Quiz 6

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Comprehension Quiz due Jul 26, 2022 23:00 PKT Completed

Problem 1

1/1 point (graded)
You are given a binary 4-dimensional linear decision boundary with coefficient vector $\mathbf{w} = [2, 1, 4, 3]$ and $b = -12$. How would you classify the point $(2, 1, 1, 2)$?

- ◯ -1
- ◯ 0
- ◉ 1

✓

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Problem 2

1/1 point (graded)
In which of the following situations has our linear classifier correctly labeled a data point? Select all that apply.

- [x] $\mathbf{w} \cdot \mathbf{x} + b > 0$ and $y > 0$
- [x] $y\left(\mathbf{w} \cdot \mathbf{x} + b\right) > 0$
- [x] $\mathbf{w} \cdot \mathbf{x} + b < 0$ and $y < 0$
- [ ] $y > \mathbf{w} \cdot \mathbf{x} + b$

✓

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Problem 3

1/1 point (graded)
Let's say that we have a linear classifier given by $\mathbf{w} = [1, 1, -3, 0]$ and $b = -2$. Our loss function measures the amount by which our prediction is incorrect: $\text{loss} = -y\left(\mathbf{w} \cdot \mathbf{x} + b\right)$. If our prediction is correct, there is no loss.

What is the loss on the data point $(\mathbf{x}, y)$ where $\mathbf{x} = (3, 1, 1, 4)$ and $y = 1$?

- ◯ 0
- ◉ 1
- ◯ 2
- ◯ 3

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Problem 4

1/1 point (graded)
If the Perceptron algorithm does 9 updates before converging on a solution, what value of b can you expect to have?

- ○ $b = 9$
- ○ $b = -9$
- ◉ $b \in [-9, 9]$
- ○ $b \in [0, 9]$

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Problem 5

1/1 point (graded)
What is a support vector?

- ○ A data point from the test set that is used to test the classifier
- ○ A vector that we are trying to minimize
- ○ A data point which is correctly classified by the optimal solution for $\mathbf{w}$
- ◉ A data point from the training set that contributes to the optimal solution for $\mathbf{w}$

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Problem 6

1/1 point (graded)
What is the difference between the perceptron algorithm and the support vector machine?

- ○ The perceptron uses gradient descent while the SVM uses stochastic gradient descent
- ○ The perceptron finds a linear separator that separates most of the data points in the training set, while a SVM finds a linear separator that separates all of the data in the training set
- ◉ The perceptron finds any solution that perfectly separates the training set, while the SVM finds the solution that perfectly separates the training set with the greatest margin of separation
- ○ The perceptron algorithm may not find a solution while the SVM is guaranteed to find a

solution

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Problem 7

1/1 point (graded)
The optimal solution for a SVM is given by the coefficient vector $\mathbf{w}$ and the constant b. The width of the margin is given by γ. What is the value of γ?

- (selected) $\gamma = \frac{1}{||\mathbf{w}||}$
- $\gamma = ||\mathbf{w}||$
- $\gamma = b - \frac{1}{||\mathbf{w}||}$

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Problem 8

1/1 point (graded)
True or false: A soft-margin SVM has fewer support vectors than a hard-margin SVM.

- True
- (selected) False

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Problem 9

1/1 point (graded)
Decreasing the value of C in the soft-margin SVM results in which of the following:

- [ ] fewer number of support vectors
- [x] wider margin
- [ ] more data points being correctly classified
- [x] lower penalty for incorrectly classified data points

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Problem 10

1/1 point (graded)
True or false: All support vectors are contained between, or on, the margins of the two classes.

- ◯ True
- ◉ False

✓

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Problem 11

1/1 point (graded)
What does the slack variable represent?

- ◉ It is a vector containing the amount of error each point $(x^{(i)}, y^{(i)})$ contributes to the optimization problem
- ◯ It is a coefficient that we must determine to optimize the problem
- ◯ It is a vector containing the number of times each w_i is updated
- ◯ it is a value that determines how much error the optimization problem is allowed to have

✓

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Problem 12

1/1 point (graded)
Using the dual form of the perceptron algorithm, which of the following values are updated during each pass over the training set?

- [ ] $\mathbf{w}$
- [x] α
- [x] b
- [ ] $\mathbf{y}$

✓

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Problem 13

1/1 point (graded)
When optimizing the dual form of the hard-margin SVM, when are the values α_i non-zero?

- ○ When the data point $(x^{(i)}, y^{(i)})$ is on the linear separator between the two classes
- ◉ When the data point $(x^{(i)}, y^{(i)})$ is right on the margin for its class
- ○ When the data point $(x^{(i)}, y^{(i)})$ is in the interior of the region for its class
- ○ When the data point $(x^{(i)}, y^{(i)})$ is on the wrong side of the linear separator

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Problem 14

1/1 point (graded)
When using multiclass logistic regression on data with labels, $Y = \{1, 2, \ldots, k\}$, and a linear classifier specified by $\mathbf{w}_1, \mathbf{w}_2, \ldots, \mathbf{w}_k \in \mathbb{R}^d$ and $b_1, b_2, \ldots, b_k \in \mathbb{R}$, and given a point $(\mathbf{x}, y)$, what is the probability that $y = j$, where $0 < j \leq k$?

- ○ $Pr\left(y = j|\mathbf{x}\right) = e^{\mathbf{w}_j \cdot \mathbf{x} + b_j}$
- ○ $Pr\left(y = j|\mathbf{x}\right) = \frac{e^{\mathbf{w}_j \cdot \mathbf{x} + b_j}}{e^{\mathbf{w}_k \cdot \mathbf{x} + b_k}}$
- ◉ $Pr\left(y = j|\mathbf{x}\right) = \frac{e^{\mathbf{w}_j \cdot \mathbf{x} + b_j}}{e^{\mathbf{w}_1 \cdot \mathbf{x} + b_1} + e^{\mathbf{w}_2 \cdot \mathbf{x} + b_2} + \ldots + e^{\mathbf{w}_k \cdot \mathbf{x} + b_k}}$
- ○ $Pr\left(y = j|\mathbf{x}\right) = \frac{e^{\mathbf{w}_j \cdot \mathbf{x} + b_j}}{1 + e^{\mathbf{w}_j \cdot \mathbf{x} + b_j}}$

✔

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Problem 15

1/1 point (graded)
What does ξ_i represent in the soft-margin SVM?

- ○ It is the number of times the i'th point was updated
- ◉ It is the amount of slack the i'th point has
- ○ It represents the i'th support vector
- ○ It represents the width of the margin

✔

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