CITS4402 Computer Vision

Project: Linear Regression for Face Recognition

Due: Friday, 21st of May 2021, 4pm (NO EXTENSIONS)

Grouping

Form groups of 3 students and include the first names and surnames of the group members on LMS Discussion board. This should have been done by now.

Timeline

Wednesday 7th April 2021: Last day to enter your group names on LMS "discussion board".

Week 7 to Week 12: Work on your project. You have 6 weeks. The tutor will be available in the labs or online during certain lab hours for questions (time to be confirmed on LMS under announcements).

Week 13 (17-21 May 2021): Presentation of the projects. Times will be announced.

Friday 21st May 2021 4:00PM: Final deadline to submit your project on LMS.

THE PROJECT

You are required to develop an automatic face recognition system. The idea is to develop an intelligent computer vision software to process images and recognize faces in these images. You will divide your images into training and test data. In practice, the test data will have different images from the training dataset. For example, if there are 10 images of subject A, use 5 images for training and the remaining 5 images for testing. Assuming there is a total of 40 subjects, you will have 40x5 images in the training set and 40x5 images in the test set. For the implementation of this system, please read the following article, "Linear Regression for Face Recognition", IEEE PAMI 2010 (Implement the Linear Regression Classification – LRC-- Algorithm proposed in Section 2.1 for this project). During your implementation, focus on the pseudocode of the LRC algorithm provided in Sec 1 of the PAMI manuscript.

The PAMI paper is available on LMS (under Project).

Image dataset for this project: available on LMS (under Project).

There are two phases to develop this face recognition system (1) the learning phase (also called training phase) and (2) the testing phase.

Learning Phase/ Training Phase

In the training phase, you will develop a class-specific model for training images as explained in the PAMI article. For a given image dataset, you can use 50% of the images for training. Remember, 50% per subject i.e., if there are 10 images per subject, use 5 images for training. Once you have your training set, downsample and normalize your training images as per the procedure outlined in the manuscript, "linear regression for face recognition" (PAMI). Use this normalized data to train your system.

Testing Phase

Use the remaining 50% images for testing. Downsample and normalize the test images as you did during the training phase. Compute the original response/label (training data/model will be required) and the predicted response (label) for the test image. Compare these responses using the distance measure, used in the PAMI paper, to predict the class of the test image. Based on the quality and consistency of the prediction, decide which class corresponds best to the test image. Once you have predicted the classes of all test images, report your overall recognition accuracy.

Repeat the above steps 5 times for different combinations of the training and test data. Calculate the recognition rate of your system. What happens when you use different combinations of training and test data?

Now capture new images (yours and your friends or classmates) from different viewpoints and expressions. ***Students are encouraged to include their photos on LMS discussion group (where you have included the names of your group members) from different viewpoints, under occlusion, and different illumination variations.*** Define your new training and test data. Give these images as input to your face recognition system for training and testing. What recognition accuracy do you get?

Develop a simple GUI to test your algorithm. The GUI should load a test image one by one, predict the class of the test face/image and display the results. The sample video provided on LMS (the project page) can be used as an example. The recognition should be fully automatic and you may only specify the directory where the test images are present.

Your code should already know where to find the training data.

Note: You are not allowed to use the Matlab Computer Vision Systems Toolbox.

Distribution of Marks [total=25 marks]

1. Image Data Partitioning: 50% images for training and remaining 50% for testing. Would a different partition give better results? E.g., 70-30%? [3 marks]
2. GUI to test your code showing the testing phase only. [5 marks]
3. Computation of class-specific model, original and predicted responses/labels. [8 marks]
4. Matching (comparison of responses) and display of recognition results. [3 marks]
5. Results with different combinations of training and test data, and new images. [6 marks]

FAQS

How do I form a group?

Try talking to fellow students before and after the lectures and during the labs. Try posting on LMS "discussion board" that you are looking for group members. But I trust this has already been done by now.

Do I have to write a report?

No. All information should be included in the readme file (submitted with your code).

Presentations

In your final lab (**week 13: 17-21 May 2021**), one group member will present their system and demonstrate that their face recognition system is working properly.

Submission Requirements

Friday 21st May 2021 by 4:00PM, you are required to upload (on LMS) a folder containing your Matlab code and new face images. Marks will be based on your presentation and the submitted code.