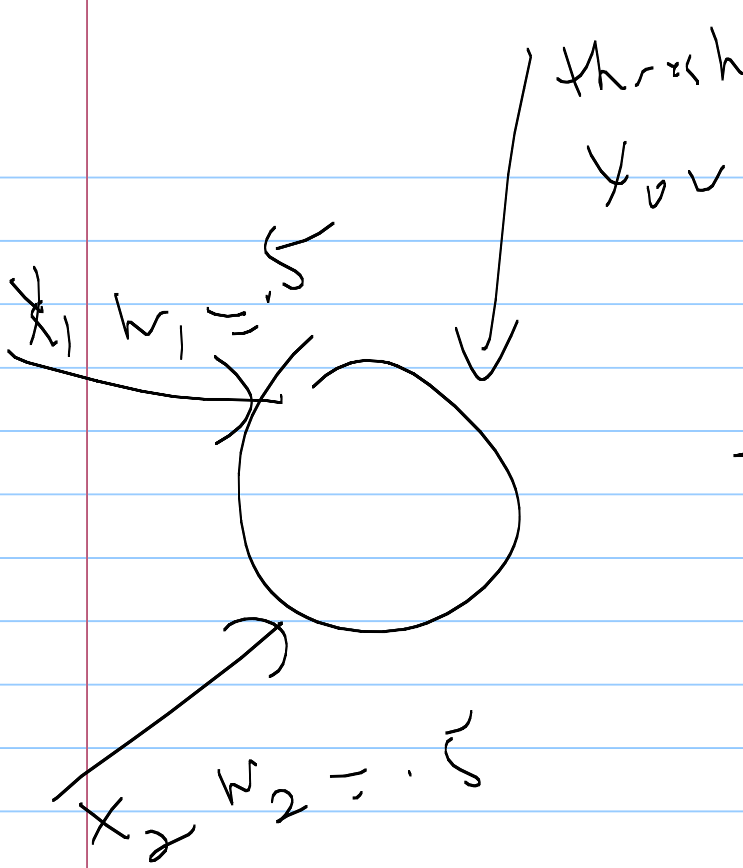
Perceptron Learning



AND

x_1 x_2	$x_1 w_1 + x_2 w_2 + x_0 w_0$	O
0 0	0 + 0 – .8	0
1 0	.5 + 0 – .8	0
0 1	0 + .5 + –.8	0
1 1	.5 + .5 + .8	1

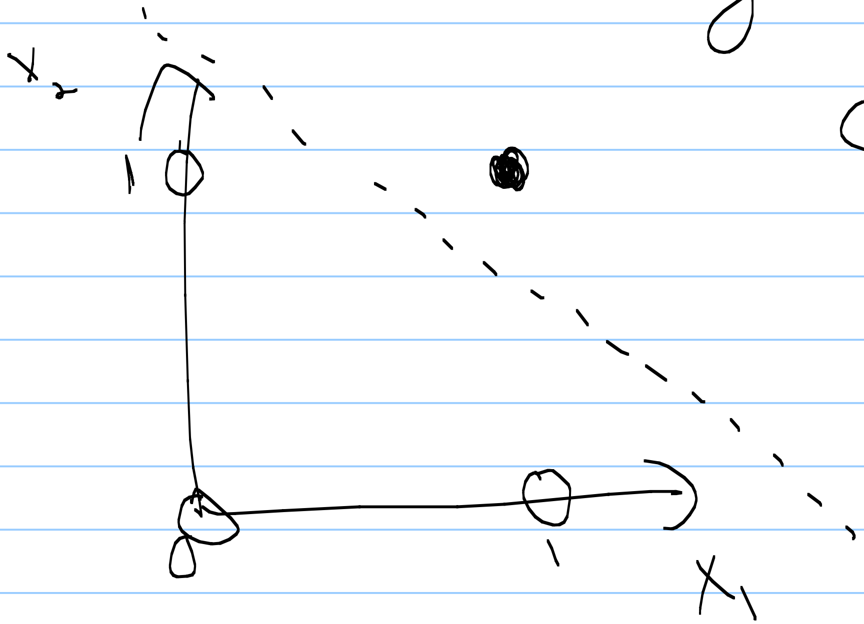


x_1	x_2	$w_1x_1 + w_2x_2 + w_0x_0$	Output
0	0	$0 + 0 - .3$	0
1	0	$.5 + 0 - .3$	1
0	1	$0 + .5 - .3$	1
1	1	$.5 + .5 - .3$	1

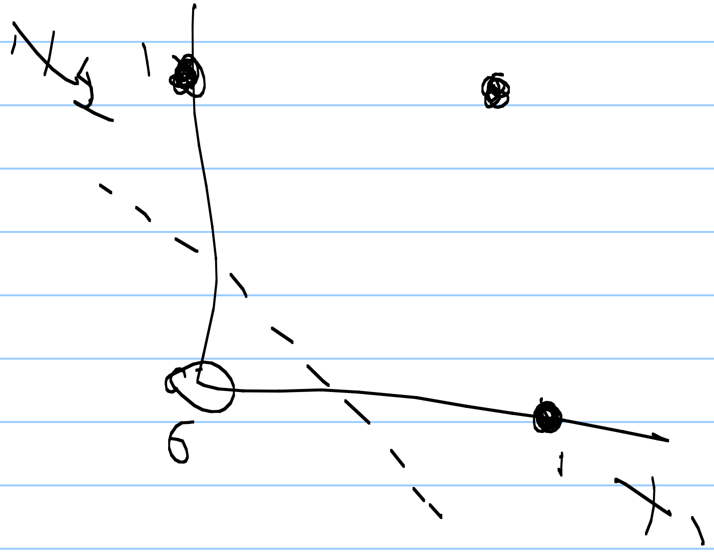
Linearly Separable Functions

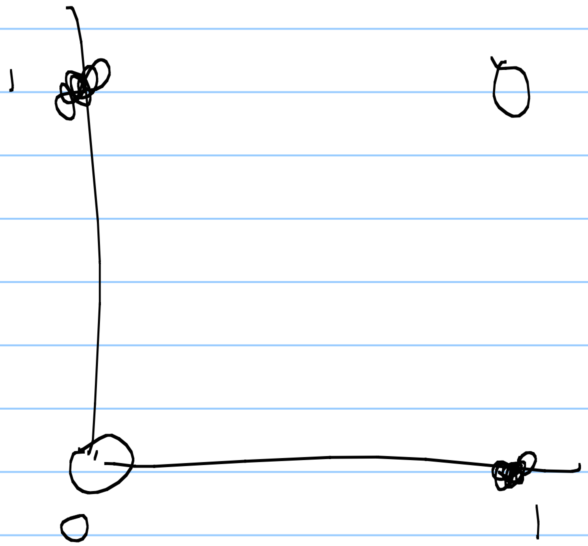
○ = 0 values

● = 1 value



AND

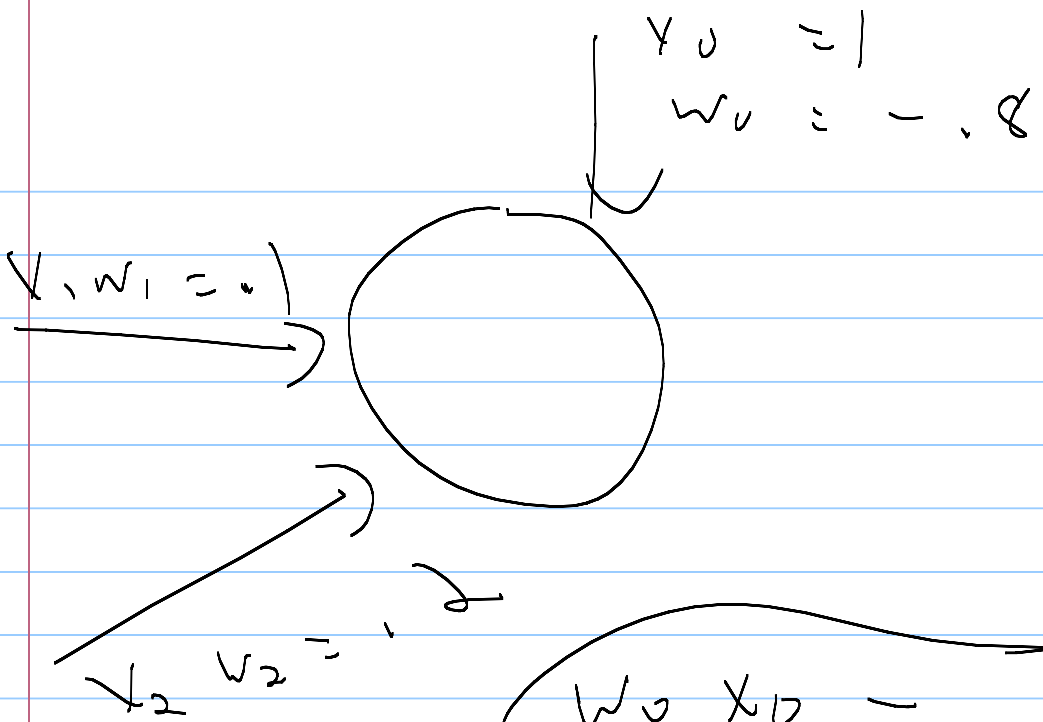




Not linearly separable

XOR

A single perceptron can only learn linearly separable functions



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

$w_0 x_0 = -.8$

x_1	x_2	w_1	w_2	$w_1 x_1 + w_2 x_2$	0
0	0	.1	.2	0 + 0	0
0	1	.1	.2	0 + .2	0
1	0	.1	.2	.1 + 0	0
1	1	.1	.2	.1 + .2	0

$w_i = w_i + \Delta w_i$

$\Delta w_i = \eta \, (t - o) \, x_i$

$\Delta w_1 = .1 \, (1 - 0) \, 1 = .1$

$w_1 = w_1 + \Delta w_1$

$= .1 + .1 = .2$

$\Delta w_2 = \eta \, (t - o) \, x_2$

$= .1 \, (1 - 0) \, 1 = .1$

$w_2 = w_2 + \Delta_2 = .2 + .1 = .3$

Repeat until everything
Classifying correctly

Gradient descent search