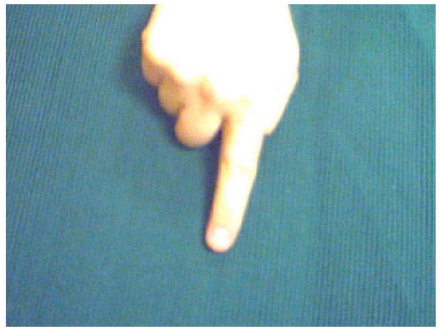
Using Hand Gestures to Control a Web Browser

Wallace Lawson



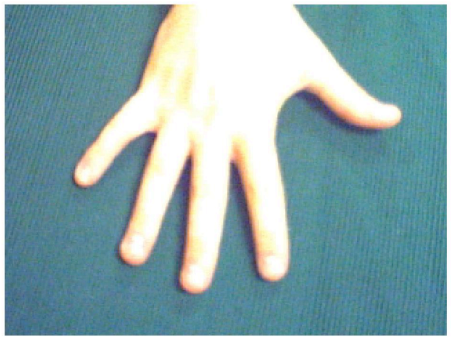
Point

Based on commonly used point gesture

Moves the location of the mouse – requires the location of the hand to be tracked

Click

- Selected because it is easy to transition from point
- Clicks a hyperlink, button, etc.



Stop

Based on commonly used stop gesture

Stops the browser from continuing to load the current page

Using Hand Gestures to Control a Web Browser

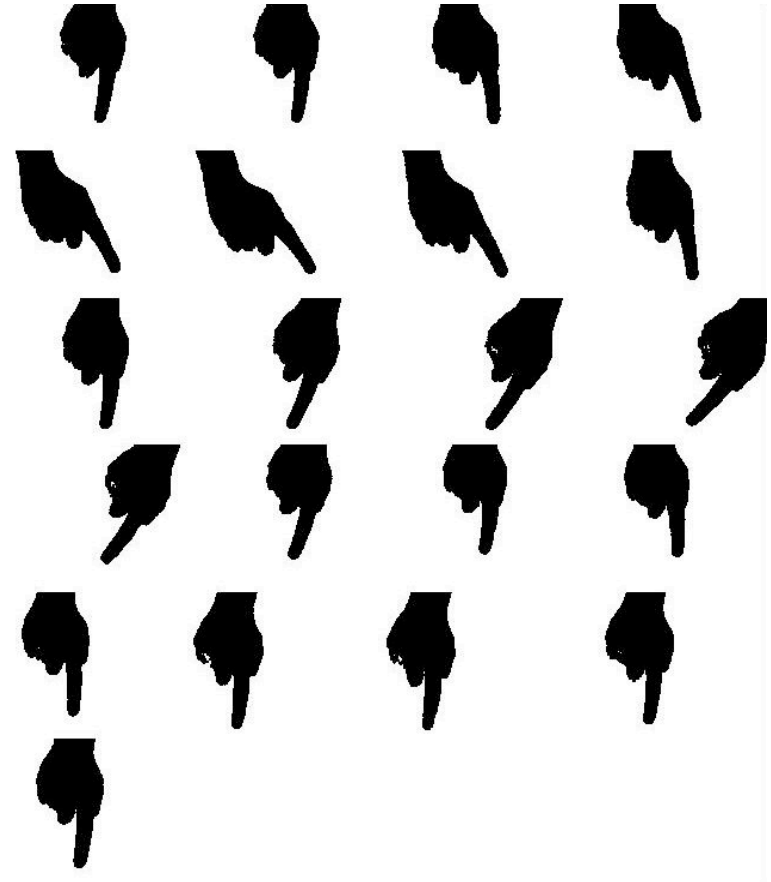
Back
Based on commonly used back gesture
Returns the browser to the previously viewed page (if applicable)

Home
Based on ease of transition from point gesture
Changes the current web page to the page marked as the home page

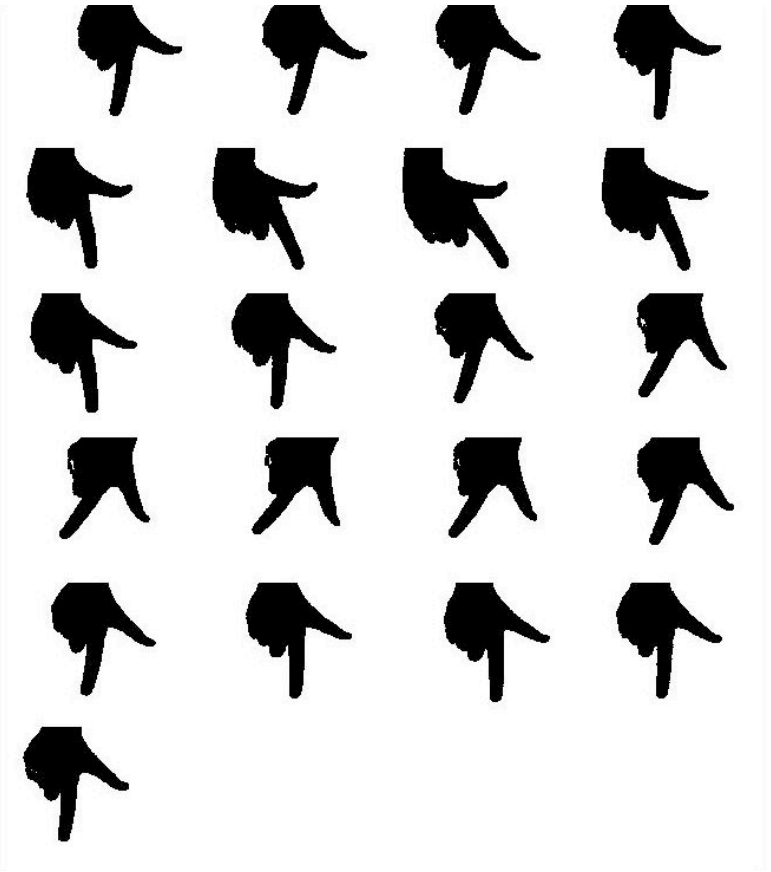
Scroll
Based on pantomime gesture for moving a piece of paper
Scrolls the current web page up / down

Examples of Gestures

Point

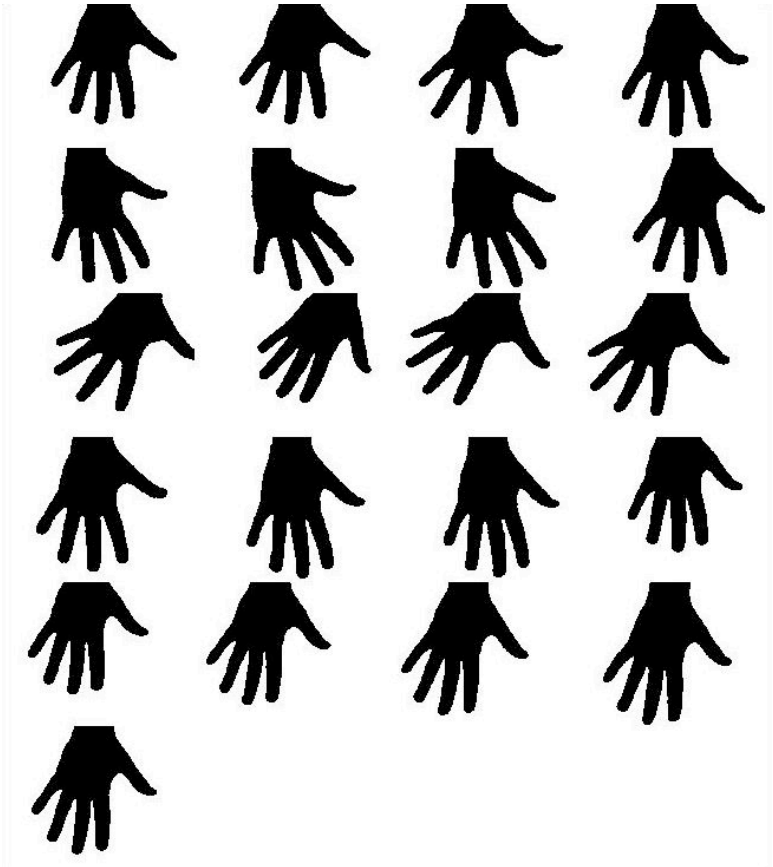


Click

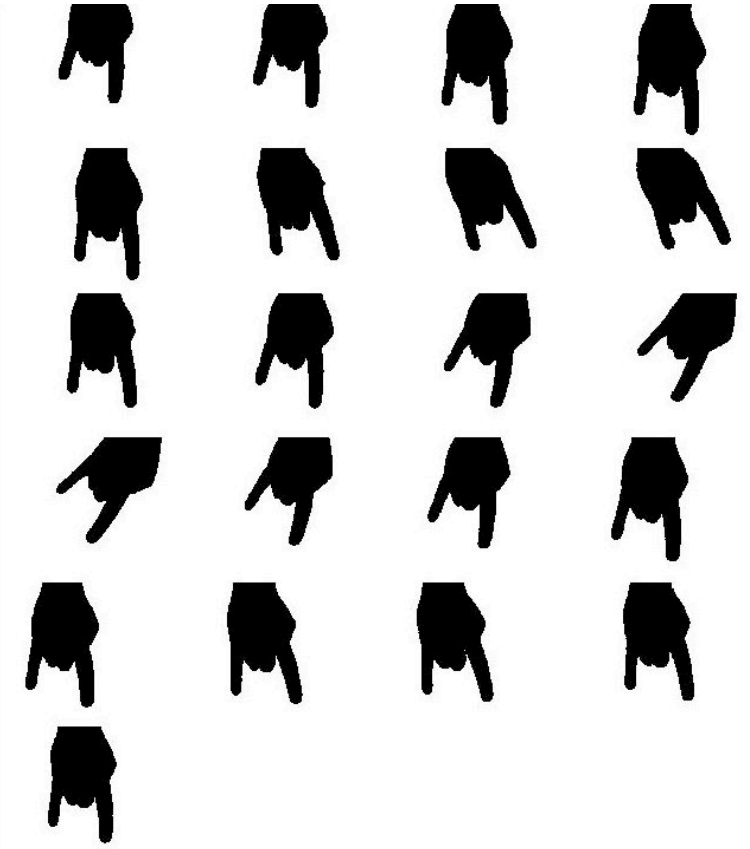


Examples of Gestures

Stop

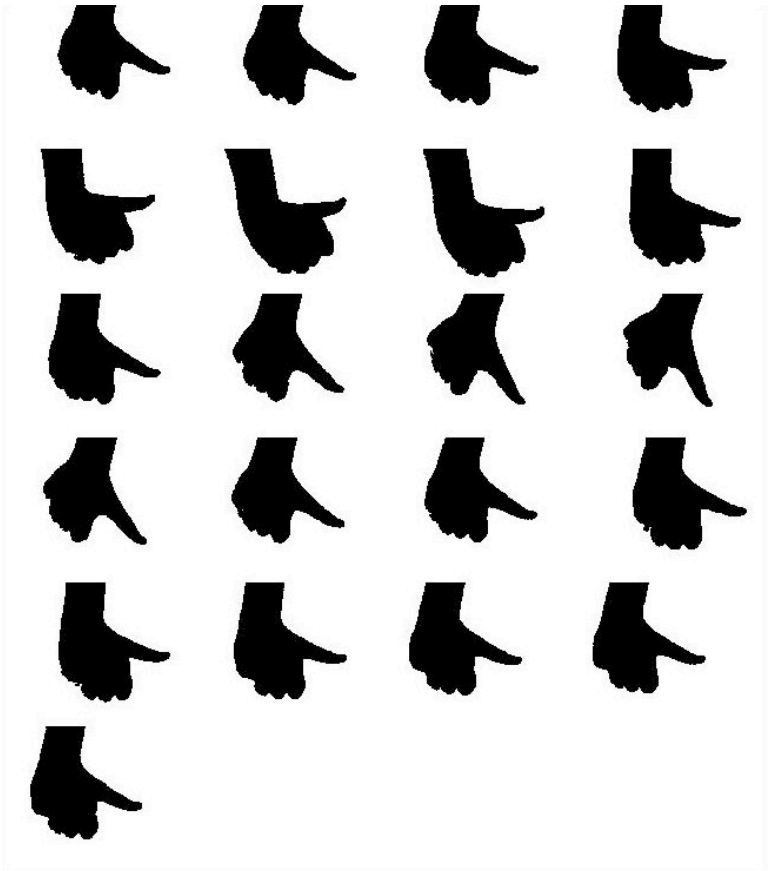


Home



Examples of Gestures

Back



Scroll

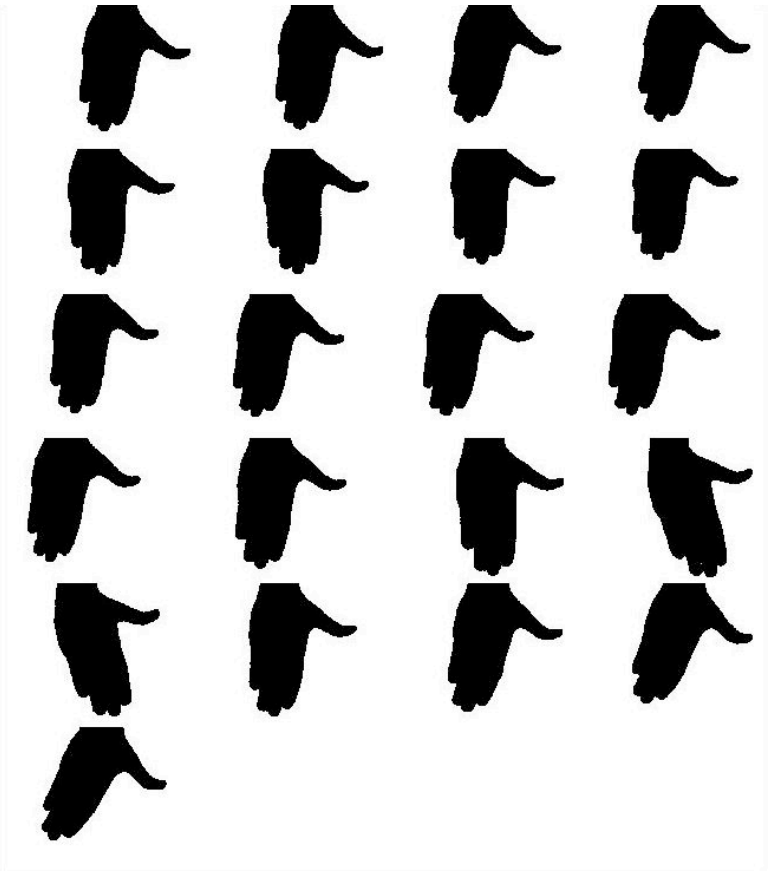
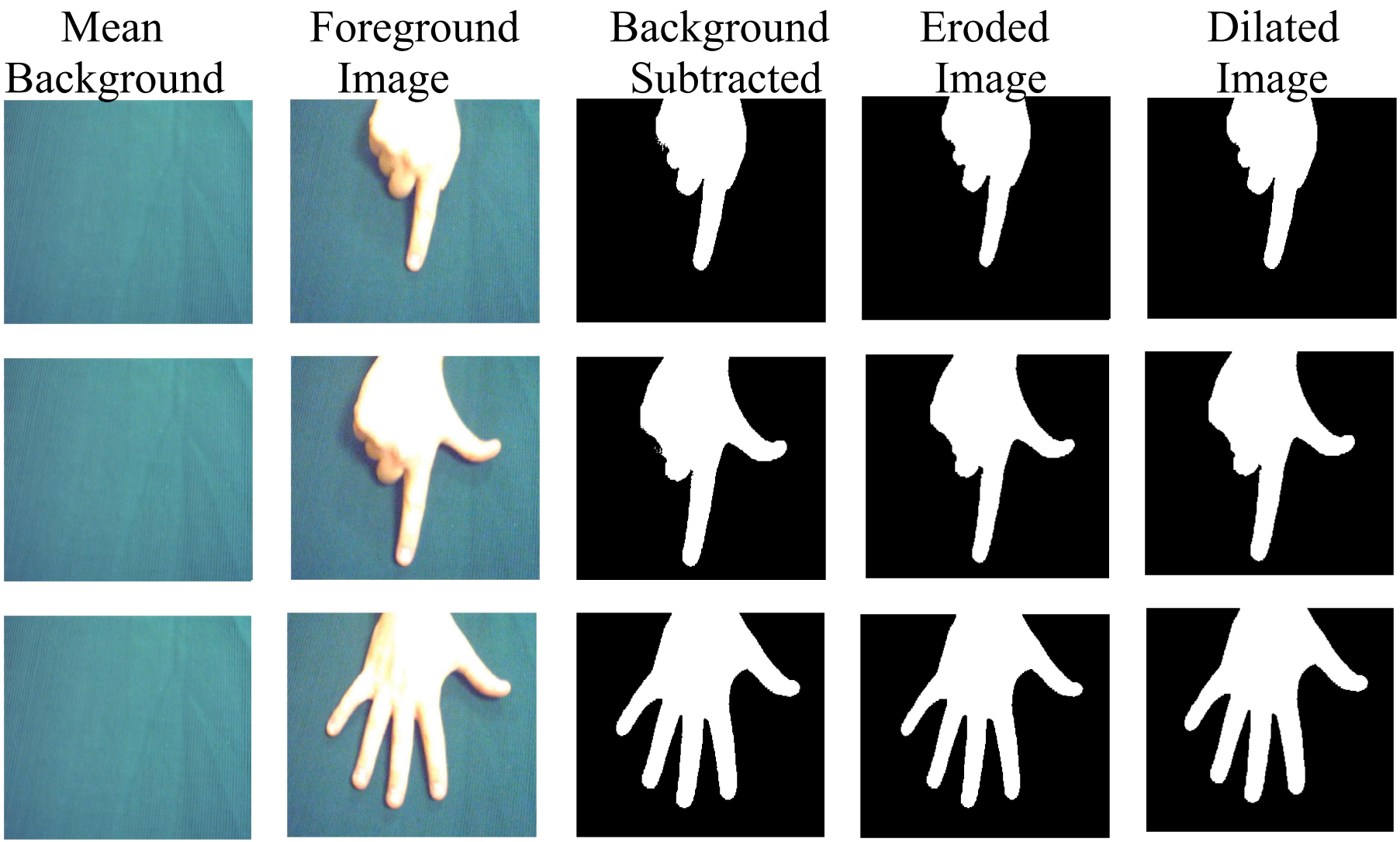


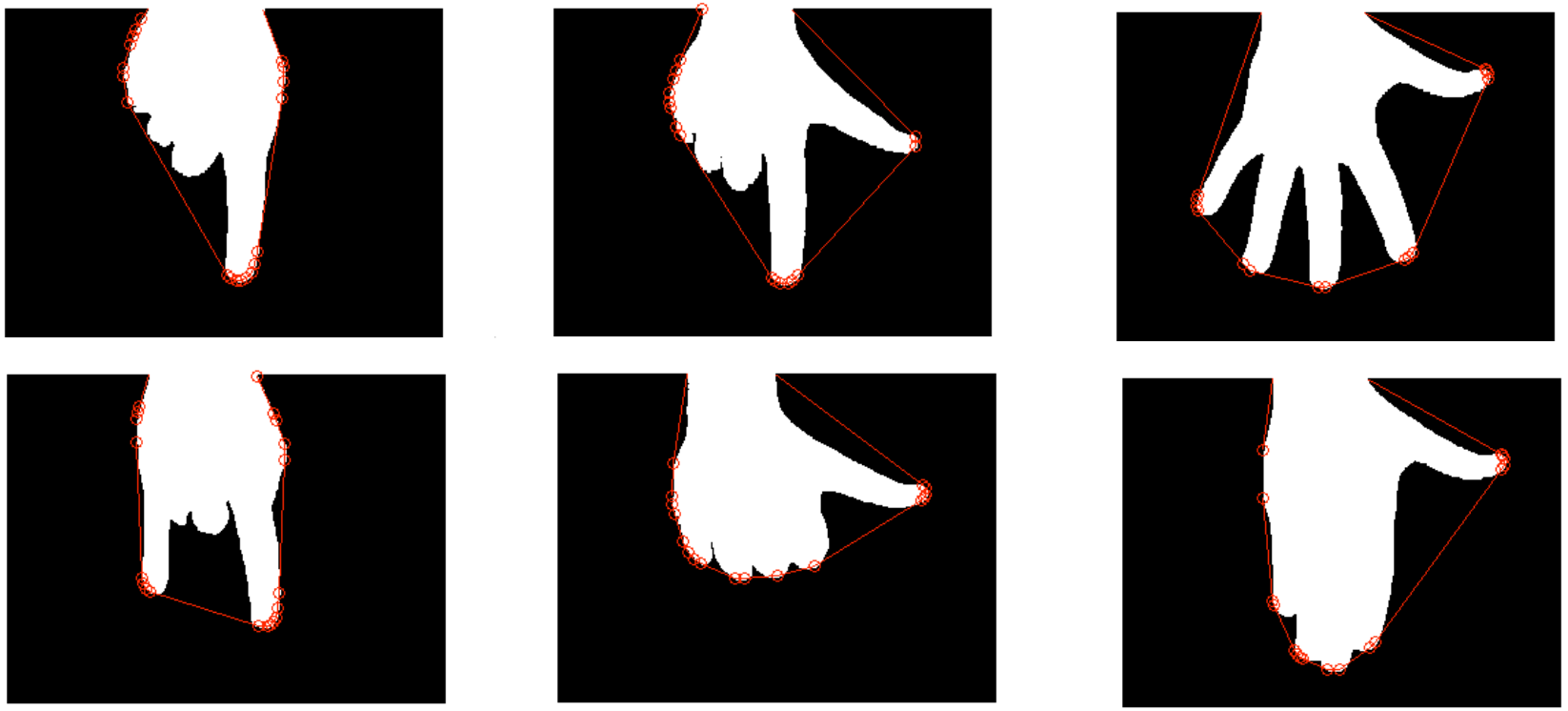
Image Processing



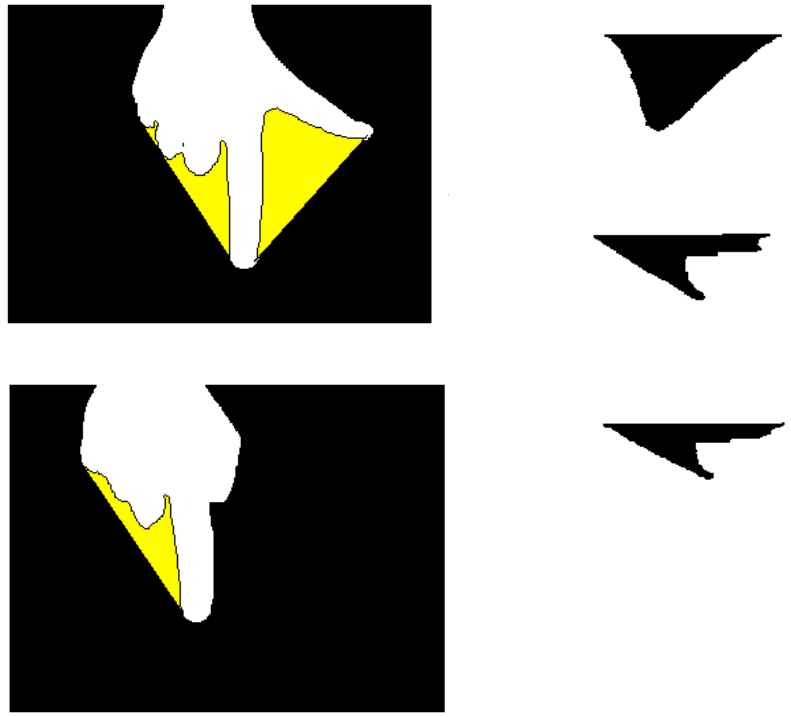
Feature Detection

- Identify important characteristics of the image
  - deficits of convexity
  - bottom-left point
- Construct the convex hull around the hand
  - Trace the hand contour from hull point to hull point to identify deficits of convexity
  - Keep significant deficits (area larger than T)
    - Removes small natural contours and rough edges

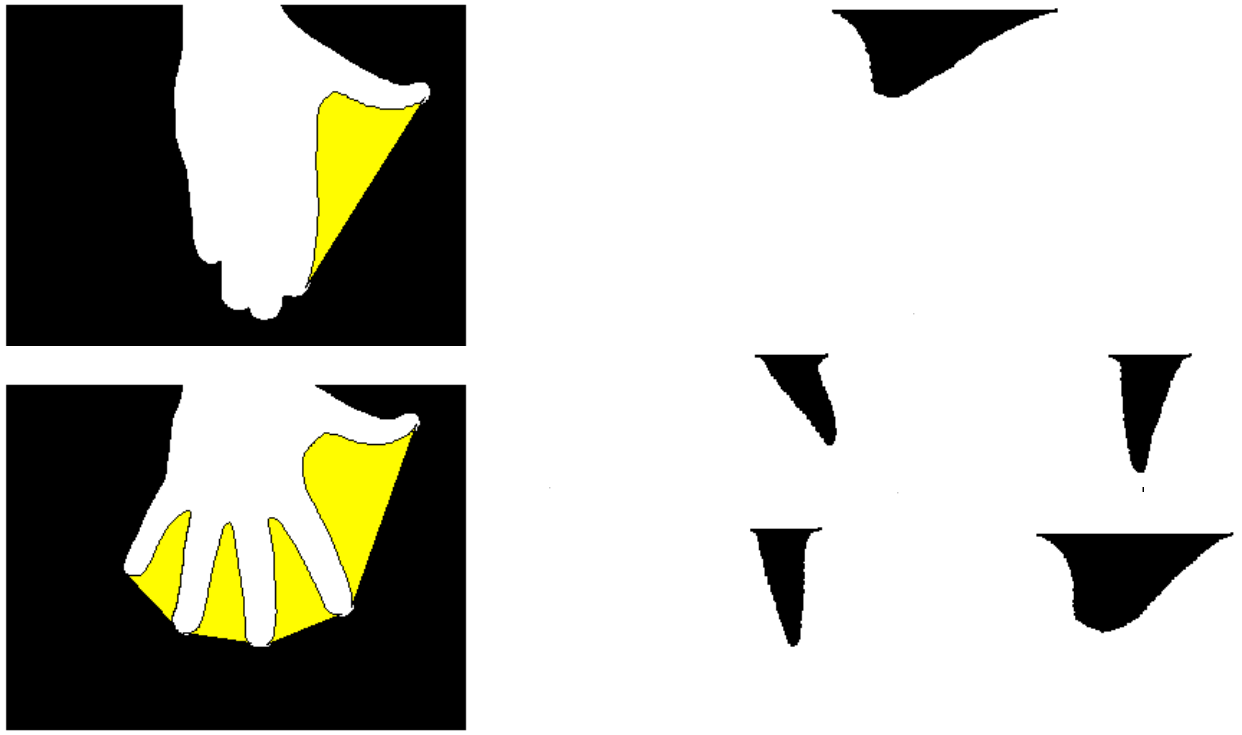
Convex Hull



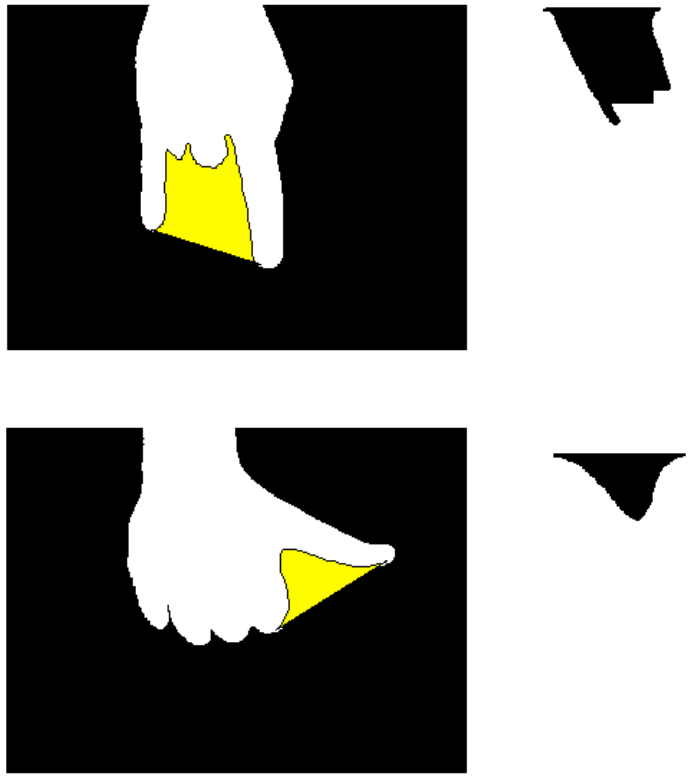
Deficits of Convexity



Deficits of Convexity



Deficits of Convexity



Representation and Learning

- In the learning mode, a number of representatives of each gesture is taken
- Deficits are extracted and *k-means* clustering is used to create 10 clusters (of deficits)
- Area intersection is used as a distance measure on the deficits
- Each cluster is assigned a symbol/letter
- A string representation is made for each gesture, based on the deficits of example gestures

Clusters

B C D

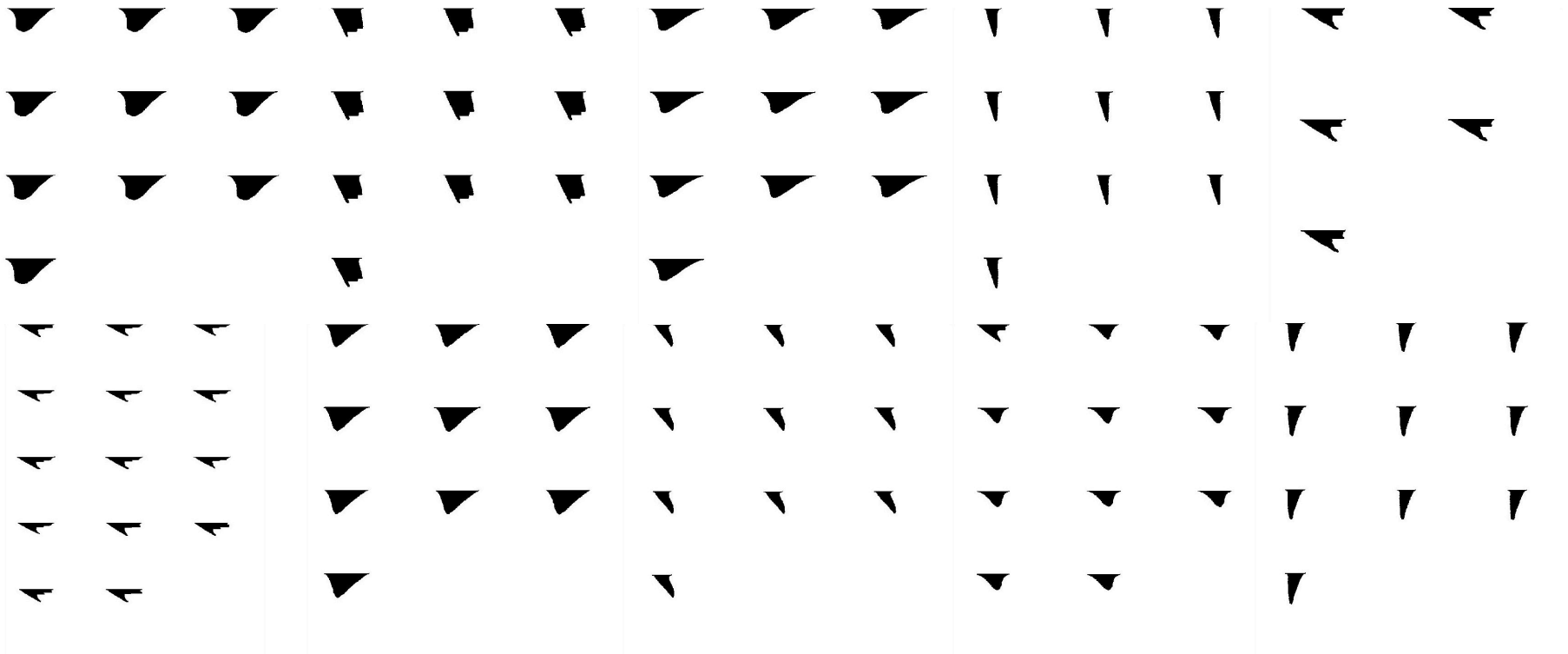
E F G

H I J

K

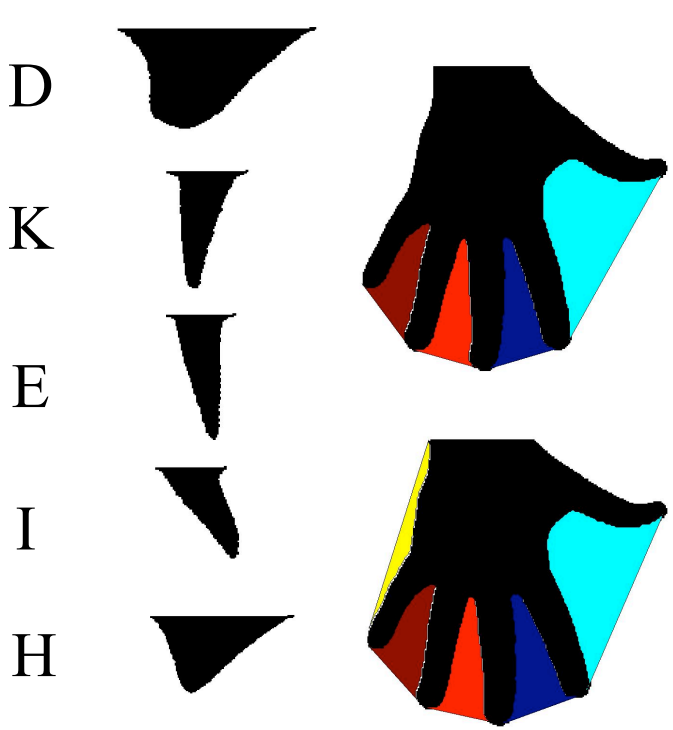
Point	Click	Stop	Back	Home	Scroll	No Action
G	HG	DKEI	J	C	B	Ø
	HF	HDKEI				
	HJ					

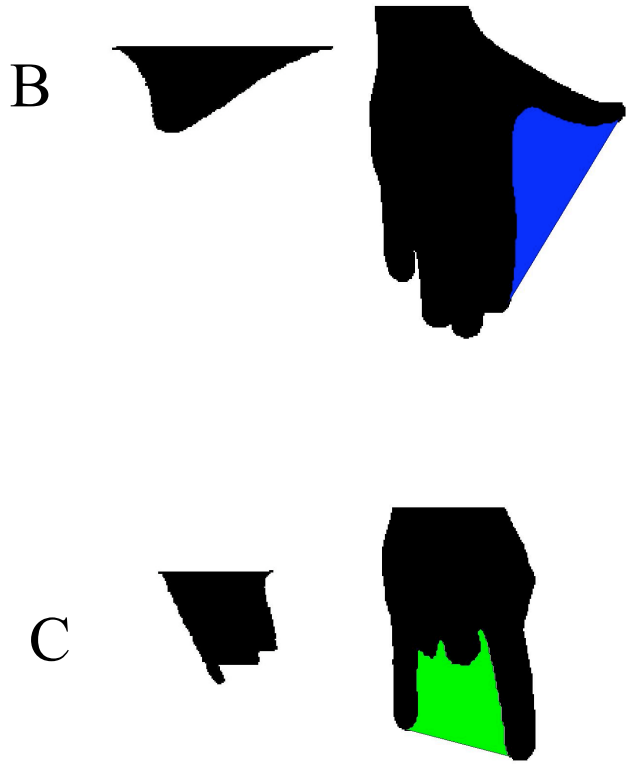
Clusters



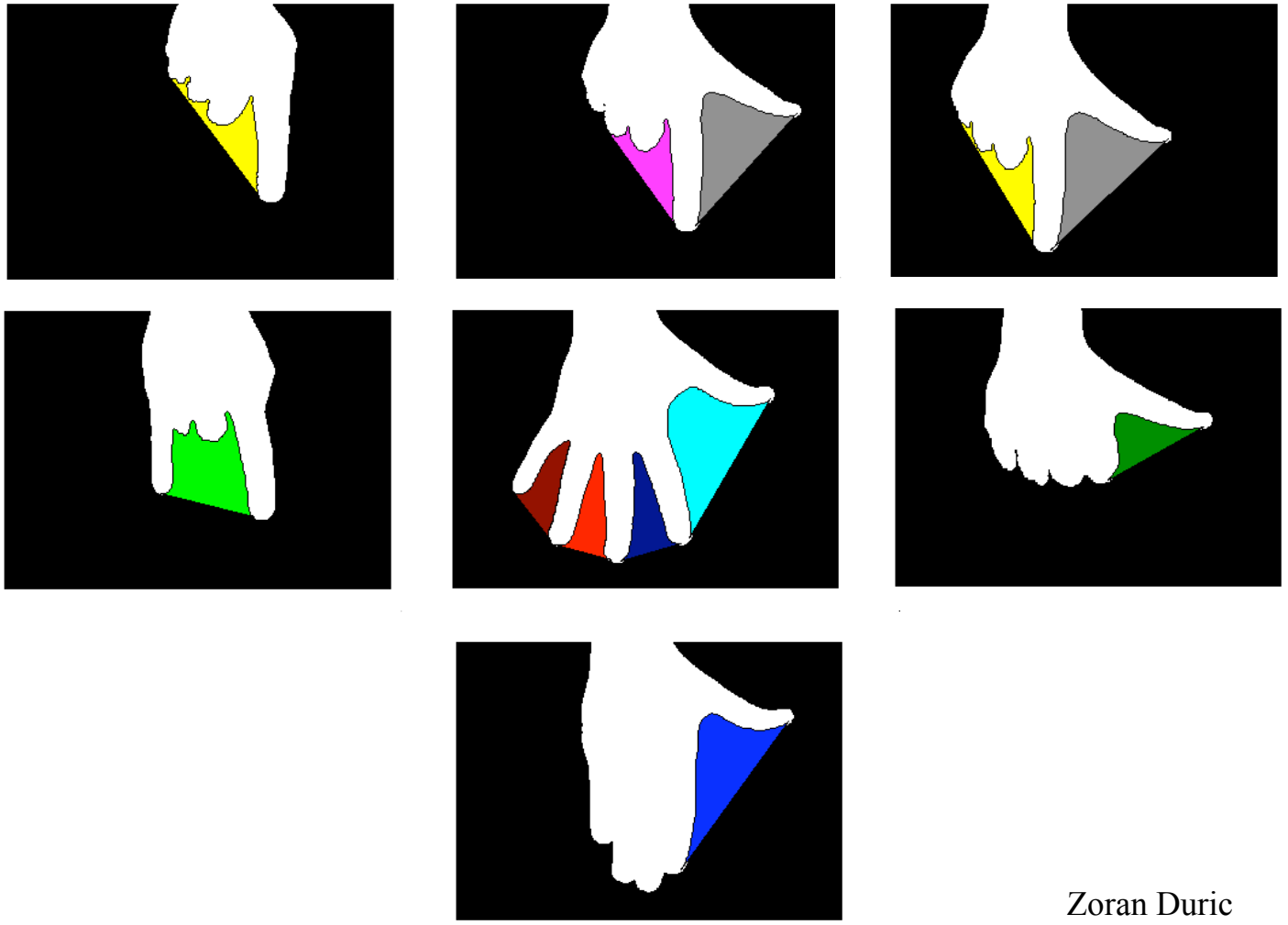
String Representations of Gestures

String Representations of Gestures





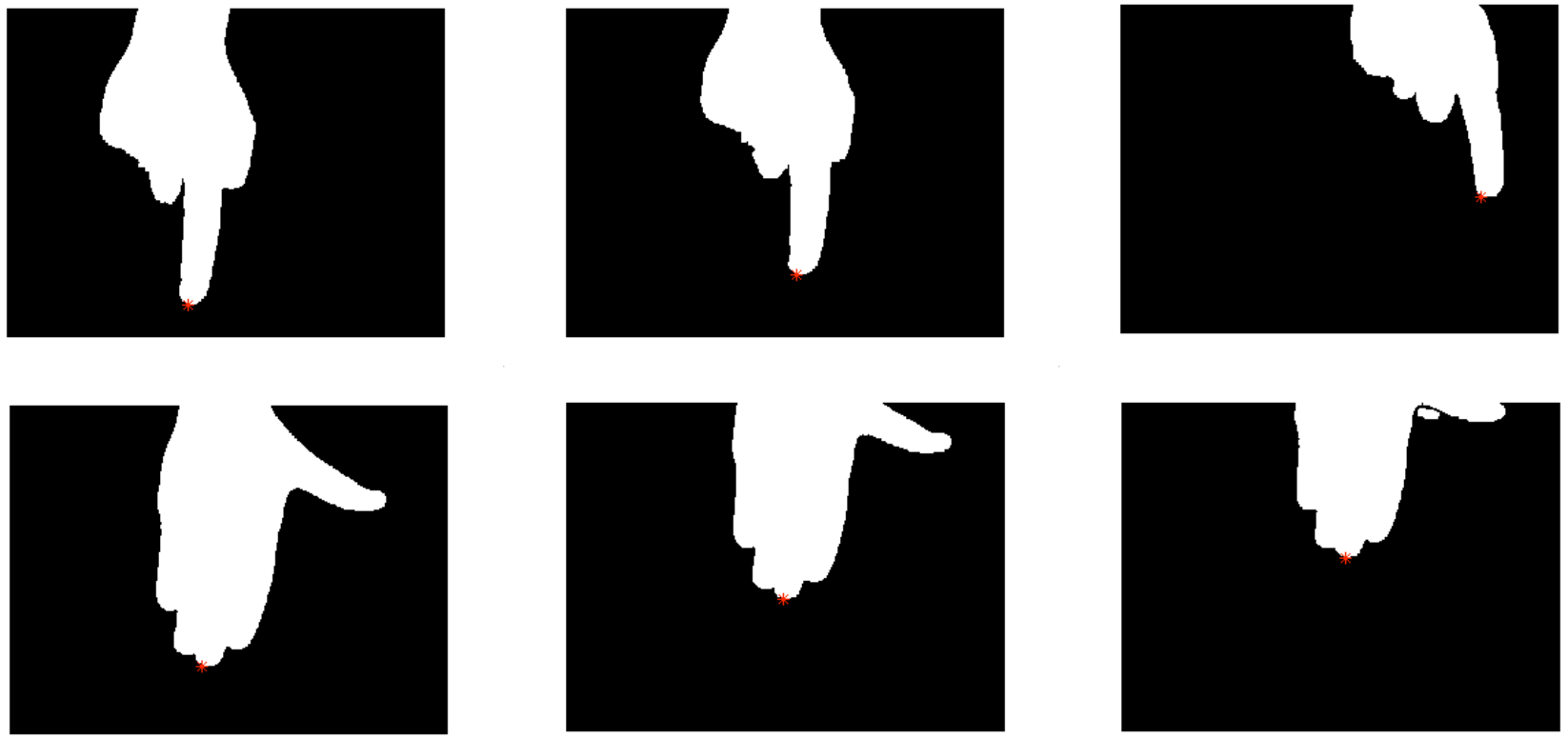
Representation and Learning



Tracking: Pointing and Scrolling

- The location of the hand must be tracked for mouse movement and scroll actions
- When a point or scroll gesture is recognized, find and store the location of the bottom-left extreme point
- If the last gesture was point or scroll, compute the difference and either move the mouse this amount or scroll this amount

Tracking: Pointing and Scrolling



Understanding Affective State from Eye Images

Dr. Ricci Heishman

Selecting Eye Images

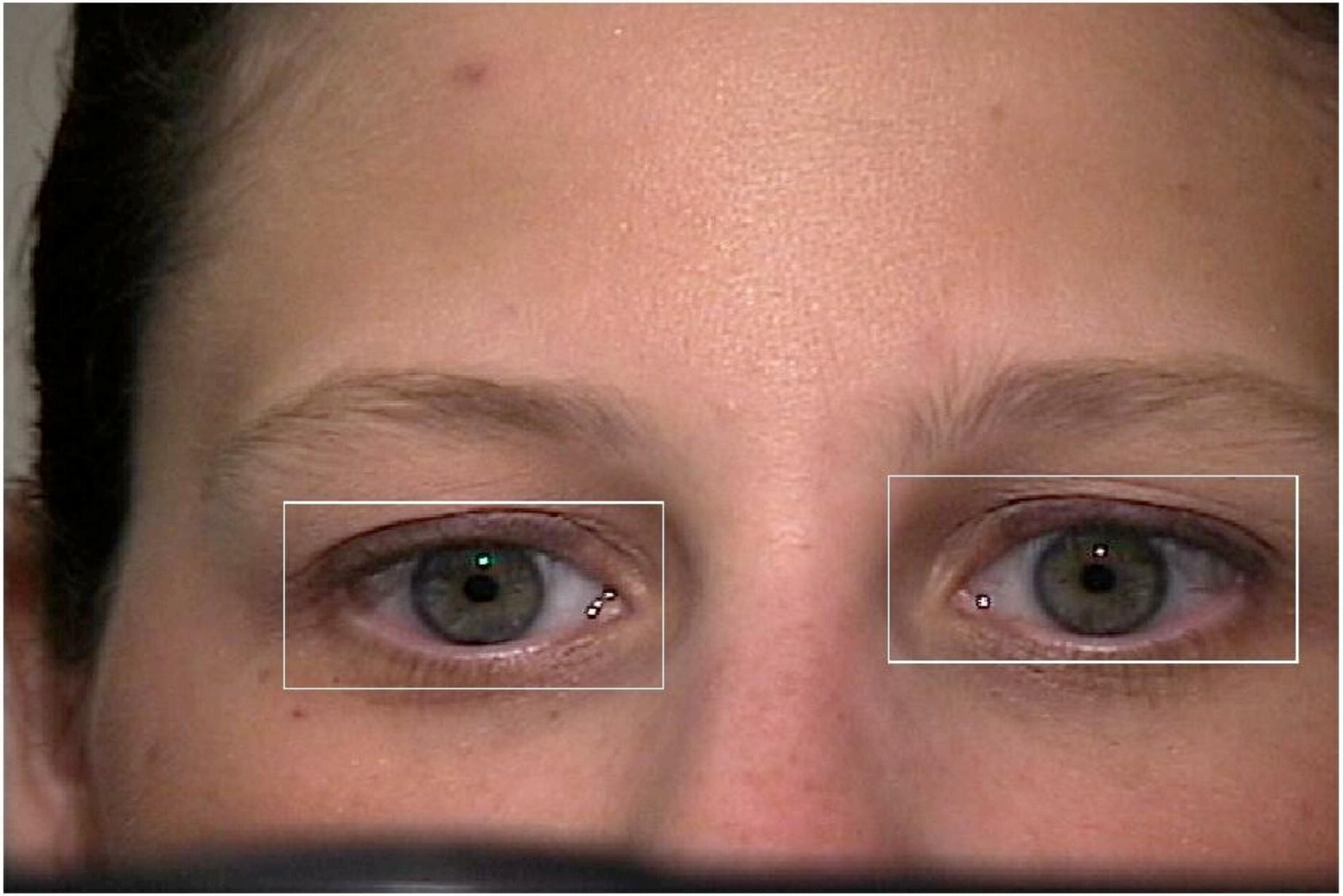
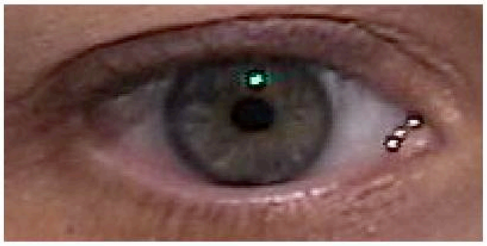
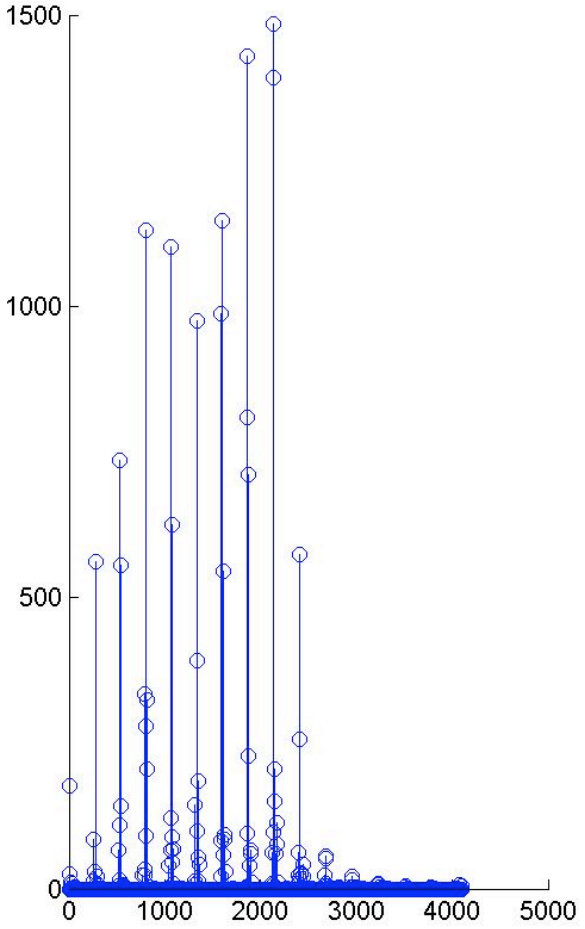
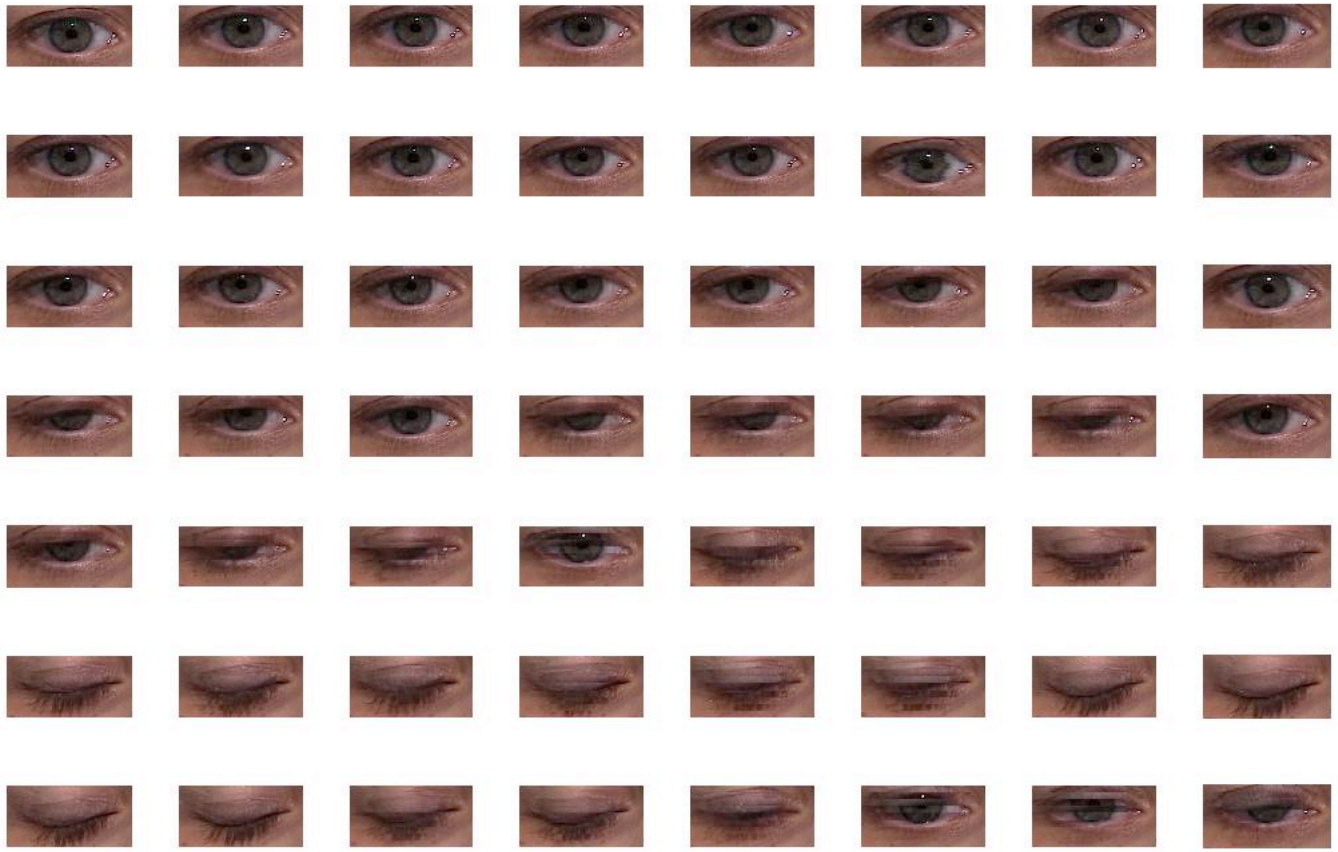


Image Representation: 4096-bin Color Histogram



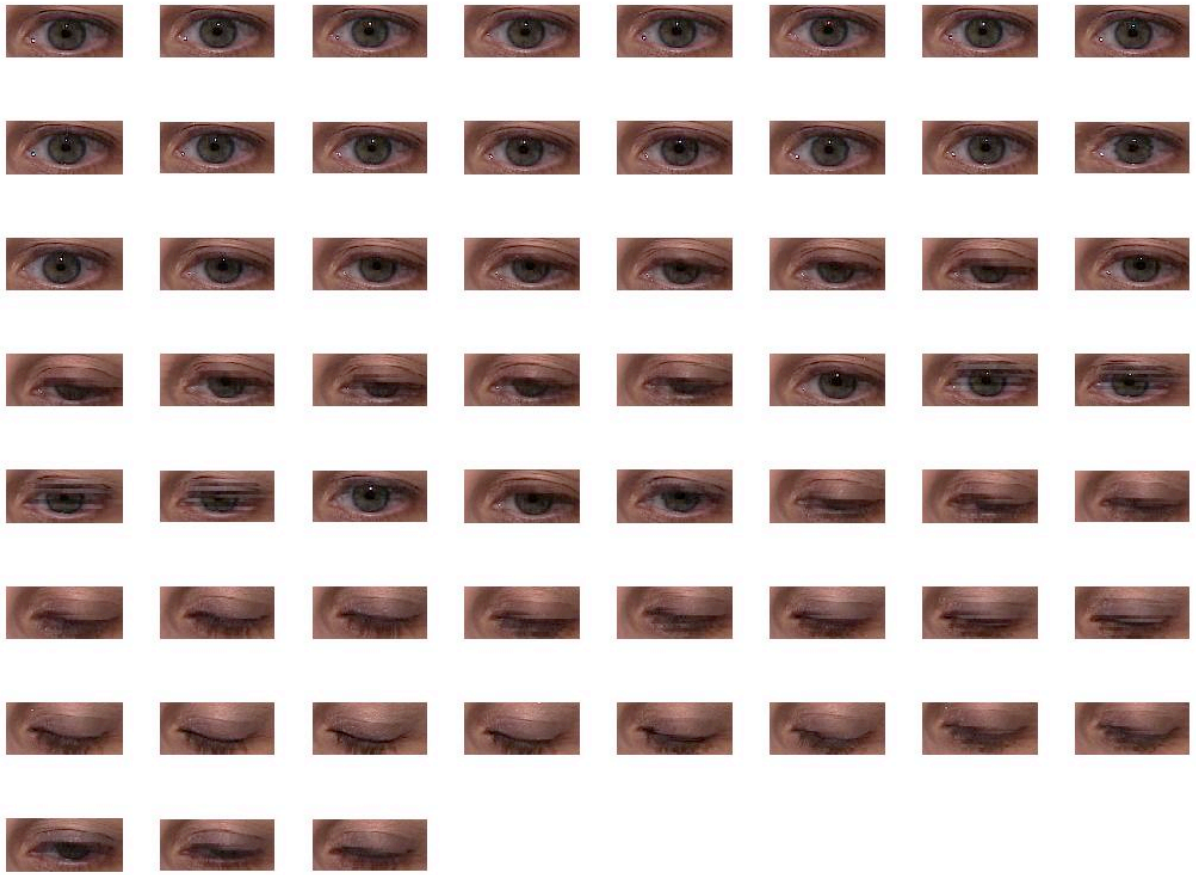


Extract Distinct Frames: Matching and Tracking



Left Eyes (from 1000 frames)

Distinct Frames: Right Eyes



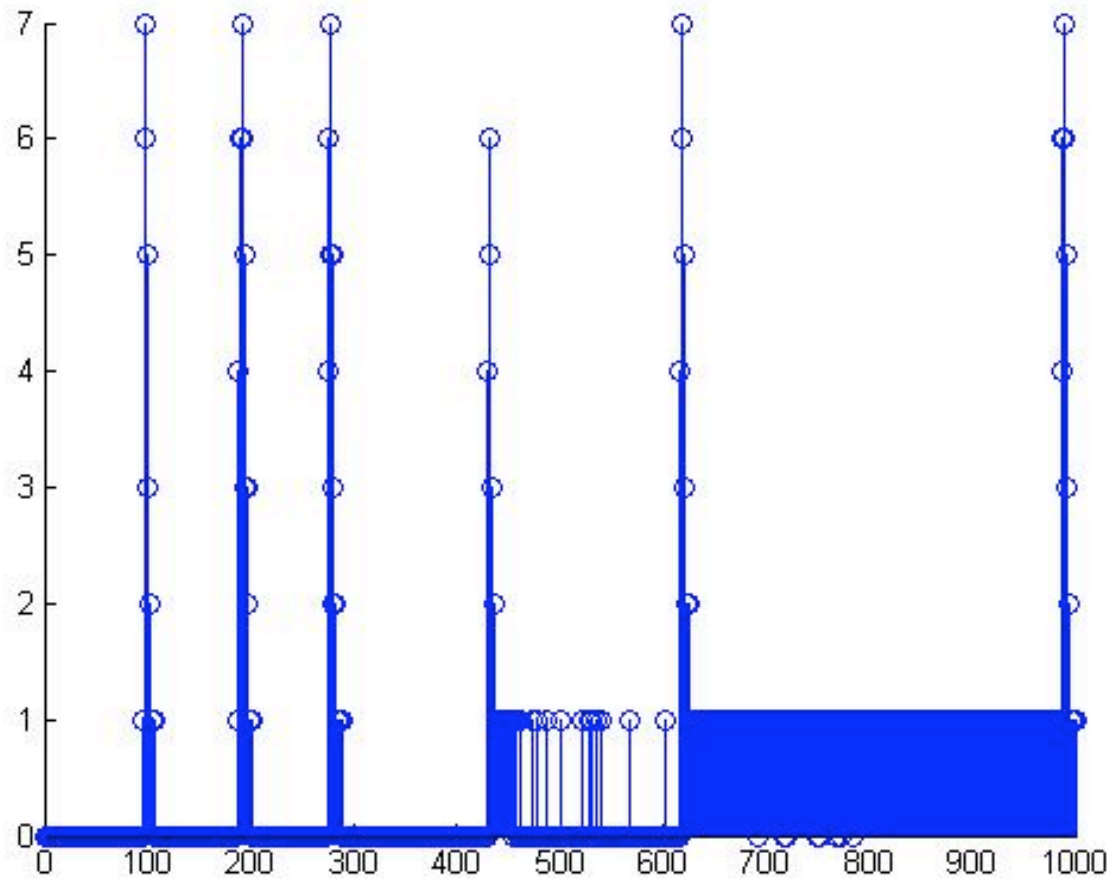
Representative Frames for the Left Eye

Extracted using *k-means:* ABCDEFGH

Representative Frames for the Right Eye

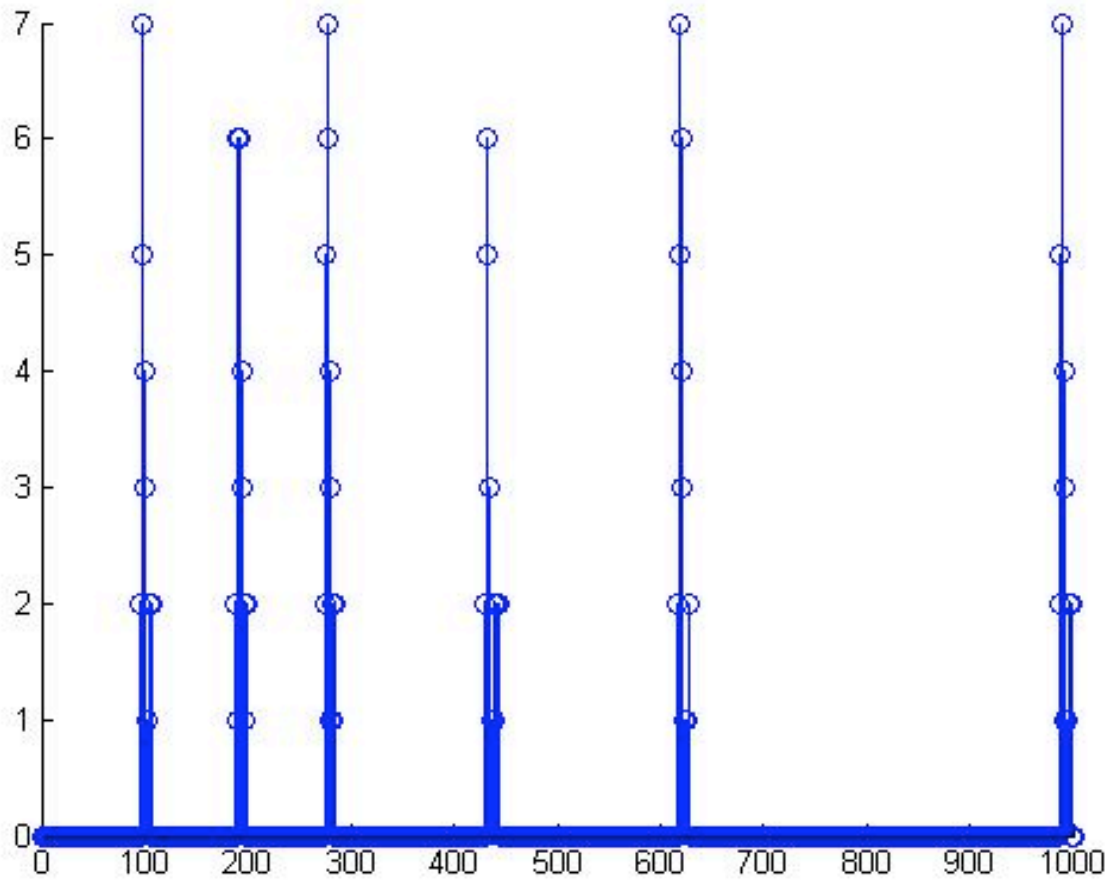
Extracted using *k-means*: ABCDEFGH

Left Eye Blinks



Eye templates numbered from 0 (open) to 7 (closed)

Right Eye Blinks



Eye templates numbered from 0 (open) to 7 (closed)