CISC452 Undergraduate Project Proposal

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Problem Description

The problem our group is trying to solve is to implement a tool that is capable of recognizing human faces in pictures. Our implementation can identify human faces that is in picture and check who the people are. Our neural network model will receive a picture as input then detect human faces based on fully trained weights, and the output is the most possible corresponding labels or names that have the highest similarity with known human faces in database respectively. Throughout the implementation, it is possible that the model will take long time to train due to the structure of model. Meanwhile, the model may need to be self-adjustable to some extent to fit the data set and increase the accuracy of training results. In addition, the pictures from real life provided as input to the model may be blurred, so the performance may decrease. Furthermore, there are more factors that may affect the accuracy of training. For example, head pose, age, illumination, facial expression, occlusion, etc. (Trigueros, Meng, & Hartnett, 2018) Our group will try to handle and solve the issues as well as possible.

Motivation

Nowadays, because of the rapid development, criminals have a lot of ways to perform information fraud. Therefore, the risk of information fraud is needed to be reduced. Our tool can solve this problem perfectly, which can be used on any position that needs to identify a person's id. For example, if the police want to know the identity of a person, our tool can help him to check whether the person is the same person that on the identity card. Our tool can not only solve for the information fraud problem, but also it can bring the convenience to our life. By using our tool, people can go to CAS lab without iButton. They only need to bring their student card to enter the CAS lab.

Data set

In terms of data set, we will mainly use resources from "Labeled Faces in the Wild" from Computer Vision Laboratory under University of Massachusetts, which is known as LFW. LFW is a database of face photographs that is widely

used for training neural networks and designed for studying the problem of unconstrained face detection and recognition. The data set is mostly gathered from web resources. More than 13,000 pictures are stored in this data set (Huang, Ramesh, Berg, & Learned-Miller, 2007). Specifically, each human face image has been labeled with the name of person pictured so that it has advantages when conducting supervised learning. Almost every image in data set is clear and distinct so that training has less constraint. The data set may also contain the photos from real life with human faces in it. The pictures can be blurred or have noise on them to simulate the natural conditions of photos.

Implementation Plan

The basic idea of our human face recognizer is to develop a deep convolutional neural network, known as CNN, to extract features from input images. To be more specific, it follows the method described in research paper named "FaceNet: A Unified Embedding for Face Recognition and Clustering" with modifications that are inspired by a project named OpenFace (Schroff, Kalenichenko, & Philbin, 2015). The Keras is used as well for implementing the CNN. Otherwise, Dlib and OpenCV are for aligning faces on input images. Face recognition performance is evaluated on a small subset of the LFW data set and it is also possible to replace the data set with our own gathered images of people.

Validation Plan

Ideally, we can use open-source platform from large companies such as IBM Watson to compare the performance between our implementation and theirs. As for the results evaluation, we will use confusion matrix, recall and precision using new test data set from pictures that are not used in training and some real-life photos.

References:

Huang, G. B., Ramesh, M., Berg, T., & Learned-Miller, E. (2007). *Labeled Faces in the Wild: A Database for Studying Face Recognition in Unconstrained Environments.* Amherst: University of Massachusetts.

Schroff, F., Kalenichenko, D., & Philbin, J. (2015). FaceNet: A Unified Embedding for Face Recognition and Clustering.

Trigueros, D. S., Meng, L., & Hartnett, M. (2018). Face Recognition: From Traditional to Deep Learning Methods.