ELL 784 Software Test: 60 mts Marks: 50

CUT AND PASTE CODE, RESULTS AND SCREENSHOTS INTO A DOC FILE AND E-MAIL IT TO THE INDICATED ACCOUNT AT THE END OF THE EXAM. NAME THE FILENAME AS ENTRY_NO.DOC. ALL OTHER WRITEUP ASKED FOR MUST BE ON YOUR ANSWERSHEET.
DETAILED STEPS FOR EACH QUESTION MUST BE CLEARLY INDICATED ON YOUR ANSWERSHEET.

Q. 1. Generate the data set for Q1 as follows:

$$(x_1^i, x_2^i) = (2, 0.5 * sin(20\pi i), \text{i = 1, 2, 3, ..., 10})$$
$$(x_1^i, x_2^i) = (4, 0.5 * sin(20\pi(i-10)), \text{i = 11, 12, 13, ..., 20})$$
$$(x_1^i, x_2^i) = (6, 0.5 * sin(20\pi(i-20)), \text{i = 21, 22, 23, ..., 30})$$

Use a RBF kernel with $\gamma = 3$ to determine the kernel principal components.

1) Determine the first three principal components, including eigenvectors and eigenvalues. Indicate all steps on your answersheet.
2) Plot the projections of the 30 samples onto the first two KPCs as points in 2D. Copy the plot onto the doc file.

(25 marks)

Q.2. The samples in Q. 1 are now associated with labels as follows:

$$y_i = +1, \text{i = 1, 2, 3, ..., 10})$$
$$y_i = -1, \text{i = 11, 12, 13, ..., 20})$$
$$y_i = +1, \text{i = 21, 22, 23, ..., 30})$$

Determine the kernel SVM classifier using a RBF kernel. Find a suitable kernel width and value of C. Plot the decision regions along with the samples. Paste the plot onto your doc file.

(25 marks)

$$V = \sum \alpha \phi(x^i)$$
$$\langle \phi(x^k) \cdot V \rangle = \sum \alpha \, \phi(x^i) \cdot \phi(x^k)$$
$$= \sum \alpha \, K_{ik}$$