2018 CSE3/4VIS Visual Information Systems Assignment

Proposed by A/Prof. Justin D. Wang

This assignment contributes **30%** of your overall marks for students enrolled in CSE3VIS, and **20%** of your overall marks for students enrolled in CSE4VIS. **Please read this assignment sheet carefully before doing your jobs.**

Problem Summary: The assignment aims at consolidating your knowledge base and developing practical skills to build a face recognition system using eigenfaces. Your results will be asked to present in two tables, which correspond to the combinations of cases with different image sizes (40x30 and 80x60) and different types of datasets (the training dataset and the test dataset). You need to investigate the effects of both the information loss ratio used to determine the number of principal components and the parameter k used in *k-NN* classifiers.

This is a **GROUP-based** assignment (the number of the group members: 1~3, no more than 3 please; all group members will receive a same marks) for both 3rd and 4th year students. You are **NOT** permitted to work as a mixed-group (i.e., all group members must be from the same grade) when completing this assignment. The length of the assignment report is about 1200 words with codes used in Matlab.

Copying, Plagiarism: Plagiarism is the submission of somebody else's work in a manner that gives the impression that the work is your own. The Department of Computer Science and Information Technology at La Trobe University treats plagiarism very seriously. When it is detected, penalties are strictly imposed.

Date due and late submission policy: May 17, 2018 (Thursday)

- All assignments are due at **10:00 am**.
- A penalty of 5% per day will be imposed on all late assignments up to 5 days. An assignment submitted more than five working days after the due date **will NOT be accepted and zero mark will be assigned**.
- Students will **not** be granted an extension of the assignment deadline. Students are requested to submit an application for special consideration through Student Centre. In addition, students are advised to submit whatever incomplete work they have already done for the assignment.

Where to Submit: Your assignment report (hardcopy) is to be submitted at a labelled box opposite to **BG 139 lab**. Note that we will **NOT** accept your electronic submission.

Tasks Description (100 marks in total)

This assignment is composed of the following 5 subtasks. You need to use ONLY selective 10 persons' face images (including yourself ones) in your assignment. That is, selecting 10 (person)x3 (images from the given training dataset that we provide in LMS)=30 images to form your own training dataset to generate eigenfaces, and the remainders (another two images from the same selected persons) will be used as your own test dataset. Please note that the mentioned training and the test dataset below refer to the training dataset and the test dataset that you generate by yourself, rather than the ones that we provided.

- Resize images stored in the training dataset and the test dataset into 40x30, respectively for generating the eigenfaces and performance evaluation (see Table 1 and 2). Repeat this job with image resized as 80x60. **[10 marks]**
- Determine K1 and K2 according to the following formulas:

$$T_{K1} = \frac{\sum_{p=1}^{K1} \lambda_p}{\sum_{p=1}^{N} \lambda_p} \geq 0.85 \quad \text{and} \quad T_{K2} = \frac{\sum_{p=1}^{K2} \lambda_p}{\sum_{p=1}^{N} \lambda_p} \geq 0.95$$

  where $\lambda_1 \geq \lambda_2 \ldots \geq \lambda_N$ are the eigenvalues. Describe how do you generate K1 and K2 eigenfaces from the training datasets. Then, demonstrate the top 10 eigenfaces (corresponding to the top 10 eigenvales). **[20 marks]**
- Using 1-NN, 3-NN and 5-NN classifiers to recognise all images for the test datasets; Report the average **recognition rate** in the following tables: **[40 marks]**

Table 1 Results for the test dataset (K1)

	1-NN	3-NN	5-NN
40x30 size			
80x60 size			
Average			

Table 2. Results for the test dataset (K2)

	1-NN	3-NN	5-NN
40x30 size			
80x60 size			
Average			

- Using your own 2 face images sized as 40x30 from the testing dataset that you built and the selected value of K1, please list 5 top ranked faces (based on Euclidean distances) from the training dataset with size as 40x30. So, in total you will have 10 faces to show. Please provide some analyse on the results. **[20 marks]**

- Based on your observations and data analysis on the results given in Table 1-2, please draw some conclusions and make comments on the eigenface technology for face recognition. **[10 marks]**

Assessment Criteria

(100-80 marks) - An excellent, well-written report and demonstrate good understandings on the eigenface techniques for face recognition. The developed system produces sensible results. You have analysed the performance of the system and drew some conclusions in an interesting and sound way.
(79-60 marks) - A well-written report. You have produced a working system that produces good results. You have exhibited some initiative in the approach taken and the results are presented clearly. A sound analysis on the results is presented.

(59-40 marks) - A reasonable report that demonstrate some understandings on the eigenfaces techniques. The system performs reasonably well and the results are presented reasonably clearly.

(39-20 marks) - A report that presents some results of a working system. Demonstrating some basic understandings on face recognition.

(19-0 marks) - Either no report submitted or a report that shows little or no understanding on face recognition.

~ End of Assignment Paper ~