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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 $b = -1$?

○ $2x_1^2 + x_2^2 + 2x_1 - x_2 - 1 = 0$

○ $2x_1^2 + x_1 + 2x_2^2 - x_2 - 1 = 0$

◉ $2x_1 + x_2 + 2x_1^2 - x_2^2 - 1 = 0$

○ $2x_1 + x_1^2 + 2x_2 - x_2^2 - 1 = 0$

✔

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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 $x_2 x_4$.

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○ True

⦿ 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 $w \cdot \Phi(x) + b = 0$?

⦿ $w = (-4 \quad -2 \quad 1 \quad 1 \quad 0)$, $b = -11$

○ $w = (-4 \quad -2 \quad 1 \quad 1 \quad 0)$, $b = -16$

○ $w = (1 \quad 1 \quad -4 \quad -2 \quad 5)$, $b = -11$

○ $w = (1 \quad -2 \quad 1 \quad -11 \quad 0)$, $b = 16$

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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?

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○ 24

○ 57

● 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

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Given vectors , which of the following expressions can be used in place of , where is the basis expansion used for a quadratic boundary?

○ *[Math Processing Error]*

○

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○

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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)

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

☑ $\text{sign}\left(\sum_{i=1}^{n} \alpha_i y^{(i)}\left(\Phi\left(x^{(i)}\right)\cdot\Phi\left(x\right)\right)+b\right)$

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

☑ $\text{sign}\left(w\cdot\Phi\left(x\right)+b\right)$

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

✔

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Problem 10

1/1 point (graded)

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

$\Phi\left(x\right)$

○ True

◉ False

✔

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Problem 11

1/1 point (graded)

Which is/are the correct kernel function(s), , that is used to find a degree decision

-3 polynomiaßboundary.)

Φ

- [ ] $k(x, z) = x \cdot z$

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

- [x] $k(x, z) = \Phi(x) \cdot \Phi(z)$

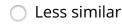- [ ] $k(x, z) = (1 + \Phi(x) \cdot \Phi(z))^3$
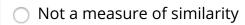
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Problem 12

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?
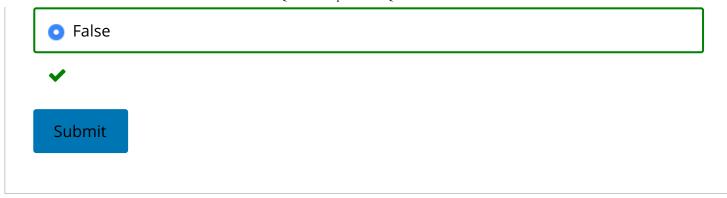
- (●) More similar

- ( ) 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 .

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○ 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

☑ Training error going down

☑ 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

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⦿ False

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