**Pattern Recognition / NCTU Fall 2025 Assignment #1 (due: 10/28/2025)**

The goal of this assignment is to let you experiment with classifiers. You can use Matlab, python, or C++. For the experiments, you are allowed to use existing libraries/modules/toolboxes or AI generated codes in your experiments. You are responsible to make your program organized and correct.

Your program should include the following modules:

1. The classifier modules (one for each classifier type), with separate methods for training and testing. The training method takes training data and their labels as inputs. The testing method takes testing data as input and returns both the predicted classes of the testing data and values of the discriminant functions.

2. The evaluation module. This module uses the outputs of the classifier module for the testing data, as well as their ground-truth class labels, to do evaluation of the classification results. You should compute and display the confusion matrices, and the ROC curves (as well as AUCs) for two-class datasets. Use these values to compare the different classifiers.

In addition, in the main program, you need to split the dataset into training and testing subsets, with both sets having similar distributions. Evaluation using cross-validation is also required.

You can go to the UCI Machine Learning Repository or Kaggle to get datasets for your experiments. Choose only datasets for classification and having numerical attributes. The different datasets have different data file formats, so you need to carefully read the descriptions. Select at least two two-class datasets and two datasets with more classes.

You have the option to include at most one dataset that is of "raw" formats, such as image or plain text. You will need to use a pretrained model to obtain the feature vector of an input sample. For example, you can use one pretrained ResNet to compute a feature vector for an image. No finetuning of the feature extraction model for this project, also do not use the model itself for classification.

Experiment with at least three classifiers. No deep learning models here. Regular MLPs are allowed.

You need to do experiments with your classifiers. Try changing things and see what happens. You can do experiments with hyperparameters, subsets of features, or different numbers of training samples.

Write a report (limited to 10 pages, single-spaced) describing

- Methods you have implemented.
- Experiments you have done, and the results.
- Analysis - Are the results what you expect? Why?

The report (PDF format only) is to be submitted electronically through e3. Also include the program listing as an appendix to your report (in the same file, not counted toward the page limit).

Late submission policy: 10% credit deduction for each day late; up to 7 days late accepted.