Eye Detection and Gaze Estimation

Bryant Tan, Max Praglin
Department of Electrical Engineering, Stanford University

Goal

Develop software to locate a subject's eyes and estimate his/her gaze direction

Motivation

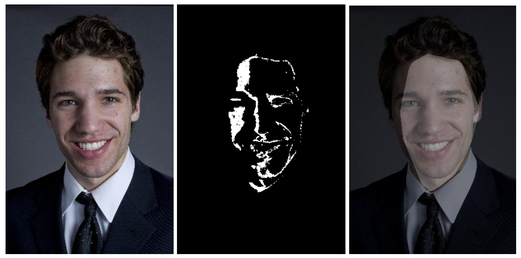
- Hands-Free Interface
- Human-Computer Interaction
- Sociological Studies
- Driver Awareness
- Surveillance
- Advertising
- Photograph Enhancement

Methodology

① MAP Training

Use training set to count positives and negatives in RGB bins, perform thresholding

② Face Detection

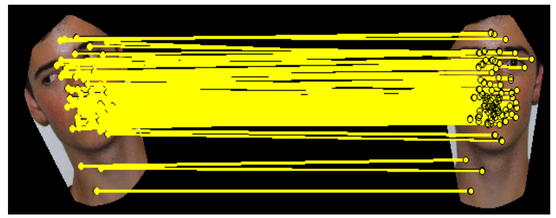


Identify average color of image's center | **Find pixels close in color** | **Convex hull**

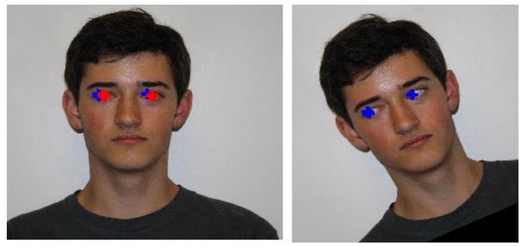
③ Eye Detection

MAP detection | **Mask detected points with convex hull of face** | **Adjust threshold until two regions remain**

④ Gaze Estimation



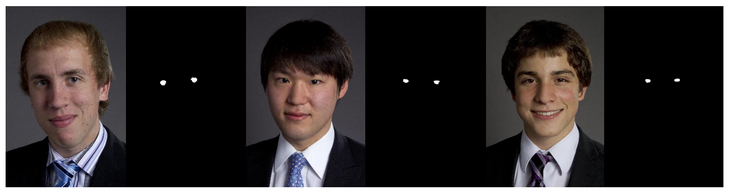
Face detection and masking, compute homography (SIFT + RANSAC)



Detect eyes, use homography to map onto calibration image (looking straight ahead)

Data Set

Training Set (portrait photos)



Test images (portrait photos at various gaze angles)

Results

Eye detection was performed on 50 images from the training set. Both eyes (and no other regions) were correctly identified for 25 of 50 subjects. The algorithm located at least one eye in 47 of the 50 subjects. 6 of the 25 failing subjects wore glasses.

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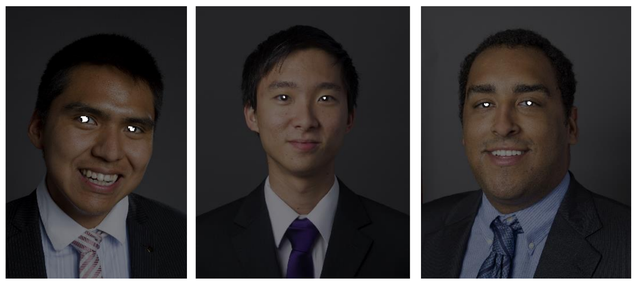

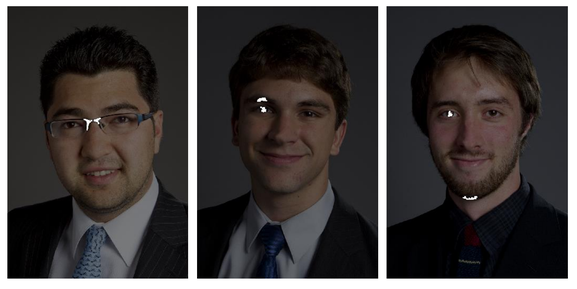

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Future work includes detection of gaze angle without a reference image (perhaps via centerline detection), extraction of user intent, operation with low-quality or distorted images, or a mobile device implementation.