Quiz 5

Started: Nov 12 at 11:31am

Quiz Instructions

Question 1

1 pts

Given $\mathbf{x} \in R^3$, what is the corresponding mapping function $\phi(\mathbf{x})$ for the kernel function $K(\mathbf{x}, \mathbf{y}) = \phi(\mathbf{x})^T \phi(\mathbf{y}) = (1 + \mathbf{x}^T \mathbf{y})^2$.

(A) $\phi(\mathbf{x}) = [1, x_1, x_2, x_3, x_1x_2, x_1x_3, x_2x_3]$

(B) $\phi(\mathbf{x}) = [1, x_1, x_2, x_3, x_1x_2, x_1x_3, x_2x_3, x_1^2, x_2^2, x_3^2]$

(C) $\phi(\mathbf{x}) = [1, 2x_1, 2x_2, 2x_3, 2x_1x_2, 2x_1x_3, 2x_2x_3, x_1^2, x_2^2, x_3^2]$

(D) $\phi(\mathbf{x}) = [1, \sqrt{2}x_1, \sqrt{2}x_2, \sqrt{2}x_3, \sqrt{2}x_1x_2, \sqrt{2}x_1x_3, \sqrt{2}x_2x_3, x_1^2, x_2^2, x_3^2]$

- A
- B
- C
- D

Question 2

1 pts

Which of the following statements about kernels are true?

(A) After applying the mapping function $\phi(\mathbf{x}) = [\mathbf{x}, \mathbf{x}^2]$, the data always become linearly separable.

(B) $\mathbf{x}, \mathbf{y} \in R^2, K(\mathbf{x}, \mathbf{y}) = (1 + 8\mathbf{x}^T \mathbf{y})^2$ is a valid kernel.

(C) Let $K(\mathbf{x}, \mathbf{y}) = \phi(\mathbf{x})^T \phi(\mathbf{y})$. Computing the inner product between $\phi(\mathbf{x})$ and $\phi(\mathbf{y})$ using kernel function $K(\mathbf{x}, \mathbf{y})$ is always slower than directly estimating from $\phi(\mathbf{x})^T \phi(\mathbf{y})$.

(D) A kernel function may allow us to map feature vectors in to another space where the data is linearly separable.

Select all that apply

- [ ] A
- [ ] B
- [ ] C
- [ ] D

Question 3

1 pts

select all that apply

- [ ] A
- [ ] B
- [ ] C
- [ ] D

Question 4

1 pts

As we see in the lecture, Soft SVM identifies a hyper-plane $\mathbf{w}^T\mathbf{x} + b = 0$ by solving the following optimization problem.

$$\min_{w,b,\xi_i} \quad \frac{1}{2}\mathbf{w}^T\mathbf{w} + C \cdot \sum_{i=1}^{N} \xi_i$$

$$s.t \ \forall i, \ y(\mathbf{w}^T\mathbf{x}_i + b) \geq 1 - \xi_i$$

$$\xi_i \geq 0$$

Let $\mathbf{w} = [-1, -1]$ and $b = 1$ are the solution of the above optimization problem. Given two positive data points $\mathbf{x}_1 = (0, 0)$ and $\mathbf{x}_2 = (1, 0)$, $y_1 = y_2 = 1$, what are their corresponding slack variables ξ_1 and ξ_2, respectively?

(A) $\xi_1 = 0, \ \xi_2 = 0.5$

(B) $\xi_1 = 0, \ \xi_2 = 1$

(C) $\xi_1 = 1, \ \xi_2 = 0$

(D) $\xi_1 = 1, \ \xi_2 = 0.5$

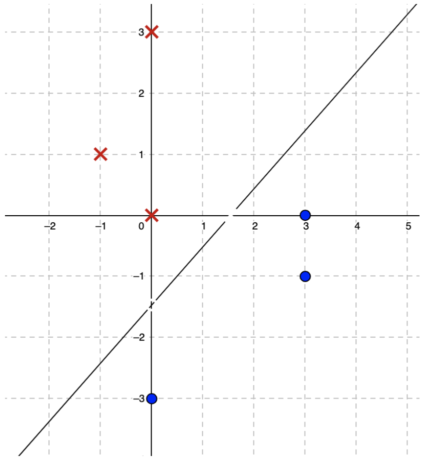
- ○ A
- ○ B
- ○ C
- ○ D

Question 5

1 pts

Assume you have datapoints and labels as X={[0,0],[0,3],[-1,1],[3,0],[3,-1],[0,-3]} and Y={-1,-1,-1,1,1,1}.

We train a hard SVM classifier as shown in below.



What is w1? (round to 2 decimal places)

w1 = ______

Question 6

1 pts

Follow the previous question. What is w2? (round to 2 decimal places)

w2= ______

Question 7

1 pts

What is b? (round to 2 decimal places)

b= _______

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