

Machine Learning from Data -IDC

HW5–Theory+ SVM

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Question 1)

a)

Let K, L be two kernels (operating on the same space) and let α, β be two positive scalars

Prove that $\alpha K + \beta L$ is a kernel.

b)

Provide (two different) examples of non-zero kernels K, L (operating on the same space), so that:

i. $K - L$ is a kernel

ii. $K - L$ is not a kernel

Question 2)

Use Lagrange Multipliers to find the maximum and minimum values of the function subject to the given constraints:

Function: $f(x, y, z) = x^2 + y^2 + z^2$.

Constraint: $g(x, y, z) = \frac{x^2}{\alpha^2} + \frac{y^2}{\beta^2} + \frac{z^2}{\beta^2} = 1$, where $\alpha > \beta > 0$

Question 3)

Let $X = \mathbb{R}^2$. Let $C = H + \{h(a, b, c) = (x, y, z) \text{ s.t. } |x| \leq a, |y| \leq b, |z| \leq c \text{ s.t. } a, b, c \in \mathbb{R}_+\}$ the set of all origin centered boxes.

Describe the polynomial sample complexity algorithm L that learns C using H . State the time complexity and sample complexity of your suggested algorithm. Prove all your steps.