

## Abstract

- By utilizing integrated computer vision libraries and protocols, we apply basic facial recognition technology to optimally track a user's eye movements with parallel programming.
- This includes the use of Haar Cascading to divide the recognition into stages of classifiers, as well as basic mathematical approaches to track the eyes themselves.
- The primary application for this project is to record a user's gaze in real time while the user drives and to detect signs of drowsiness and highway hypnosis.

## Background

- Drowsy Driving / Highway Hypnosis:** Drowsy driving is the gateway to highway hypnosis and accounts for 10.8% of vehicular related accidents every year according to the AAA Foundation of Traffic Safety. A person who has lapsed into highway hypnosis experiences slowed brain activity and has no recollection of consciously driving.
- Previous Work:** Automakers have already implemented technology addressing drowsy driving, such as pre-collision systems and lane-departure warning systems in some vehicles that are commercially available.
- Gaze Tracker:** This is a software application that runs on Unix and Linux in conjunction with a webcam. It detects features in the order of the user's face, eyes, and irises using edge detection and eye and face classifiers which are collected at approximately 30 frames per second. The irises are found by locating the darkest groups of pixels.

## Concurrent Systems

- Alert**
  - audible signaling system to warn user of drowsiness/highway hypnosis
- Tracking**
  - face/eyes/iris detection
  - duration of blinks

## Acknowledgement

We would like to thank Professor Maria Striki for supporting us throughout the course of this project.

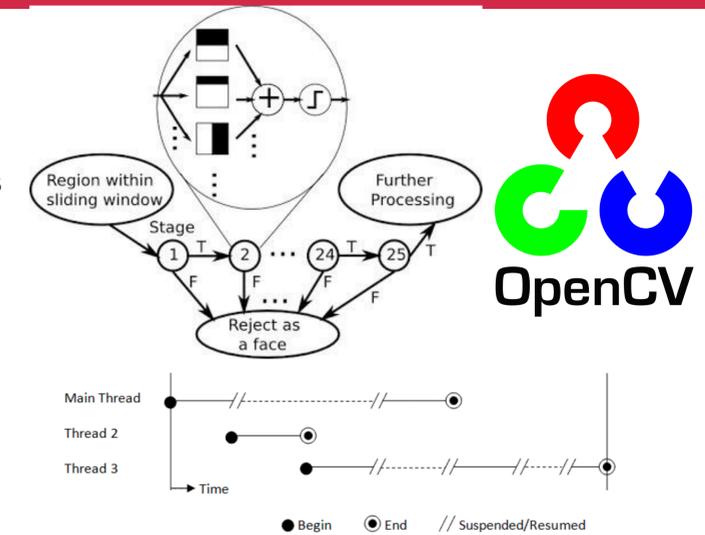
## Methodology

### Viola-Jones Object Detection Framework

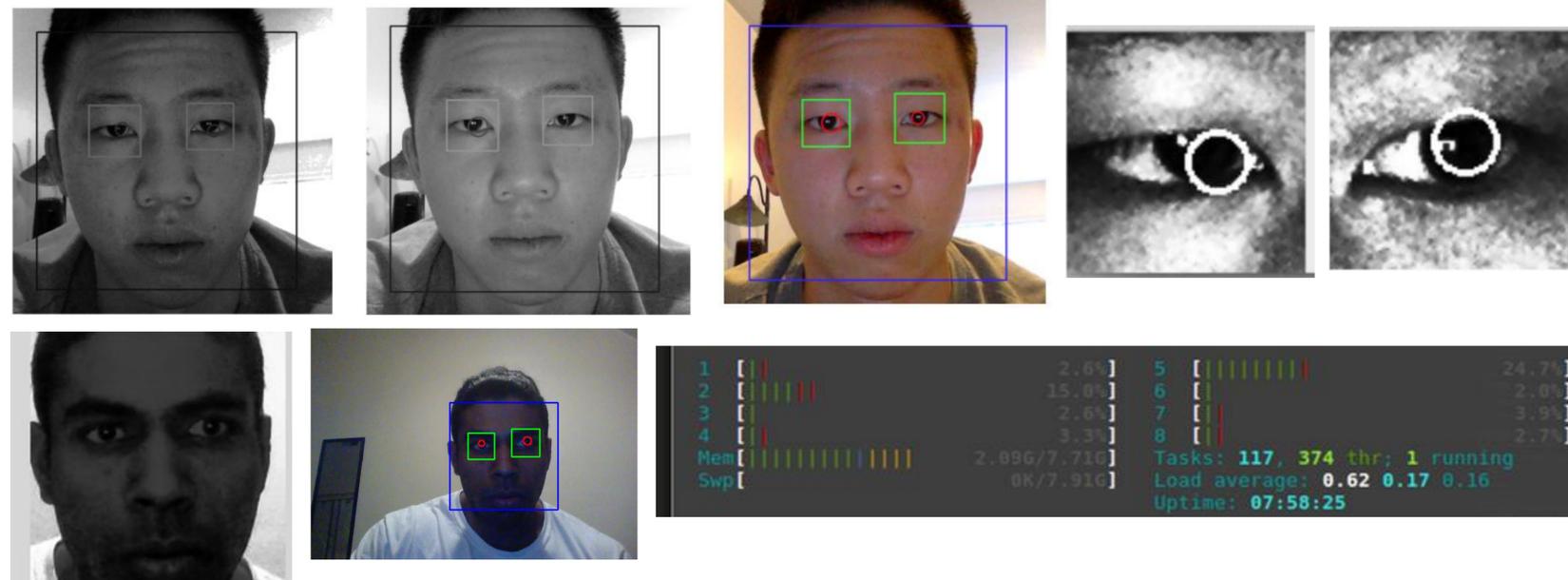
-Machine Learning based approach for object detection using stages of classifiers formed from many positive and negative images.

### Multi-threading

- We used Pthreads, sets of C programming language types, functions, and constants to run the alert system and tracking system at the same time while allowing seamless data communication amongst the threads. To efficiently optimize the tracking system, we parallelized how it recognized the user's gaze.



## Results and Future Work



## Results

- We have successfully implemented both the tracking system to detect the face, eyes, and iris, and the alert system to warn the user with two audible beeps: one for when the program is unable to detect the irises for longer than 9 seconds, and one for when the face is undetectable for longer than 4 seconds.

## Future Work

- We would like to work on implementing a more effective alert system that will physically warn the user with vibrations in the use cases where the user is unaffected by audible alerts.
- In addition, we plan on displaying a visual alert message on the webcam view

## References

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[2] Helmenstine, Anne Marie. "Understanding Highway Hypnosis." *ThoughtCo*, [www.thoughtco.com/understanding-highway-hypnosis-4151811](http://www.thoughtco.com/understanding-highway-hypnosis-4151811).

[3] "Face Detection Using Haar Cascades." *OpenCV: Face Detection Using Haar Cascades*, docs.opencv.org/3.4.1/d7/d8b/tutorial\_py\_face\_detection.html.