Face Recognition Using OpenCV

Sohail Khan (B16CS036) Harshul Sharma (B16ME011)
Mentor: Chiranjoy Chattopadhyay
Department of Computer Science and Engineering
Indian Institute of Technology, Jodhpur

Motivation:

The motivation behind this project is that facial recognition has an amplitude of possible applications. Webcams are often used as a security measure for locking a personal computer. The webcam's facial recognition technology allows for the computer to be accessible to the user only if it recognizes their face. Facial recognition technology can also be used to keep track of the attendance of the students.
Facial recognition is the identification of humans by the unique characteristics of their faces. Facial recognition technology is the least intrusive and fastest biometric technology.It works with the most obvious individual identifier the human face. With increasing security needs and with advancement in technology extracting information has become much simpler. This project aims on building an application based on face recognition using algorithms and comparing the results with different databases.

Objective:

1. The basic purpose being to identify the face and retrieving information stored in database. It involves two main steps. First to identify the distinguishing factors in image and storing them and Second step to compare it with the existing images and returning the data related to that image

2. Trying to find a face within a large database of faces. In this approach the system returns a possible list of faces from the database. The most useful applications contain crowd surveillance, video content indexing, personal identification (example: drivers license), mugshots matching, etc.

3. Real time face recognition: Here, face recognition is used to identify a person on the spot and grant access to a building or a compound, thus avoiding security hassles. In this case the face is compared against a multiple training samples of a person

Challenges/Research Issues:

The problem of Facial recognition becomes more challenging in unconstrained environment and in the presence of several variations like :

1. Illumination variations
2. Pose variations
3. Facial expressions
4. Facial hair changes
5. Age changes
6. Face wearable changes

Methodology/Algorithm:

First of all the dataset is trained to extract the features from the images and then it is stored for comparing it later with the input image. The basic steps for face recognition are :

1. **Find a face in a image:** Face detection in this project is done by using openCVs built in pre-trained facial detector, namely, haar_cascade_classifier and LBP_cascade_classifier.

2. **Extract facial features from the face image:** The project uses descriptor based methodology. Feature vector from the face image is computed using LDRP (Local Directional Relation Pattern) which encodes the relationship among directional neighbors and then utilizes the encoded values with central pixel to generate final pattern.
3. **Compare against known faces:** The feature vector is computed for the input(testing) face image, and then the obtained feature vector is compared with the existing list of feature vectors of the trained images by KNN using Euclidien distance.

4. **Make a prediction:** Based on the distances computed with the list of feature vector, K nearest neighbors of the input feature vector are obtained. Then the prediction is made based on the votes given to the K nearest neighbors.

Results:

The descriptor is evaluated under image retrieval framework for various face databases like ESSEX - Face94 and Face95 , AT&T, etc. The face94 had 50 subjects and each subject had 20 images with expression variation. The face95 had 30 subjects and each subject had 20 images with expressions, light variations, and slight pose variations. AT&T had 40 subjects with 10 images for each subjects with expressions, light variations, and slight pose variations (with and without glasses).

The descriptor gave promising results for all the above mentioned databases and recognised faces under unconstrained environments.

Conclusion:

LDRP is a robust facial feature retrieval descriptor which can be used to recognise faces under unconstrained environment with pose, light , expression variations. LDRP is also invariant of image size and computes a feature vector of dimension 1X1024 which is a good number as compared to the other existing facial feature descriptor.

References:

[1] Local Gradient Hexa Pattern: A Descriptor for Face Recognition and Retrieval Soumendu Chakraborty, Graduate Student Member, IEEE, Satish Kumar Singh, Senior Member, IEEE, and Pavan Chakraborty, Member, IEEE

[2] Local Directional Relation Pattern for Unconstrained and Robust Face Retrieval Shiv Ram Dubey

[3] HOG: https://www.learnopencv.com/histogram-of-oriented-gradients/

[4] LBP: https://ieeexplore.ieee.org/document/7322425/

[5] Wikipedia : https://en.wikipedia.org/

[6] Haar Cascade, OpenCV: https://docs.opencv.org/2.4/index.html

Date: 16/04/2018 Mentor's signature