🏠 Course / Week 7: Combining Simple Classifiers / Comprehension Quiz 7

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Quiz 7

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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 $x_2 x_4$.

- ○ 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?

○ 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

1/1 point (graded)

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

○ [Math Processing Error]

○ $1 + (v \cdot w)^2$

◉ $(1 + v \cdot w)^2$

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

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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.

- ☑ \mbox{sign}(\sum_{i = 1}^{n}α_iy^{(i)}(\Phi (x^{(i)})\cdot \Phi (x))+b)
- ☐ \mbox{sign}(\sum_{i = 1}^{n}w \cdot \Phi (x^{(i)})+b)
- ☑ \mbox{sign}(w\cdot \Phi (x)+b)
- ☐ \mbox{sign}(\sum_{i = 1}^{n}(\Phi (x^{(i)})\cdot \Phi (x))+b)

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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_1x_3x_4x_7^2 is part of the expanded feature vector, \Phi (x).

- ○ True
- ◉ False

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Problem 11

1/1 point (graded)

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

- ☐ k(x,z) = x\cdot z
- ☑ k(x,z) = (1+x\cdot z)^3
- ☑ 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 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

☑ 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

◉ False

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