EE462, EE9SO25, EE9CS728

Machine Learning for Computer Vision

Coursework on face recognition by PCA [25% mark]

Release on 25 Jan, the report due on 14 Mar (midnight)

The course work requires Matlab programming. Use the provided face data.

Submission instructions:

One joint report by each pair

Page limit: 4-6 A4 pages per report with 10 font size (use the IEEE standard double column paper format, either in MS word or latex).

> http://www.pamitc.org/cvpr16/files/egpaper_for_review.pdf
>
> http://www.pamitc.org/cvpr16/files/cvpr2016AuthorKit.zip

Give insights, discussions, and reasons behind your answers, on the scope of lectures. Quality and completeness of discussions within the page limit will be marked.

Source code is not mandatory: optionally, this can go to appendix, which does not count for the page limit.

Submit the report **in pdf** through the Blackboard system. No hard copy is needed. Write your full names and CID numbers on the first page.

If you have questions, please contact

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Q1. [20] Partition the provided data into your training and testing data, in a way you choose. Explain briefly the way you partitioned. Apply PCA to your training data, by computing the eigenvectors and eigenvalues of the data covariance matrix $S=(1/N)AA^T$ directly. Show and discuss the results, including: show the eigenvectors, the eigenvalues, and the mean image, how

many eigenvectors with non-zero eigenvalues are obtained and how many eigenvectors are to be used for face recognition. Give insights and reasons behind your answers.

Q2. [20] Apply PCA to your training data, using the eigenvectors and eigenvalues of $(1/N)A^TA$. Show and discuss the results (similar to Q1). Compare the methods and results in Q1 and Q2, including: if the eigenvectors and eigenvalues obtained are identical, what are the pros/cons of each method. Show the respective measurements for your answers.

Hereinafter, we use a more efficient PCA technique among the methods discussed in Q1 and Q2.

Q3. [20] Perform the face image reconstruction using the PCA bases learnt. Show and discuss the results, while varying the number of bases to use, including: if the reconstruction error (or the distortion measure) obtained is same as in the theory, how good the reconstruction results are for at least 3 images of your choice (e.g. from both the training and testing dataset).

Q4. [40] Perform the PCA-based face recognition with your training and testing dataset above. Try both NN classification method and alternative method learnt in the lecture. Report and discuss, including: the recognition accuracy (success rates), example success and failure cases, the confusion matrices, comparison of the two methods in terms of accuracy/time/memory (and any other aspects you observe), by varying the parameter values/experimental settings you used. Give insights and reasons behind your answers.