

Data Mining, CSCI 347, Fall 2019
Perceptron, Oct. 7

1. Hand execute the Perceptron algorithm on the following data. Each time that a new prediction is made, show the new line of that prediction, if possible, in order to visualize how the algorithm is working.

x1	x2	class
3	0	0
-2	-3	1
-1	2	0
-3	0	1
2	-2	1
5	-2	0

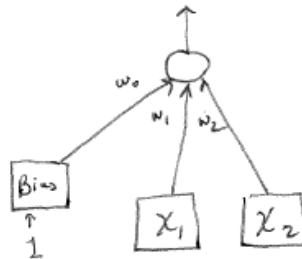
The Perceptron algorithm refers to the first and second class. Let 0 be the first class and 1 be the second class. (We could also do this letting 1 be the first class and 0 the second class.)

Overall, if the sum > 0 predict class 1 (0); else predict class 2 (1)

Perceptron Algorithm

1. Set all weights to zero
2. Until all instances in the training data are classified correctly
 - For each instance I in the training data,
 - If I is classified incorrectly by the perceptron {
 - If I belongs to the first class,
 - add it to the weight vector
 - else,
 - subtract it from the weight vector

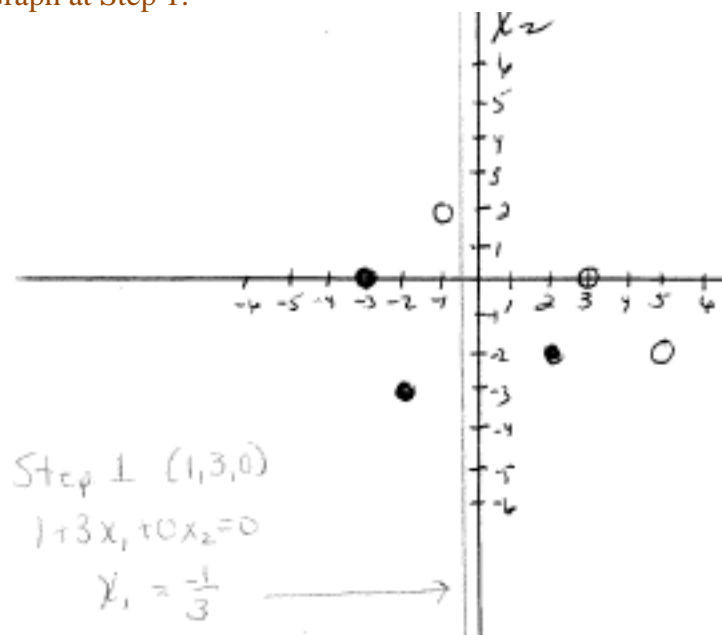
Perceptron:



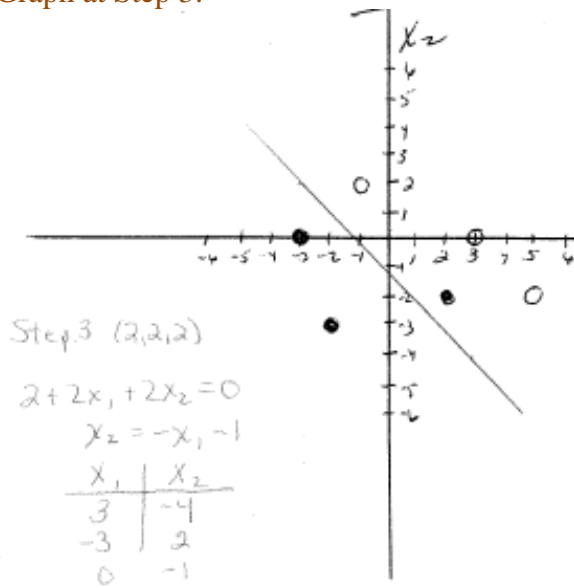
Instance	Weights	Prediction	Correct?	Update	Updated Weight
	(w_0, w_1, w_2)	$w_0 + w_1 * x_1 + w_2 * x_2$	Yes/No	Amt. to add	
1. 3 0 0	(0,0,0)	$0 + 0 * 3 + 0 * 0 = 0$	No	+(1,3,0)	(1,3,0)
2. -2 -3 1	(1,3,0)	$1 + 3 * -2 + 0 * -3 = -5$	Yes		
3. -1 2 0	(1,3,0)	$1 + 3 * -1 + 0 * 2 = -2$	No	+(1,-1, 2)	(2,2,2)
4. -3 0 1	(2,2,2)	$2 + 2 * -3 + 2 * 0 = -4$	Yes		
5. 2 -2 1	(2,2,2)	$2 + 2 * 2 + 2 * -2 = 2$	No	-(1,2,-2)	(1,0,4)
6. 5 -2 0	(1,0,4)	$1 + 0 * 5 + 4 * -2 = -7$	No	+(1,5,-2)	(2,5,2)
7. 3 0 0	(2,5,2)	$2 + 5 * 3 + 2 * 0 = 17$	Yes		
8. -2 -3 1	(2,5,2)	$2 + 5 * -2 + 2 * -3 = -14$	Yes		
9. -1 2 0	(2,5,2)	$2 + 5 * -1 + 2 * 2 = 4$	Yes		
10. -3 0 1	(2,5,2)	$2 + 5 * -3 + 2 * 0 = -13$	Yes		
11. 2 -2 1	(2,5,2)	$2 + 5 * 2 + 2 * -2 = 8$	No	-(1,2,-2)	(1,3,6)
12. 5 -2 0	(1,3,6)	$1 + 3 * 5 + 6 * -2 = 4$	Yes		
13. 3 0 0	(1,3,6)	$1 + 3 * x_1 + 6 * x_2$	Yes		
14. -2 -3 1	(1,3,6)	$1 + 3 * x_1 + 6 * x_2$	Yes		
15. -1 2 0	(1,3,6)	$1 + 3 * x_1 + 6 * x_2$	Yes		
16. -3 0 1	(1,3,6)	$1 + 3 * x_1 + 6 * x_2$	Yes		
17. 2 -2 1	(1,3,6)	$1 + 3 * x_1 + 6 * x_2$	Yes		
18. 5 -2 0	(1,3,6)				

Following are the graphs that correspond to the new weight vectors created in Steps 1, 3, 5, 6 and 11.

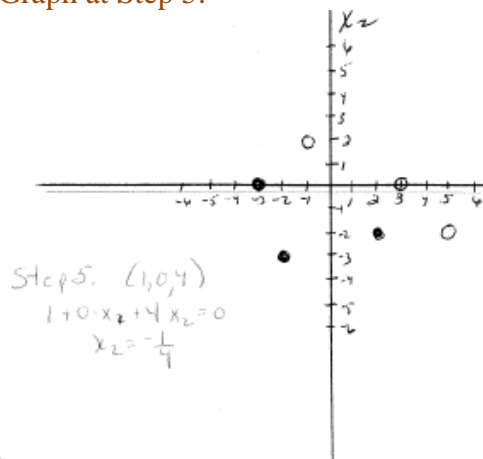
Graph at Step 1:



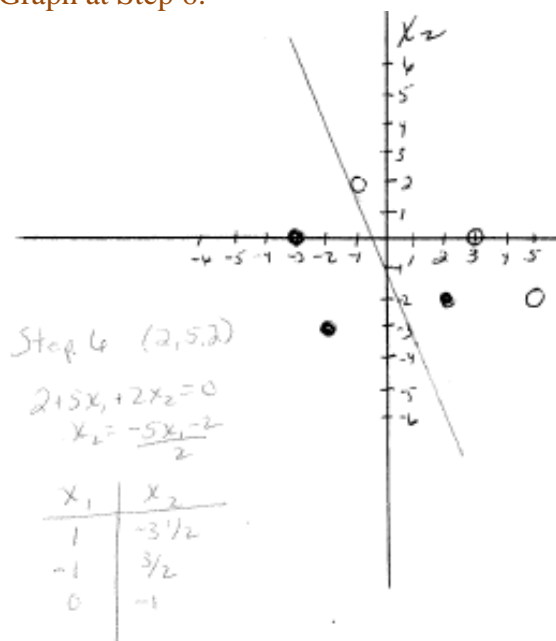
Graph at Step 3:



Graph at Step 5:



Graph at Step 6:



Graph at Step 11:

