

February-May 2021 Semester
CS5691: Pattern recognition and Machine Learning
Programming Assignment III

Date: **26th April, 2021**

Deadline for submission of PDF file of report: **Monday, 10th May, 2021**

Dataset 1: 2-dimensional artificial data:

- (a) Linearly separable data set for static pattern classification
- (b) Nonlinearly separable data set for static pattern classification

Dataset 2: Image data set for static pattern classification

Classifiers to be built for Dataset 1(a):

1. Perceptron for every pair of classes
2. Multilayer feedforward neural network (MLFFNN) with a single hidden layer for all classes
3. Linear SVM classifier for every pair of classes

Classifiers to be built for Dataset 1(b) :

1. MLFFNN with two hidden layers
2. Nonlinear SVM using one-against-the-rest approach : (a) Polynomial kernel, (b) Gaussian kernel

Classifiers to be built for Dataset 2:

1. MLFFNN with two hidden layers
2. Gaussian kernel based SVM using one-against-the-rest approach

Use the cross-validation method to choose the best values of hyperparameters.

Report should include the following for each classifier and for each dataset:

1. Table of classification accuracies of the model on training data and validation data for different values of hyperparameter
2. Classification accuracy of the best configuration of the model on test data
3. Confusion matrix for the best configuration of the model, on training data and test data
4. Decision region plots for Datasets 1(a) and 1(b). Superpose the training data on the decision region plot. For SVM model, mark the support vectors.
5. For the best configuration of MLFFNN classifier on Dataset 1(b), plot the surfaces of the outputs of hidden layer nodes and output layer nodes after the following epochs: 1, 5, 20, 100, and after convergence.

Report should also include your observations about the performance for each classifier, and for each dataset.