January-May 2017 Semester
CS6011: Kernel Methods for Pattern Analysis
Programming Assignment I

Date: January 25, 2017
Deadline for submission of PDF file of report: **Monday, February 13, 2017**

Datasets

Dataset 1: 1-dimensional (Univariate) input data
Dataset 2: 2-dimensional (Bivariate) input data
Dataset 3: Multivariate real world data

Regression Models:

1. Polynomial curve fitting for Dataset 1
2. Linear model for regression using polynomial basis functions for Dataset 2
3. Linear model for regression using Gaussian basis functions for Datasets 2 and 3
4. MLFFNN with 1 hidden layer for Dataset 1
5. MLFFNN with 2 hidden layers for Datasets 2 and 3
6. Generalized RBF model for Datasets 2 and 3. Use the same Gaussian basis functions as in Model 3.

Regularization:

1. Quadratic regularization for Models 1, 2 and 3
2. Measure of roughness of hypersurface for Model 6**.**

Presentation of Results:

- Dataset 1 and Model 1: Plot of the approximated functions obtained using training datasets of different sizes, for different model complexities and for different values of regularization parameter. (Similar to Figures 1.4, 1.6 and 1.7 of Bishop's book).
- Dataset 2 and Models 2, 3 and 6: Plot of target output and model output for training data, for different model complexities and for different values of regularization parameter.
- Dataset 2 and Model 5: Plot of target output and model output for training data, for different model complexities.
- Datasets 1, 2 and 3, and All 6 Models: Scatter plot with target output on *x*-axis and model output on *y*-axis, for training data, validation data and test data.
- Dataset 2 and Model 5: Plots of outputs for each of the hidden nodes and output nodes after 1, 2, 10, 50, 100 epochs and after training is complete, for the best performing configuration of MLFFNN.

Selection of model complexity and regularization parameter is to be done using the cross-validation method.

A single report by a team should also include the details of the models used and the observations about the results of studies.