Facial Recognition for Access Point Systems

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Methodology

Theory
OpenCV2 uses many statistical machine learning libraries that involve:
- Deep Neural Networks
- Support Vector Machines
- Random Forest

Quantification of facial features for classification
It is important to understand the concept of *eigenfaces* that the dlib library in Python utilizes first. This library basically quantifies images into a 128d feature vector that allows the OpenCV’s SVM algorithm to classify and make a decision. This decision in particular is whether the feature vector of the face(s) shown on the webcam matches the feature vectors to the face images with the most similar feature vectors in the database.

Methodology

Design Objective and Goal
To create an accurate facial recognition machine learning program in Python that fully utilizes OpenCV2, a high performance library for digital image processing and computer vision. Furthermore, our project will contain both an automatically generated database and a manually inputted database to allow robust control of what faces will be recognized by the program. More importantly, the project focuses on software solution rather than hardware solution making our project accessible by any contractor or customers without needing to buy extra hardware.

Analysis and Results

As seen in the figures above, our software accurately detects the facial features of the person and matches it with the ones in our database. It detects the faces of people accurately no matter what their facial expression may be. If the picture of the person is not in the database, the face will be detected as “Unknown”. The live feed of the software via the webcam currently runs at around 10 frames per second with occasional drops. This is attributed to the computer and webcam hardware, memory and data-bus bandwidth, and processor speed which could be improved later on.

Summary/Conclusions
Our group was able to produce an accurate facial recognition security system, which is capable of recognizing faces in real time. With the amount of user input freedom our software has, our product can easily contribute to the improvement of public security at an affordable price. Besides selling our product to home and business owners, we are also open to collaborate with the law enforcement and other public surveillance companies.

Speed is one flaw that our software suffers from. Currently, the live feed runs at around 30 frames per second but it occasionally drops to 3 to 5 frames per second. The sudden drop in frames make it difficult for the program to detect a person’s face in real time. This can easily be improved by using Internet Protocol cameras or dedicated local computers that can handle heavy load.

Key References


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