iTracking: Low Cost Eye Tracking System

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Vanderbilt Department of Electrical Engineering and Computer Science, Nashville, TN | April 22, 2019

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Introduction

Current eye trackers are expensive and require licenses for each user, driving up research costs. Use in child behavior research poses additional difficulties, including following subject movement and managing lighting conditions.

Objectives

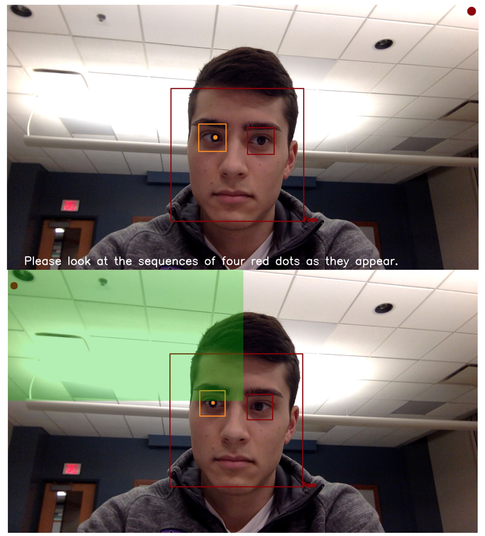
- Real time face identification
- Determine facial landmarks and locate eyes
- Stable performance in various lighting
- Unaffected by user movement
- Low-cost and portable

System Design

- Hardware
  - Google AIY Vision Kit
  - Stepper Motors
- Software
  - Neural Network (TensorFlow)
  - OpenCV (Python)

Implementation

- Face and eye detection and gaze tracking through OpenCV
- Directional gaze calculation using neural network with established eye databases



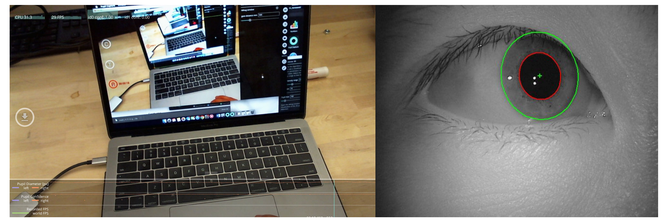
1. Calibration process: the subject is asked to follow 4 red dots on screen. A trim mean is applied that removes the first ¼ of the data and the 0.25 outliers.
2. A red dot appears on screen where the algorithm estimates the location of the subject's gaze.

Results

- Pupil centered eye tracking has limited freedom of movement and is sensitive to extreme lighting changes
- Gaze detection is calculated at a 58.98% quadrant accuracy

Future Work

- Implement infrared illumination and infrared camera to improve accuracy
- Implement Corneal Reflection Method to track gaze
- Transfer algorithm to Raspberry Pi Camera
- Head mounted design to aid in calibration maintenance
- Integrate two AIY kits with motors



Acknowledgements

Our deepest gratitude goes out to the individuals who had an impact on our project:

- Dr. Daniel Levin (Peabody)
- Dr. Ralph Bruce
- Charles Gerrity
- Vanderbilt School of Engineering