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Week 4: Assignment 4

The due date for submitting this assignment has passed.

Due on 2023-08-23, 23:59 IST.

Assignment submitted on 2023-08-23, 08:32 IST

1) Consider the data set given below. ***1 point***

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

Claim: PLA (perceptron learning algorithm) can learn a classifier that achieves zero misclassification error on the training data. This claim is:

- (•) True
- ( ) False
- ( ) Depends on the initial weights
- ( ) True, only if we normalize the feature vectors before applying PLA.

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

2) Which of the following loss functions are convex? (Multiple options may be correct) ***1 point***

- [ ] 0-1 loss (sometimes referred as mis-classification loss)
- [x] Hinge loss
- [x] Logistic loss
- [x] Squared error loss

Yes, the answer is correct.
Score: 1

Accepted Answers:
Hinge loss
Logistic loss
Squared error loss

3) Which of the following are valid kernel functions? ***1 point***

- $(1 + < x, x' >)^d$
- $tanh(K_1 < x, x' > + K_2)$
- $exp(-\gamma ||x - x'||^2)$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$(1 + < x, x' >)^d$
$tanh(K_1 < x, x' > + K_2)$
$exp(-\gamma ||x - x'||^2)$

4) Consider the 1 dimensional dataset: ***1 point***

x	y
-1	1
0	-1
2	1

(Note: x is the feature, and y is the output)

State true or false: The dataset becomes linearly separable after using basis expansion with the following basis function $\phi(x) = \begin{bmatrix} 1 \\ x^3 \end{bmatrix}$

- (•) True
- ( ) False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

5) State True or False: ***1 point***

SVM cannot classify data that is not linearly separable even if we transform it to a higherdimensional space.

- ( ) True
- (•) False

Yes, the answer is correct.
Score: 1

Accepted Answers:
False

6) State True or False: ***1 point***

The decision boundary obtained using the perceptron algorithm does not depend on the initial values of the weights.

- True
- False

Yes, the answer is correct.
Score: 1
Accepted Answers:
False

7) Consider a linear SVM trained with n labeled points in R^2 without slack penalties and ***1 point*** resulting in $k = 2$ support vectors, where $n > 100$. By removing one labeled training point and retraining the SVM classifier, what is the maximum possible number of support vectors in the resulting solution?

- 1
- 2
- 3
- n − 1
- n

No, the answer is incorrect.
Score: 0
Accepted Answers:
n − 1

8) Consider an SVM with a second order polynomial kernel. Kernel 1 maps each input ***1 point*** data point x to $K_1(x) = \begin{bmatrix} x \\ x^2 \end{bmatrix}$. Kernel 2 maps each input data point x to $K_2(x) = \begin{bmatrix} 3x \\ 3x^2 \end{bmatrix}$. Assume the hyper-parameters are fixed. Which of the following option is true?

- The margin obtained using $K_2(x)$ will be larger than the margin obtained using $K_1(x)$.
- The margin obtained using $K_2(x)$ will be smaller than the margin obtained using $K_1(x)$.
- The margin obtained using $K_2(x)$ will be the same as the margin obtained using $K_1(x)$.

Yes, the answer is correct.
Score: 1
Accepted Answers:
The margin obtained using $K_2(x)$ will be larger than the margin obtained using $K_1(x)$.