Working Description

Problem?

Our everyday lives are explicitly and implicitly dependent on some kind of face detection and recognition software. We encounter them more than we think. Be it our phone with its face recognition module, our office entry with a face detection camera, or any kind of security measure that employs and depends on face recognition in real time. This module has been used explicitly in various projects but still has wide ranges of potential applications that it can be used for. For this project we decided to research this face recognition domain and dynamically adapt and conform it to be used in House Security system. This is an ambitious project but we have successfully reached our goal of recognizing face in real time under a GUI interface which will be operated by the owner of the system and an user in real time, which later can be deployed in houses as a Security system module that uses camera to ensure safety of a house by monitoring everyone who is entering the house.

Introduction to our approach

Dynamic Target Recognition is a big and emerging field in Real-Time image and video processing. Its uses range from security protocols to gaming devices. For the final project of this class, we collectively have decided to work on Webcam based motion detection and face recognition by using python programming language. The main idea of the project is to have a GUI interface which will allow the user to have real- time face recognition installed and update the user if anyone face has been detected and not recognized from the library.

The user of this system will have stored a .jpg format picture for each family member, he or she trusts to enter in the house. This for our project will simply mean having a file with pictures of the family members saved under their respective names. As soon as someone new approaches the front door, the guest will have to touch the camera option which will open the webcam attached to it. It will try to recognize the new face in real-time from the database of pictures pre-stored by the user. If it recognizes the face then it will print the name of the person on the screen around the square shaped contour which detects the face. Once the recognition happens, the guest will have the permission to open the door and get into the house, which means the main owner or the user of the system will not be identified since the face has been recognized. But as soon as a face has not been recognized, thus, meaning an unknown face as been detected but not recognized, it will store a message for the user saying “An Unknown face has been detected, signalling an intruder is trying to get into the house.

The idea presented above is the bigger picture that we have in mind for the project. However, currently we have successfully made a GUI interface using, “tkinter” functions taught to us in the course, and it will be explained in great details under a different section in this paper, which deploys a face recognition library that recognizes any face in real-time with precise accuracy. The system is also able to send Detected object(s) and their snapshots with real-time stamps and save them in a folder which can later be checked by the user for any new information.

We have built a Real time Intrusion Detection System that incorporates two modules, namely an interactive GUI and an Intrusion Detection module.

2.1 GUI

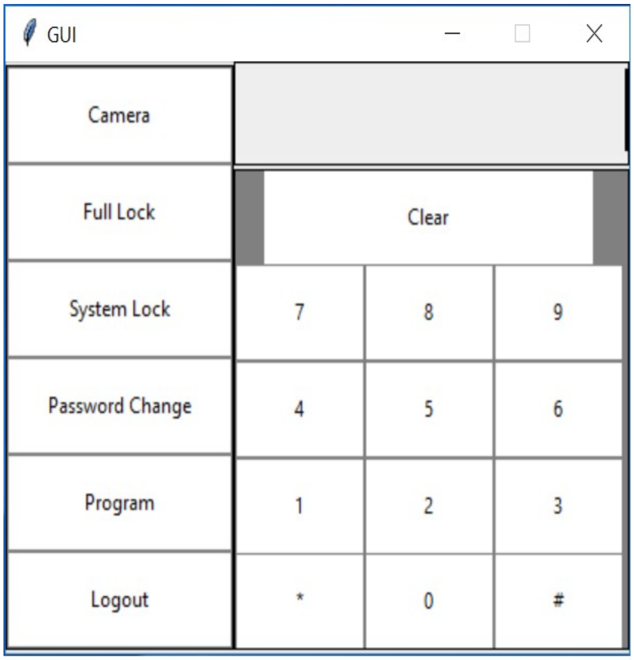

Figure 2.1: GUI

We have two security modules embedded in the GUI that can enabled/disabled using passcodes.

1. **System Lock:**

   What is the function?

   Let's first think of a situation when the device is installed in a family's house and it has access to multiple cameras that have been installed at inner and surrounding corners of the house.

If the user enables the System Lock, it locks the features of changing passwords and adding new faces to the facial training module embedded in the GUI. Only the Camera (i.e.

facial recognition module) button and the Full lockdown feature are accessible. In this case no outsider or intruder can manually access and change the passwords for the two security modules and use the “Program” button to add a new face to the back-end server for facial training.

Why is the Camera button still accessible?

The user might want to use the camera option to check activities on every camera attached to the system. In case there is a stranger or an intruder presence while everyone is inside the house, the user can instantly see that. If intruder detected, then pictures along with timestamp of the intruder will be taken and stored in the database of the back-end server.

Why is the full lockdown button still accessible?

The user might want to put the system on full lockdown (if the family decides to go out of the house for some time) provided the user enters the correct password and it triggers the facial recognition module automatically.

Another case:

This can also be helpful for the user to prevent tempering from the children playing around.

2. **Full Lock**

What is the function?

Now let’s think of a situation when the family is going for a vacation and no one will be in the house for a significant amount of time. The user obviously will want to activate a Full Lockdown which will automatically trigger facial recognition module to be alarmed and notify the user for intruder activity.

How does it help?

When the full lockdown in activated, activities of intruders or burglars can be reported. Since the facial recognition module is on full lockdown mode, it will be on the lookout for any such possibilities. If an unknown face is detected, pictures will be clicked and stored in the database and the user is notified. These activities can also be checked by logging to the back-end server.

Added feature:

Due to poor lighting and various other conditions, the facial recognition module can do mis-prediction maybe due to the slight resemblance of the person being recognized with someone else, maybe with one of the known persons. Our algorithm checks for such possibilities for a pre-set number of times and if it still finds the confidence value of the prediction to be high continues with the final decision. As an additional security measure, after the face unlock, the user is asked for the password to completely disable the full lockdown mode. If wrong password entered, the access to GUI/Security-Panel is disabled and recognition module reruns the process.

Other Buttons in the GUI interface include Password Change, Program and logout buttons. Each one is explained in detail below.

1. **Password Change**

   It provides options to change password of the Full Lock and as well as the System Lock. You still must enter the current password which has been already set, in order to set or modify a new password.

2. **Program**

   It opens a module that will allow the user, to add a new face in the back-end server for the facial training model to train this face as a „known‟ face. The entered name acts as a label for the captured face.

3. **Logout**

   Completely shuts down the system