Quiz 6

This is a preview of the published version of the quiz

Started: Oct 26 at 10:15am

Quiz Instructions

Question 1

1 pts

Consider $X \in R^d$ to be our instance space, and a kernel $K(x, y) = (x^T y + 1)^2$. Assume that, rather than using this kernel, you will explicitly blow up the feature space to learn the same model as using the kernel. What is the minimal dimensionality of the resulting feature space (including one constant feature)?

- $2^d + 2$
- $d \cdot (d-1)/2$
- $(d^2 + 3d + 2)/2$
- $d^2 + 2$

Question 2

1 pts

Given a kernel $k(x, y) = (x^T \cdot y + 4)^2$ where $x = [x_1, x_2]$ and $y = [y_1, y_2]$, which of the following shows that it is indeed a valid kernel?

-

$k(x,y) =< \phi(x), \phi(y) >$ where $\phi(x) = \begin{bmatrix} x_1^2 \\ x_2^2 \\ 2\sqrt{2}x_1 \\ 2\sqrt{2}x_2 \\ \sqrt{2}x_1x_2 \\ 4 \end{bmatrix}, \phi(y) = \begin{bmatrix} y_1^2 \\ y_2^2 \\ 2\sqrt{2}y_1 \\ 2\sqrt{2}y_2 \\ \sqrt{2}y_1y_2 \\ 4 \end{bmatrix}$

○ $k(x,y) =< \phi(x), \phi(y) >$ where $\phi(x) = \begin{bmatrix} 4x_1^2 \\ 4x_2^2 \\ \sqrt{2}x_1x_2 \\ 8x_1 \\ 8x_2 \\ 16 \end{bmatrix}, \phi(y) = \begin{bmatrix} 4y_1^2 \\ 4y_2^2 \\ \sqrt{2}y_1y_2 \\ 8y_1 \\ 8y_2 \\ 16 \end{bmatrix}$

○ $k(x,y) =< \phi(x), \phi(y) >$ where $\phi(x) = \begin{bmatrix} x_1^2 \\ x_2^2 \\ 4 \end{bmatrix}, \phi(y) = \begin{bmatrix} y_1^2 \\ y_2^2 \\ 4 \end{bmatrix}$

○ None of the above.

Question 3

1 pts

Let $x, z \in R^n$. Then $K(x,z)$ is a valid kernel if there exists a transformation $\phi : R^n \rightarrow R^m, \phi(x), \phi(z) \in R^m$ such that:

○ $K(x,z) = \phi(x)\phi(z)$

○ $K(x,z) = \phi(x)^T\phi(z)$

○ $K(x,z) = \phi(x)\phi(z)^T$

○ $K(x,z) = \phi(x) + \phi(z)$

Question 4

1 pts

If we want to map sample points to a very high-dimensional feature space, the kernel trick can save us from having to compute those features explicitly, saving us a lot of time.

- ◯ True
- ◯ False

Question 5

1 pts

$K(x, z) = (x^T z)^2$ is not a valid kernel.

- ◯ True
- ◯ False

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