

Homework 5 - The Perceptron

Recall from the notes that the Perceptron model has a single artificial neuron which can have multiple inputs but with a single binary output. Suppose that we are interested in training the algorithm to determine if a point (x, y) lies above or below the x -axis. Assume that each input (x, y) has a corresponding weight w_x, w_y which satisfies $-1 \leq w_x, w_y \leq 1$.

1. What do you think the exact values for the weights should be? (Hint: Should both weights play a role in the final solution?)
2. For the algorithm we assume that the output is -1 if the point is below the x -axis and +1 if it is on or above the x -axis. We set the threshold to be 0 and calculate $t = xw_x + yw_y$ and check it against the threshold; for simplicity we ignore the bias here. We calculate the signed error as actual value - predicted value. For the learning rate use 0.01. For starting weights take $w_x = .2$ and $w_y = -.1$. Use the training set

$$\{ (1, -1), (1, 2), (.5, -2), (0, 3) \}$$

Compute one iteration of the algorithm using the data above; output your results in a table like the one below. I have completed the table for the first point in the dataset so you can see what we are asking for.

Point	Actual	t	Predicted	Error	w_x	w_y
(1,-1)	-1	$(1)(.2) + (-1)(-.1) > 0$	1	-2	$.2 - 2(1)(.01) = .18$	$-.1 - 2(-1)(.01) = -.08$
