

# Q4) Perceptron

Assignment - 03

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①

$w_2$	1	1	-1	0	2
$w_1$	0	0	1	2	0
$w_2$	-1	-1	1	1	0
$w_1$	4	0	1	2	1
$w_1$	-1	1	1	1	0
$w_1$	-1	-1	-1	1	6
$w_2$	-1	1	1	2	1

②

2	1	1	-1	0	2
1	0	0	1	2	0
2	-1	-1	1	1	0
1	4	0	1	2	1
1	-1	1	1	1	0
1	-1	-1	-1	1	6
2	-1	1	1	2	1

③

Adding one's column at the front.

-1x	1	1	1	-1	0	2
	1	0	0	1	2	0
-1x	1	-1	-1	1	1	0
	1	4	0	1	2	1
	1	-1	1	1	1	0
	1	-1	-1	-1	1	6
-1x	1	-1	1	1	2	1

Multiply -1 to the class 2.

④

-1	1	1	-1	0	2
1	0	0	1	2	0
-1	-1	-1	1	1	0
1	4	0	1	2	1
1	-1	1	1	1	0
1	-1	-1	-1	1	6
-1	-1	1	1	2	1

initial weights =  $[3 \ 1 \ 1 \ -1 \ 2 \ -7]$ .

learning rate = 1

⑤ Taking sample 1 i.e 1st row. and multiplying with initial weight.

$$-1 \times 3 + (-1) \times (1) + (-1)(1) + (1)(0) + (2)(2) + (-7)(-2) \\ = 8 > 0$$

Gradient Descent single sample rule

$$a^{(k+1)} = a^k + \eta \sum_y$$

② 2nd sample  $[1 \ 0 \ 0 \ 1 \ 2 \ 0]$   
weights are as it is  $[3 \ 1 \ 1 \ -1 \ 2 \ -7]$

~~3 \times 1 + 1 \times 0 + 1 \times 0 + (-1) \times 1 + 2 \times 2 + (-7) \times 0~~

$$3 \times 1 + 1 \times 0 + 1 \times 0 + (-1)(1) + (2)(2) + (-7) \times 0$$

$$= 6 > 0$$

2nd sample is not misclassified

3rd sample  $[-1 \ 1 \ 1 \ -1 \ -1 \ 0]$

weights are as it is

$$[3 \ 1 \ 1 \ -1 \ 2 \ -7]$$

$$= 3(-1) + (1)(1) + (1)(1) + (-1)(-1) - (2) + (-7)(0)$$

$$= -3 + 1 + 1 + 1 - 2$$

3rd is misclassified.

$$[3 \ 1 \ 1 \ -1 \ 2 \ -7] + [-1 \ 1 \ 1 \ -1 \ -1 \ 0]$$

$$= [2 \ 2 \ 2 \ -2 \ 1 \ -7]$$



⑥

Take 4th sample  $[1 \ 4 \ 0 \ 1 \ 2 \ 1]$

$$\text{New weight} = [2 \ 2 \ 2 \ -2 \ 1 \ -7]$$

$$= 2 + 8 - 2 + 2 - 7$$

$= 3 > 0$  classified correctly.

Take 5th sample  $(1 \ -1 \ 1 \ 1 \ 1 \ 0)$

$$[2 \ 2 \ 2 \ -2 \ 1 \ -7]$$

$$= 2 - 2 + 2 - 2 + 1 + (0)(-7) = 1$$

+ve. classified correctly.

Here on all the samples will be +ve when multiplied

with this

$$\text{weight } [2 \ 2 \ 2 \ -2 \ 1 \ -7]$$

so final weights

$$\text{will be } [2 \ 2 \ 2 \ -2 \ 1 \ -7]$$