COMP 632: Assignment 2

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Presented to Dr. Doina Precup

Geoffrey Stanley
Student ID: 260645907

Question 1

A)

For a function to be considered a kernel function the kernel matrix defined as $K_{ij} = K(x_i, x_j)$ must have two properties:

1. be symmetric

2. be positive semidefinite

As such, a Kernel matrix must abide by the following:

$$K_{ij} = K_{ji} \tag{1}$$

$$z^T K z \geq 0 \tag{2}$$

Where z is an arbitrary vector.

B)

As l increases words will have a tendency of having higher scores when compared with itself then any other words. This will result in a diagonal matrix.
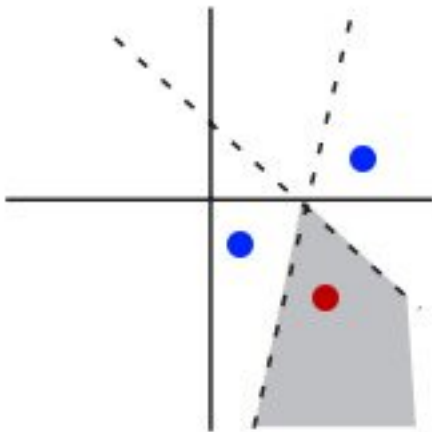
C)

Yes.

D)

Question 2

A)

B)

The VC-dimension of this hypthesis class is 4. This is because it can successfully all configurations of 4 points. However, it would not be able to do so for all configuration of 5 points.

C)

The VC-dimension of any type of boolean combination of 2 linear classifiers is also 4.

Question 3

A)

Given the log-likelihood of a hypothesis h :

$$\log L(h) = \sum_{i=1}^{m} \log P(y_i|x_i, h) \tag{3}$$

And the probability of an example x belonging to class K as being :

$$P(K|x) = 1 - \sum_{i=1}^{K-1} h^i(x) \tag{4}$$

We can derive the log likelihood for a set of hypotheses and a given data set D as:

$$\log L(h) = \sum_{i=1}^{m} \sum_{j=1}^{K} \log \left(1 - \sum_{l=1}^{K-1} h^l(x_i) \right) \tag{5}$$

B)

C)

Question 4

A)

B)

C)

D)

E)