CS5691 : Tutorial 7

Question 1

Consider a Support Vector Machine and the following training data from two categories:

category	x1	x2
1	1	1
1	2	2
1	2	0
2	0	0
2	1	0
2	0	1

Part A

Plot these six training points, and construct by inspection the
weight vector for the optimal hyperplane.

Part B

What are the support vectors?

Part C

Will our solution change if we delete point D .

Question 2a True/False

In theory, a Gaussian kernel SVM can model any complex
separating hyperplane.

Question 2b True/False

For every kernel function used in a SVM, one can obtain a equivalent closed form basis expansion.

Question 2c True/False

Overfitting in an SVM is a function of number of support vectors

Kernel

Consider 1 dimensional data points $x_1 = -1, x_2 = 0, x_3 = 2$, with labels -1 , 1 , -1 respectively.

Part A

For the basis function $\phi(x) = \begin{bmatrix} 1 \\ x^2 \end{bmatrix}$ find the kernel K.

Part B

Use the basis expansion to see the data becomes linearly separable.

Suppose we have kernels k1 and k2. Then show that
$k(x, z) = \alpha k1(x, z) + \beta k2(x, z)$ for $\alpha, \beta \geq 0$ is a valid kernel

Acknowledgment

The question for SVM has been taken from Duda and Hart PRML book.