Indian Institute of Space Science and Technology – Thiruvananthapuram

MA622 Pattern Recognition and Machine Learning

Assignment-11

Date: 13-03-2015

1. Consider $w \in \mathbb{R}^n$. Let $f(x) = \langle w, x \rangle, \forall x \in \mathbb{R}^n$. Find $||f||$.

2. Let the data $\{(x_i, y_i), i = 1, 2, \ldots N\}, x_i \in \mathbb{R}^N, y_i \in \mathbb{R}$ be generated by a hyperplane. By kernel theory, the function that generates the data can be written as a linear combination of N training points and a bias term. However if the data is n dimensional the equation of the hyper plane consists of $n+1$ terms. Are these the same? Justify your answer.

3. Consider the following data {((1,1),-1), (1,-1),1), (-1,-1),-1), (-1,1), 1)}.
   (a) Plot the nonlinear boundary in the input space.
   (b) Plot the linear boundary in RKHS space generated by the kernel $k(x, y) = (\langle x, y \rangle)^2$ and the representor of evaluation at the input points.

4. Apply SVM classification on Data 1 & regression on Data 2 (find the attached documents).
   (a) Apply direct method and an iterative technique to solve the problem.
   (b) Find suitable kernel using cross validation techniques.

(c) Plot the decision boundary for classification and the SVM points.

(d) Plot the function that generates the data for the regression.

(e) Plot the value of primal and dual objective function against iteration.

(f) Assess the performance of the model.

5. Discuss the scalability of kernel methods.

Notes

- Assignment has to be written in latex.
- All the files related with the assignment should be saved in a single folder and send to sumitra@iist.ac.in.
- Last date of submission: 23-03-2015.
- **As far as assignments are concerned, students are expected to observe academic honesty and integrity. Though the students can collaborate and discuss, copying directly other students' assignment or allowing your own assignment to be copied constitute academic dishonesty and is highly discouraged.**