Computer Engineering Department
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Face Recognition System
Project Proposal

Team Members

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Project Idea

Face Recognition is one of the most technological trends in our modern world. Face recognition has many applications one of them is biometric authentication. Facial biometrics continues to be the preferred biometric benchmark. That's because it's easy to deploy and implement and there is no physical interaction with the end-user.

The system should be able to

- Detected faces from a given stream of video
- Recognize faces in the video that were added before in the system database
- Friendly interface to add more people that the system can recognition

Project Pipeline

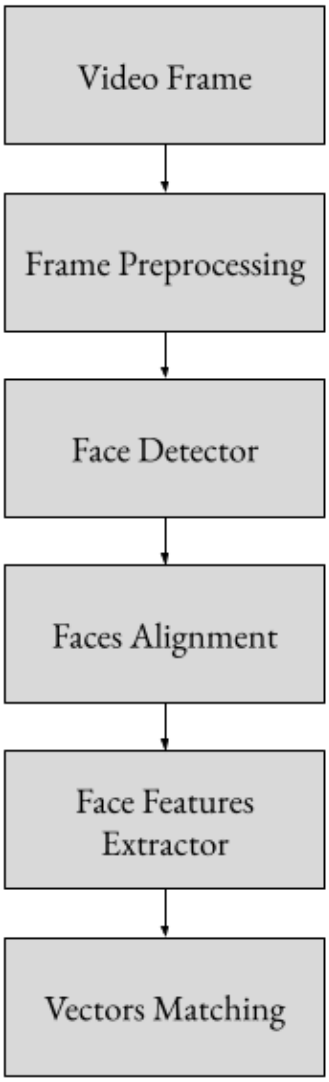

Figure 1: The full pipeline for the project

Frame Processing Stage

Input: Given video frame
Output: The frame after removing noise and enhancing contrast
Description: In this stage, we will use a set of filters and contrast-enhancing techniques so that the noise and difference, and illumination don't affect our detection accuracy.

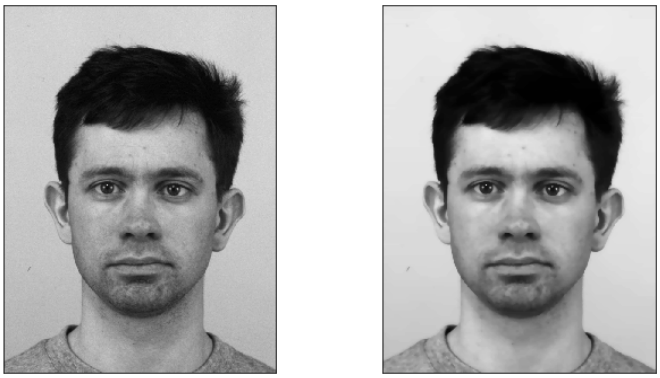

Figure 2: the output image after removing noise and contrast-enhancing

Face Detector Stage

Input: Video frame
Output: An array contains detected faces and their position
Description: In this stage, we will use a face detector algorithm to scan the frame and extract faces from it. In our project, we will use **Viola-Jones Algorithm** for this task because of its high accuracy and speed.

Viola-Jones Algorithm Stages

- Haar Feature Selection
- Creating an Integral Image
- Adaboost Training
- Cascading Classifiers

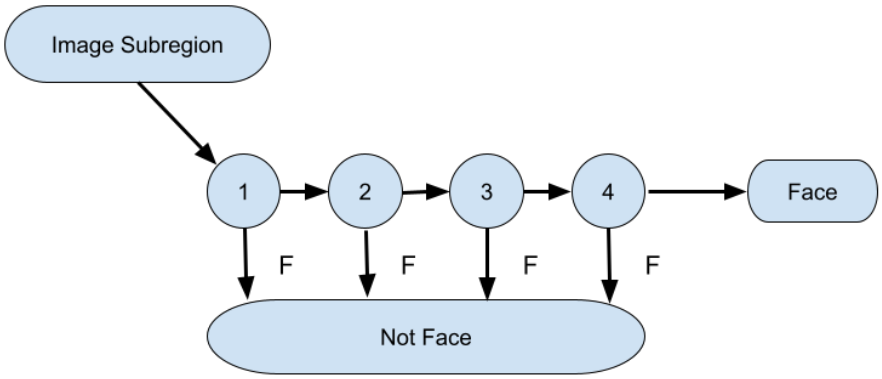

Figure 3: How Viola-Jones Algorithm predicts if a subregion contains a face or not

Faces Alignment Stage

Input: Subregions of the frame that contain faces
Output: A centered version of the extracted faces
Description: In this stage, we align faces image to be in the center this stage is useful to generate a feature vector smiler to what we have in our database

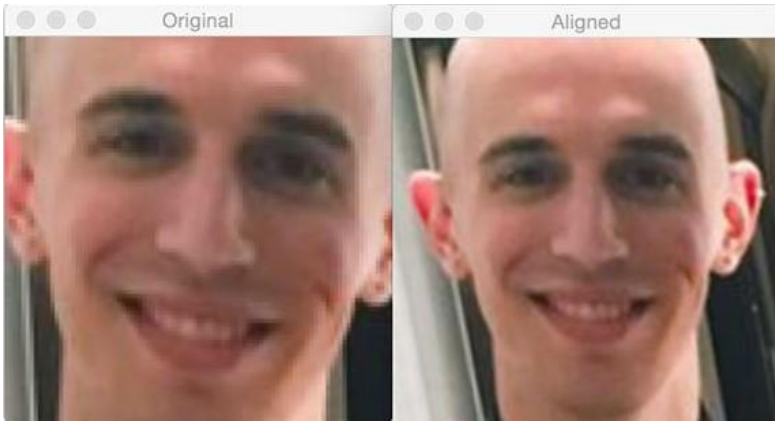

Figure 3: The face before and after alignment

Face Features Extractor Stage

Input: Centered subregion contains a face
Output: A vector that contains floats to represent features in the face
Description: In this stage, we will extract features from the face using **Hybrid** methods that combines techniques from **holistic** and **feature-based** methods

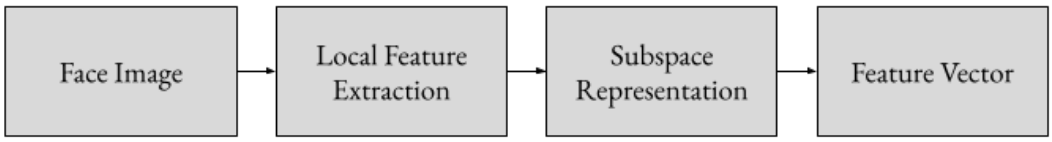

Figure 4: The architecture of feature extractor

Vector Matching Stage

Input: A given face feature vector
Output: A predicted class for the face (there is a class for unknown faces)
Description: In this stage, two templates are compared to produce a similarity score that indicates the likelihood that they belong to the same subject

Non-primitive Functions

- Using OpenCV-Python for video capture and to get frames
- Using Sklearn for any needed machine learning algorithm such as PCA and Adaboost
- Using Numpy for matrix operations and calculating image integral
- Using Skimage for transforming images to grayscale and convolution

As we start implementing the project we can find a need for other functions and we will ask permission from the TA.

Scientific Papers

- Rapid Object Detection using a Boosted Cascade of Simple Features
- Face Recognition: From Traditional to Deep Learning Methods
- Real-time face recognition using AdaBoost improved fast PCA algorithm
- Review of existing algorithms for face detection and recognition