Face Recognition

7th November 2017

Abstract

This laboratory is devoted to face recognition using eigenfaces. First we deal with gender recognition and then with subject recognition.

Contents

1   Introduction

In this session, we will introduce concepts involved in the face recognition problem. In particular, we will deal with the problems of gender recognition and subject recognition. You can download from the Campus Virtual all the material you need for this practicum.

2   Gender Recognition

Let us develop different gender recognition systems using the AR-Face database[1]. The provided folder contains some matlab functions and the file AR-Face which stores the data base.

Open the file main_gender_recognition.m corresponding to a gender classification system and follow the comments to complete the code and answer the posed questions. There are, in total, 7 gaps to complete in the functions main_gender_recognition.m, apply_pca.m.

In the function main_gender_recognition.m the data set samples are prepared identifying data and labels (male/female) from the loaded structure AR-Face.

Questions 1:

- *Which is the information contained in ARFace.person?*

- *Why the size of the field internal, size(ARFace.internal), is 1188 x 2210?*

The function feature_extraction.m allows to choose different strategies to reduce dimensionality (PCA and LDA) and returns the matrix with reduced attributes. PCA strategy is used to reduce dimensionality with different dimensions. The option 'PCA' sets the parameter *dim* to 5, the option 'PCA95' estimate the value of parameter *dim* which keep the 95% of the variance of the data. The option 'LDA' performs linear discriminant analysis.

Finally, the function fold_validation.m defines a F-fold cross validation strategy. The data set is split to define the training set and testing set from the data set. For the classification step, the method K-Nearest Neighbor (K-NN) is used.

Question 2:

- *What are the variables 'n' and 'index' of the function fold_validation.m?*

Question 3:

- *The provided code computes some evaluation measures of the results obtained with 'PCA' (dim=5), 'PCA95' (95% variance explained) and 'LDA'. Which is the meaning of these measures?*

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[1] http://www2.ece.ohio-state.edu/ aleix/ARdatabase.html

Tasks:

- *Show some eigenfaces using the function show_ eigenfaces.m and comment them.*

- *Summarize the obtained results in a table, comparing the performances and including details of the feature extraction method and the classifier (parameter dim, # nearest neighbors).*

- *Comment the validation measures and confusion matrices to illustrate the results and conclusions for the methods.*

- *Make a discussion about the results and conclude with the pros and cons of the proposed systems.*

3   Subject Recognition

Now, consider the subject recognition problem using the AR-Face database and answer the following question.

Question 4:

- *Knowing that the AR-Face database has several instances (photos) of the same subject, how do you have to distribute the samples in the fold-cross validation strategy for the subject recognition problem?*

3.1   Optional exercise

Develop a subject recognition system using the same AR-Face database. Use a F-fold cross validation strategy to classify each subject using random examples of the data set in each run. Start with the file main_subject_recognition.m and follow the structure of the previous code. Answer the following questions.

Questions:

- *Which are the necessary changes in the code? Detail all the changes you need to do when changing to the subject recognition problem.*

- *Which is the best dimensionality reduction method for this particular problem?*

- *Include error measure and confusion matrices to illustrate the results and conclusions for the methods.*

- *Comment the particularities of this problem.*

4 Practicum submission

You are requested to submit a file "StudentName1+StudentName2_Lab5-6.zip" containing:

- A report entitled "Face Detection and Recognition" including the results of the problems posed in the lab 5 and lab 6 properly commented and all necessary images to fully understand your discussion. The report must provide answers for all questions.

- The matlab files where code should be completed.

Deadline: 20th November, 23:55h by Campus Vitual.