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Quiz 7

Problem 1

1/1 point (graded)

Suppose we use a basis expansion $\Phi(x)$ for the purposes of getting a quadratic decision boundary. For two-dimensional data, we can do this by expanding to five features. What decision boundary is represented by $w \cdot \Phi(x) + b = 0$ for $w = (2, 1, 2, -1, 0)$ and $b = -1$?

- $2x_1^2 + x_2^2 + 2x_1 - x_2 - 1 = 0$
- $2x_1^2 + x_1 + 2x_2^2 - x_2 - 1 = 0$
- (selected) $2x_1 + x_2 + 2x_1^2 - x_2^2 - 1 = 0$
- $2x_1 + x_1^2 + 2x_2 - x_2^2 - 1 = 0$

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Problem 2

1/1 point (graded)

True or false: When using a basis expansion of $x \in \mathbb{R}^6$ to get a quadratic boundary, the expanded feature vector $\Phi(x)$ has 36 pairwise features of the form $x_1 x_6$ or $x_2 x_4$.

- True
- (selected) False

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Problem 3

1/1 point (graded)

We want to use basis expansion of two-dimensional inputs $x = (x_1, x_2)$ to get a quadratic boundary. If the target boundary is given by the equation $(x_1 - 2)^2 + (x_2 - 1)^2 = 16$, what is the coefficient vector, w, and constant, b, such that the boundary has the form $w \cdot \Phi(x) + b = 0$?

- (selected) $w = (-4 \quad -2 \quad 1 \quad 1 \quad 0),\ b = -11$
- $w = (-4 \quad -2 \quad 1 \quad 1 \quad 0),\ b = -16$
- $w = (1 \quad 1 \quad -4 \quad -2 \quad 5),\ b = -11$
- $w = (1 \quad -2 \quad 1 \quad -11 \quad 0),\ b = 16$

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Problem 5

1/1 point (graded)

For 12-dimensional x, what is the dimension of the basis expansion $\Phi(x)$ that we use for getting a quadratic boundary?

- 24
- 57
- (selected) 90

- ( ) 144

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Problem 6

1/1 point (graded)

Given a data set with n data points, each of d dimensions, what is the dimension of the vector, α, which is used in the dual form of the perceptron algorithm?

- ( ) d
- (•) n
- ( ) d^2
- ( ) n^2

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Problem 7

1/1 point (graded)

Given vectors $v, w \in \mathbb{R}^d$, which of the following expressions can be used in place of $\Phi\left(v\right) \cdot \Phi\left(w\right)$, where Φ is the basis expansion used for a quadratic boundary?

- ( ) *[Math Processing Error]*$||w - v||^2$
- ( ) $1 + \left(v \cdot w\right)^2$
- (•) $\left(1 + v \cdot w\right)^2$

- ( ) $(1, v_1, v_2, \ldots, v_d) \cdot (1, w_1, w_2, \ldots, w_d)$

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Problem 8

1/1 point (graded)

Which vector are we solving for when using the dual form of the SVM?

- ( ) w
- (•) α
- ( ) x
- ( ) none of the above

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Problem 9

1/1 point (graded)

Which expression(s) can be used to classify a new point with the kernel SVM? Select all that apply.

- [x] $\operatorname{sign}\left(\sum_{i=1}^{n} \alpha_i y^{(i)} \left(\Phi\left(x^{(i)}\right) \cdot \Phi\left(x\right)\right) + b\right)$
- [ ] $\operatorname{sign}\left(\sum_{i=1}^{n} w \cdot \Phi\left(x^{(i)}\right) + b\right)$
- [x] $\operatorname{sign}\left(w \cdot \Phi\left(x\right) + b\right)$

- [ ] $\text{sign}\left(\sum_{i=1}^{n}\left(\Phi\left(x^{(i)}\right)\cdot\Phi\left(x\right)\right)+b\right)$

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Problem 10

1/1 point (graded)

If you are finding a degree 4 decision boundary and if $x \in \mathbb{R}^7$, then the term $x_1 x_3 x_4 x_7^2$ is part of the expanded feature vector, $\Phi\left(x\right)$.

- ( ) True
- (•) False

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Problem 11

1/1 point (graded)

Which is/are the correct kernel function(s), $k\left(x,z\right)$, that is used to find a degree 3 decision boundary? (Here Φ refers to the basis expansion for a degree-3 polynomial boundary.)

- [ ] $k\left(x,z\right)=x\cdot z$
- [x] $k\left(x,z\right)=\left(1+x\cdot z\right)^3$
- [x] $k\left(x,z\right)=\Phi\left(x\right)\cdot\Phi\left(z\right)$
- [ ] $k\left(x,z\right)=\left(1+\Phi\left(x\right)\cdot\Phi\left(z\right)\right)^3$

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Problem 12

1/1 point (graded)

Vectors that produce high values with the kernel function are more similar or less similar than vectors that produce low values?

- (•) More similar
- ( ) Less similar
- ( ) Not a measure of similarity

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Problem 13

1/1 point (graded)

True or false: Decision trees typically perform best when they are grown until the training error is 0%.

- ( ) True
- (•) False

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Problem 14

1/1 point (graded)

Overfitting the data with a decision tree will result in which of the following?

- [ ] Training error going up
- [x] Training error going down
- [x] Test error going up
- [ ] Test error going down

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Problem 15

1/1 point (graded)
True or false: When decision stumps are used as weak classifiers for AdaBoost, the final decision boundary is linear.

- ( ) True
- (•) False

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