CSE 802 Pattern Recognition and Analysis
Term Project

Unconstrained Face Recognition Challenge

Spring 2017

1 Objective

In this project, students will get a chance to gain hands-on experience on designing, implementation and evaluation of pattern recognition algorithms for unconstrained face recognition. The goal of this project is to get an insight on how the methods taught in the class perform on real world datasets. It is important for students to understand the underlying mechanisms and assumptions of the methods they use in solving large scale pattern recognition problems.

2 Description

In this project, we recommend teams of two students to implement a deep network architecture and some traditional methods such as PCA and LDA to evaluate verification and identification performances of the unconstrained face recognition problem using the BLUFR protocol. Details of BLUFR (Benchmark of Large-scale Unconstrained Face Recognition) can be found in [1]. MATLAB code for BLUFR evaluation will be provided. Students are advised to get familiar with the protocol as soon as possible.

Training and testing splits containing cropped face images from the CASIA WEBFace Database [2] will be provided. The database contains 494,414 images of 10,575 subjects in total with approximately 46 images per subject. Final evaluation will be done on Labeled Faces in the Wild (LFW) database [3] which contains 13,233 images, 5,749 subjects and 1680 subjects with two or more images.

2.1 Network Architecture

An example deep network architecture is given in Table 1. Details about this architecture, which is a standard convolutional neural network (CNN), can be found

in [4]. Each team will need to implement the network with specifications in Table 1 and tune its parameters such as batch size, learning rate, dropout percentage, and number of channels to improve the performance. Number of layers and the filter sizes can also be altered. The reasoning behind all changes should be reported. A popular deep learning library, Tensorflow [5], will be accessible to every student on HPCC.

Table 1: Deep Network Architecture

Name	Type	Filter Size/Stride	Number of channels
Conv11	convolution	3x3 / 1	32
Conv12	convolution	3x3 / 1	64
Pool1	max pooling	2x2 / 2	-
Conv21	convolution	3x3 / 1	64
Conv22	convolution	3x3 / 1	128
Pool2	max pooling	2x2 / 2	-
Conv31	convolution	3x3 / 1	96
Conv32	convolution	3x3 / 1	192
Pool3	max pooling	2x2 / 2	-
Conv41	convolution	3x3 / 1	128
Conv42	convolution	3x3 / 1	256
Pool4	max pooling	2x2 / 2	-
Conv51	convolution	3x3 / 1	160
Conv52	convolution	3x3 / 1	320
Pool5	avg pooling	7x7 / 1	-
Dropout	dropout (40%)	-	-
Fc6	fully connection	-	-
Cost	softmax	-	-

Basic deep learning concepts will be covered in the class. However, students should start getting familiar with Tensorflow [5] early on. Some relevant readings on CNN and deep learning are available in [6], [7], [8]. Teams will also compare the performance of the network with traditional methods covered in the class such as PCA and LDA and using some low level features such as LBP.

3 Submission Requirements

- A progress report explaining the current status and the next steps is due on March 27.
- A final presentation (total of 10 mins; 7 mins presentation + 3 mins Q&A) discussing the observations and findings along with the experimental results.

Presentation should be submitted by April 23 midnight.

- A final report (IEEE format [9], 11pt, double column, 3 pages excluding references) is due April 26 midnight. Students should explain their approach, discuss their findings and report the experimental results.

4 Grading

Evaluation will be based on the reported performances, quality of report, explanation of the approach.

- Progress Report 20%
- Presentation 40%
- Final Report 40%

References

[1] http://www.cbsr.ia.ac.cn/users/scliao/projects/blufr/

[2] http://www.cbsr.ia.ac.cn/english/CASIA-WebFace-Database.html

[3] http://vis-www.cs.umass.edu/lfw/

[4] Dong Yi, Zhen Lei, Shengcai Liao and Stan Z. Li. *Learning Face Representation from Scratch*, arXiv:1411.7923v1 [cs.CV], 2014.

[5] https://www.tensorflow.org/

[6] http://www.deeplearningbook.org/

[7] https://www.cs.toronto.edu/ hinton/absps/NatureDeepReview.pdf

[8] https://arxiv.org/pdf/1512.07108v5.pdf

[9] https://www.ieee.org/conferences_events/conferences/publishing/templates.html