X

Week 1 : Assignment 1

The due date for submitting this assignment has passed.

Due on 2024-08-07, 23:59 IST.

Assignment submitted on 2024-08-02, 18:30 IST

1) Consider the following table, where x_1 and x_2 are features and y is a label ***1 point***

x_1	x_2	y
0	0	1
0	1	1
1	0	1
1	1	0

Assume that the elements in $\mathbf{w}$ are initialized to zero and the perception learning algorithm is used to update the weights $\mathbf{w}$. If the learning algorithm runs for long enough iterations, then

- The algorithm never converges
- The algorithm converges (i.e., no further weight updates) after some iterations
- The classification error remains greater than zero
- The classification error becomes zero eventually

No, the answer is incorrect.
Score: 0

Accepted Answers:
The algorithm converges (i.e., no further weight updates) after some iterations
The classification error becomes zero eventually

2) In the perceptron model, the weight $\mathbf{w}$ vector is perpendicular to the linear decision boundary at all times. ***1 point***

- (selected) True
- False

Yes, the answer is correct.
Score: 1

Accepted Answers:
True

3) What is the perceptron algorithm used for? ***1 point***

- Clustering data points
- (selected) Classifying data
- Solving optimization problems
- Finding the shortest path in a graph

Yes, the answer is correct.
Score: 1

Accepted Answers:
Classifying data

4) Choose the correct input-output pair for the given MP Neuron. ***1 point***

$$f(x) = \begin{cases} 1, & \text{if } x_1 + x_2 + x_3 > 2 \\ 0, & \text{otherwise} \end{cases}$$

- [ ] $y = 1$ for $(x_1, x_2, x_3) = (0, 1, 1)$
- [x] $y = 0$ for $(x_1, x_2, x_3) = (0, 0, 1)$
- [ ] $y = 1$ for $(x_1, x_2, x_3) = (0, 0, 0)$
- [x] $y = 1$ for $(x_1, x_2, x_3) = (1, 1, 1)$
- [x] $y = 0$ for $(x_1, x_2, x_3) = (1, 0, 1)$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$y = 0$ *for* $(x_1, x_2, x_3) = (0, 0, 1)$
$y = 1$ *for* $(x_1, x_2, x_3) = (1, 1, 1)$
$y = 0$ *for* $(x_1, x_2, x_3) = (1, 0, 1)$

5) Which of the following Boolean functions can be implemented using a perceptron? ***1 point***

- [x] NOR
- [x] NAND
- [x] NOT
- [ ] XOR

Yes, the answer is correct.
Score: 1

Accepted Answers:
NOR
NAND
NOT

6) Which of the following threshold values of MP neuron implements AND Boolean function? Assume that the number of inputs to the neuron is 7 and the neuron does not have any inhibitory inputs. ***1 point***

- 1
- 3
- 6
- 7
- 8

Yes, the answer is correct.
Score: 1

Accepted Answers:
7

7) Suppose we have a boolean function that takes 4 inputs x_1, x_2, x_3, x_4? We have an MP neuron with parameter $\theta = 3$. For how many inputs will this MP neuron give output $y = 1$? ***1 point***

- 5
- 4
- 1
- 16

Yes, the answer is correct.
Score: 1

Accepted Answers:
5

8) Consider points shown in the picture. The vector $\mathbf{w} = \begin{bmatrix} -1 \\ -1 \end{bmatrix}$. As per this weight vector, the Perceptron algorithm will predict which classes for the data points x_1 and x_2. ***1 point***

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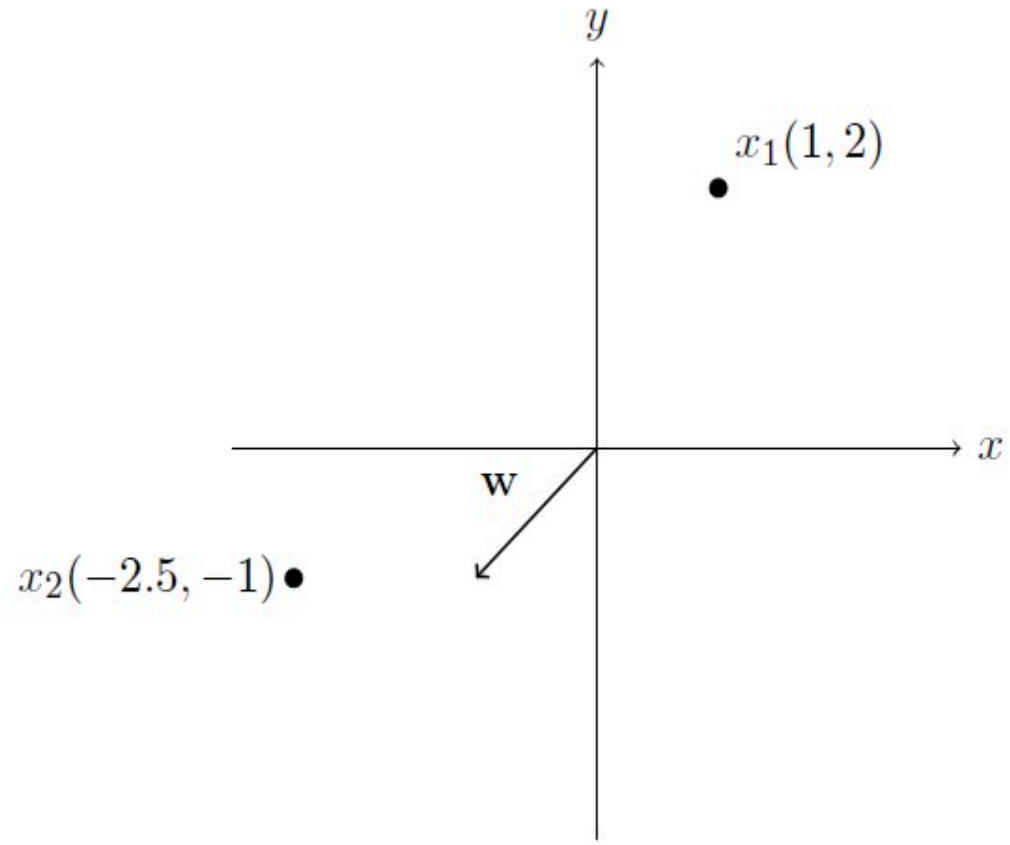
$$y = \begin{cases} 1 & \text{if } \mathbf{w}^{\mathrm{T}}\mathbf{x} > 0 \\ -1 & \text{if } \mathbf{w}^{\mathrm{T}}\mathbf{x} \leq 0 \end{cases}$$



- [x] $x_1 = -1$
- [ ] $x_1 = 1$
- [x] $x_2 = -1$
- [ ] $x_2 = 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x_1 = -1$
$x_2 = 1$

9) Consider the following table, where x_1 and x_2 are features (packed into a single vector $\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$) and y is a label: ***1 point***

x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	1

Suppose that the perceptron model is used to classify the data points. Suppose further that the

weights $\mathbf{w}$ are initialized to $\mathbf{w} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. The following rule is used for classification,

$$y = \begin{cases} 1 & \text{if } \mathbf{w}^T\mathbf{x} > 0 \\ 0 & \text{if } \mathbf{w}^T\mathbf{x} \leq 0 \end{cases}$$

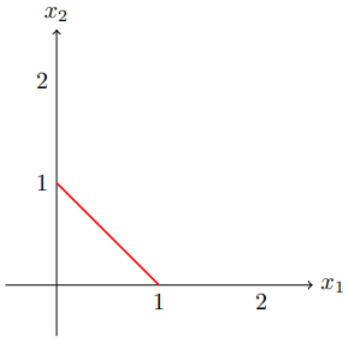
The perceptron learning algorithm is used to update the weight vector $\mathbf{w}$. Then, how many times the weight vector $\mathbf{w}$ will get updated during the entire training process?

- 2
- 1
- 0
- Not possible to determine

Yes, the answer is correct.
Score: 1

Accepted Answers:
0

10) Which Boolean function with two inputs $x1$ and $x2$ is represented by the following decision boundary? (Points on boundary or right of the decision boundary to be classified 1) ***1 point***



- AND
- OR
- XOR
- NAND

Yes, the answer is correct.
Score: 1

Accepted Answers:
OR

11) Choose the correct input-output pair for the given MP Neuron. ***1 point***

$$y = \begin{cases} 1, & \text{if } x_1 + x_2 + x_3 \geq 2 \\ 0, & \text{otherwise} \end{cases}$$

- $y = 1$ for $(x_1, x_2, x_3) = (0, 1, 1)$
- $y = 0$ for $(x_1, x_2, x_3) = (0, 0, 1)$
- $y = 1$ for $(x_1, x_2, x_3) = (1, 1, 1)$

$y = 0$ for $(x_1, x_2, x_3) = (1, 0, 0)$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$y = 1$ *for* $(x_1, x_2, x_3) = (0, 1, 1)$
$y = 0$ *for* $(x_1, x_2, x_3) = (0, 0, 1)$
$y = 1$ *for* $(x_1, x_2, x_3) = (1, 1, 1)$
$y = 0$ *for* $(x_1, x_2, x_3) = (1, 0, 0)$

12) Suppose we have a boolean function that takes 4 inputs x1, x2, x3, x4? We have an MP neuron with parameter $\theta = 2$. For how many inputs will this MP neuron give output $y = 1$? ***1 point***

- 11
- 21
- 15
- 8

Yes, the answer is correct.
Score: 1

Accepted Answers:
11

13) We are given the following data: ***1 point***

$x1$	$x2$	$y3$
2	4	1
3	-1	-1
5	6	-1
2	0	1
-1	0	1
-2	-2	1

Can you classify every label correctly by training a perceptron algorithm? (assume bias to be 0 while training)

- Yes
- No

Yes, the answer is correct.
Score: 1

Accepted Answers:
No

14) We are given the following dataset with features as (x1,x2) and y as the label (-1,1). If we apply the perception algorithm on the following dataset with w initialized as (0,0). What will ***1 point***

be the value of w when the algorithm converges? (Start the algorithm from (2,2)

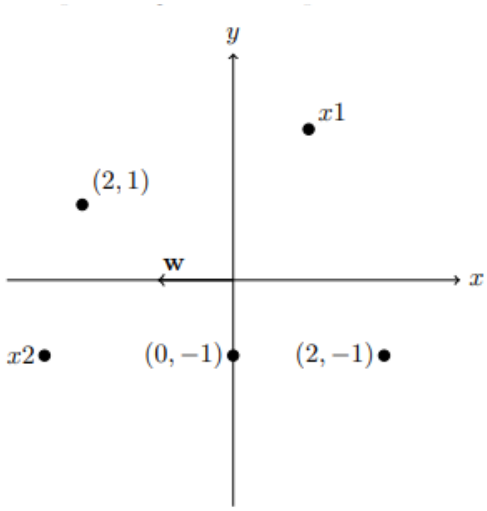
$x1$	$x2$	y
2	2	1
2	-2	1
-2	1	-1

- (-2,2)
- (2,1)
- (2,-1)
- None of These

Yes, the answer is correct.
Score: 1

Accepted Answers:
(2,-1)

15) Consider points shown in the picture. The vector w is (-1,0). As per this weight vector, the Perceptron algorithm will predict which classes for the data points x1 and x2. ***1 point***



- x1=1
- x2=1
- x1=-1
- x2=-1

Yes, the answer is correct.
Score: 1

Accepted Answers:
x2=1
x1=-1

16) Given an MP neuron with the inputs as x1,x2,x3,x4,x5 and threshold $\theta = 3$ where x5 is inhibitory input. For input (1,1,1,0,1) what will be the value of y? ***1 point***

- $y = 0$
- $y = 1$ since $\theta \geq 3$

- $y = 1/2$
- Insufficient information

Yes, the answer is correct.
Score: 1

Accepted Answers:
$y = 0$

17) An MP neuron takes two inputs x1 and x2. Its threshold is $\theta = 0$. Select all the boolean functions this MP neuron may represent. ***1 point***

- AND
- NOT
- OR
- NOR

Yes, the answer is correct.
Score: 1

Accepted Answers:
NOR

18) What is the output of a perceptron with weight vector $\mathbf{w} = [\,2 \quad -3 \quad 1\,]$ and bias $b = -2$ when the input is $\mathbf{x} = [\,1 \quad 0 \quad -1\,]$? ***1 point***

- 0
- 1
- -1
- 2

Yes, the answer is correct.
Score: 1

Accepted Answers:
-1

19) What is the ”winter of AI” referring to in the history of artificial intelligence? ***1 point***

- The period during winter when AI technologies are least effective due to cold temperatures
- A phase marked by decreased funding and interest in AI research.
- The season when AI algorithms perform at their peak efficiency.
- A period characterized by rapid advancements and breakthroughs in AI technologies.

Yes, the answer is correct.
Score: 1

Accepted Answers:
A phase marked by decreased funding and interest in AI research.