Pattern Recognition, Spring 2022

(Due on June 15, 2022 at 11:59pm)

Submission Instructions

We do not do reverse engineering, so please DO NOT provide programming codes WITHOUT **method description**. You should also declare in the assignment that **the programming codes were written by you, not by others either partially or fully**.

You should submit your answers as *a compressed file* containing 1) a write-up report in PDF format and 2) the source code to upr2022spring@126.com. The email title is formatted as "midterm_prog_asgmt_ 学号_姓名".

If you are in doubt, talk to me (majh8@mail.sysu.edu.cn) or our teaching assistants (张皓：henryz99@foxmail.com and 张曼琳：zhangmlin3@mail2.sysu.edu.cn) to understand more.

Face Recognition

Please download the ORL face dataset from 百度网盘 of our course. Please separate the dataset into a training and a testing set. For each person, images 1-8 can be used for training and images 9-10 for testing. Totally, there are 320 face images in the training set and 80 images in the testing set. Recognition accuracy is used as the performance metric.

1. Please use Principal Component Analysis (PCA) or Linear Discriminant Analysis (LDA) for feature extraction and k-nearest neighbors (k-NN) as the classifier. In this experiment, the face recognition models including raw images + k-NN, PCA + k-NN and LDA + k-NN are evaluated. The best hyperparameters in these three models are selected by cross-validation of the training set. Remember that the testing set CANNOT be used for training or hyperparameter selection. Please report the hyperparameter selection results and analyze the face recognition performance on the testing set.

2. In this experiment, the k-NN classifier in quiz #1 is changed to Support Vector Machines (SVM) with linear kernel for evaluation. Similarly, please report the hyperparameter selection results and analyze the face recognition performance on the testing set.

3. Please evaluate the non-linear kernels e.g. Gaussian or polynomial kernels in the SVM classifier for face recognition. Please report the hyperparameter selection results and analyze the face recognition performance on the testing set.

4. Apart from the k-NN and SVM classifier, other classification techniques including logistic regression, decision tree, random forest, adaboost, neural networks, and so on, can also be used for the face recognition task. Please evaluate other classifiers you have learned inside or outside the class and try your best to determine which one is the best for face recognition on the ORL dataset.

Implementation Tips

1. Choose your familiar programming language to accomplish the experiments (e.g., Matlab, Python).
2. Feel free to use the basic packages & built-in functions (e.g., Numpy, Sklearn, PyTorch).
3. All your findings and conclusions should have persuasive data support.
4. We recommend using visualization results (e.g., compare the performance of different methods in a table, show the relation between the parameters and the accuracy in a figure) to better illustrate your analysis.