

## Abstract

Security and authentication are an important aspect of today's society. The SmHeart Rate Detector opens the door to a new form of privacy and authentication by reading in a video of the subject's face and then recognizing the subject's heart rate. With this program being hooked up to a sufficient camera, the user can protect against any threat because the user's heart rate is unique to him or her.

Even when a person is standing completely stationary, they may not realize that they are in fact moving every second. This movement is due to the force of the blood being pumped throughout their body. By taking advantage of this bodily function, the program can read in the subject's heart rate by detecting the motions of the head.

To do this, the subject's head needs to be sent through Eulerian magnification. In Eulerian magnification, each pixel in the frame is amplified to achieve a stronger output in the video. Once the video is magnified, the face needs to be recognized by the program so that the initial facial descriptors can be read in. With the descriptors, we can calculate the change in motion from the head movements. The new values can be graphed and turned into a signal which can serve as a basis for estimating the heart rate of the subject.

For the subject's heart rate to be used as a means of authentication, the heart rate signal must be saved into the program at multiple times and at different levels of heart rate. If multiple subjects were to be authenticated, there would have to be different records of measured heart rates that correspond to the specific user. By implementing object recognition algorithms, the program can detect the heart rate of a specific person. Object recognition is a means of teaching the computer to recognize that unique features correspond to a specific object. By programming the computer to detect and save specific features or patterns, the program can recognize the difference between two objects in a similar way that humans can tell the difference between two objects.

To test our project, we will be using the program to recognize each of our own heart rates. We will begin by taking videos of ourselves using a high quality camera. Using the videos, we will be passing them through Eulerian magnification to see the increase in head motion. The change in motion will be detected and turned into a signal. Finally, the heart rate signals will be saved and kept as training for the program and then used to recognize each group member's heart rate.