CHENNAI MATHEMATICAL INSTITUTE

Quiz 1 : FML

Date: Nov 11, 2024

(1) State the perceptron algorithm to find a linear separator in the realizable case. Assume that the data is presented as (x_i, y_i), and we are seeking a w such that $\forall i, y_i(w^T x_i) \geq 0$. What are the bounds on the number of steps required for convergence, assuming there is a w with norm at most B which works and assuming that all the x_i have norm at most R? (4 marks)

In the non-realizable case, give expressions for the hinge loss of w on positive and negative examples (2 marks).

(2) Assume your data is in 1 dimension. And the kernel function used maps x to an infinite dimensional vector vector, $(\psi(x)_n)$, $n = 1 \cdots \infty$, whose n-th coordinate is $\frac{1}{\sqrt{n}} e^{-x^2/2} x^n$. Describe the kernel matrix for the data points $(0, -1), (1, 1), (-1, 1)$. You may write down the matrix with entries being appropriate exponentials. (4 marks)