

Machine Learning from Data – IDC

HW5 – Theory + SVM

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.

Prove your answers.

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 $\alpha > \beta > 0$

3. Let $X = \mathbb{R}^3$. 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 a polynomial sample complexity algorithm L that learns C using H . State the time complexity and the sample complexity of your suggested algorithm. Prove all your steps.