Introduction to Pattern Recognition Assignment 4 Report

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1 Coding

2 Questions

2.1 Given a valid kernel $k_1(x, x')$, prove that 1) $k(x, x') = ck_1(x, x')$ and 2) $k(x, x') = f(x)k_1(x, x')f(x)$ are valid kernels, where $c > 0$ is a positive constant and $f(\cdot)$ is any real-valued function.

A valid kernel function $k_1(x, x')$ has to have a positive semi-definite **Gram matrix** $\mathbf{K} = [k(\mathbf{x}_n, \mathbf{x}_m)]_{nm}$. A positive semi-definite matrix is one whose eigenvalues are all positive. We are given that $k_1(x, x')$ is a valid kernel, so at the start it meets this condition. We thus have to show that multiplying k_1 by a constant also produces a valid kernel, i.e. multiplying the kernel by a constant also produces a positive semi-definite Gram matrix.