Camgaze.js: A JavaScript Library for Eye Tracking and Gaze Prediction

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- Usually done using IR or 3D cameras
- Some web-cam technologies have emerged
- However, no in-browser solutions have been presented solely using HTML5
- Until now :)

Motivation

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- We can create more intuitive user interfaces
- Using the web, we can crowd source where people are looking at on the website
- Also, since all of the eye tracking is done on the client side, we can preserve user privacy

Camgaze.js

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- A library for eye tracking that is done inside a web browser using JavaScript
- Uses only commodity camera (i.e. a web-cam)
- Anybody can use the library without downloading any external program besides a web browser
- It is possible to determine where the user is looking on the screen whilst preserving user privacy and limiting server load

Overview

1. Obtain video using Web RTC (Real Time Communication) library

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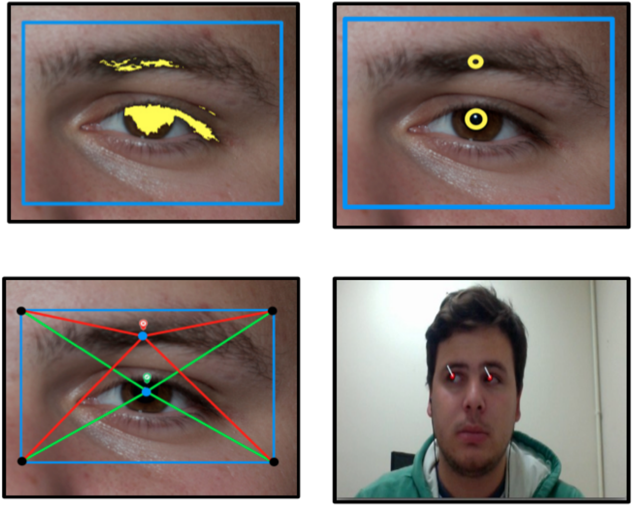
2. Determine the positions of the pupil centroids
3. Use a steady point on the face as a reference point to determine gaze
4. Add face position and head orientation vectors to the predicted gaze in order to get a result gaze vector
5. The gaze vector is mapped onto the screen using the gaze mapping from the calibration stage

Determining Gaze Direction



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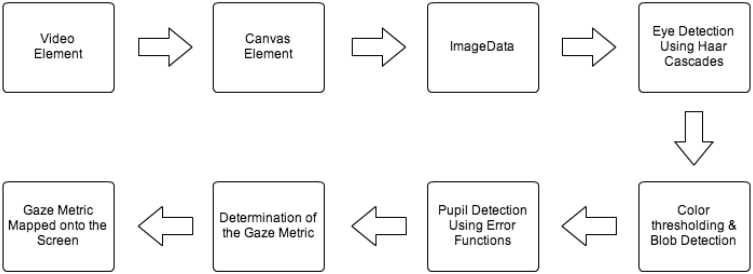
2. The user is asked to look at each circle in order for a matter of time
3. Data about the gaze vector is stored and averaged in order to create a mapping
4. The mapping is returned such that new gaze input will correlate with a position on the screen within a window of error

Process


Video Element
Canvas Element
ImageData
Eye Detection Using Haar Cascades
Color thresholding & Blob Detection
Pupil Detection Using Error Functions
Determination of the Gaze Metric
Gaze Metric Mapped onto the Screen

Results

- We can determine the point of gaze within a $2.1in(\pm 0.1)$ radius

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- We can determine the point of gaze within a $2.1in (\pm 0.1)$ radius
- This means that we are within $0.6in$ of the results *Holland et al.* which used a native iPad application.

Future Work

- Use an Active Appearance Model instead of Haar Classifiers to determine the reference points and eye rectangles

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- Use a neural network for calibration instead of linear mapping
- Undergo large scale, crowd sourced user testing

Questions