

# Using Drawn Input Devices via Computational Vision

Project by:

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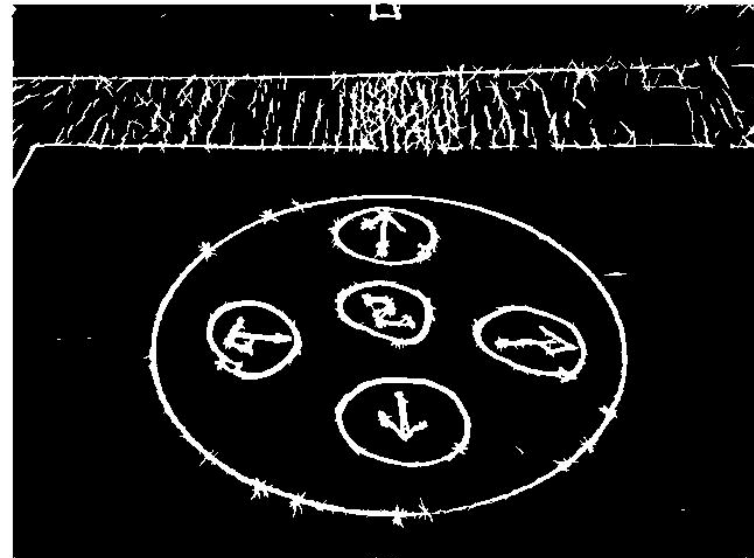
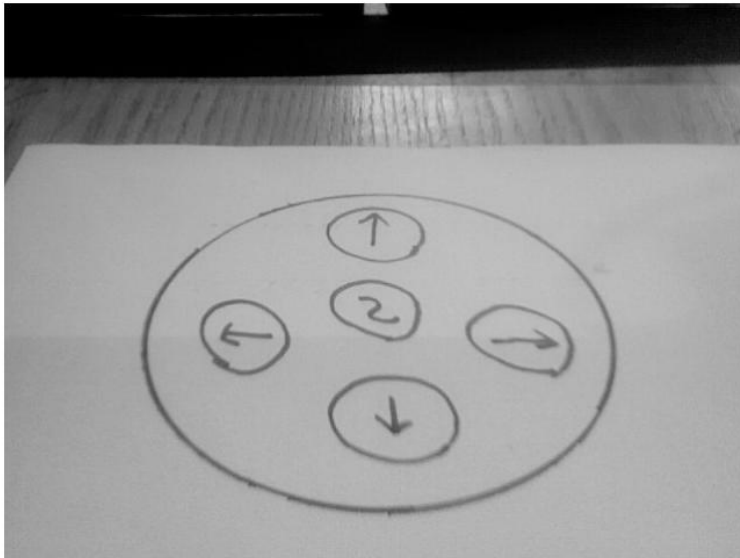
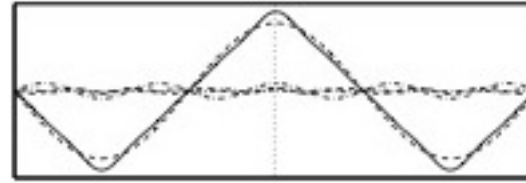
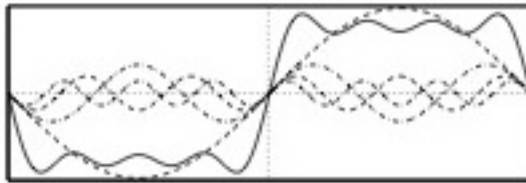
# Introduction and goals

- An infrastructure for cheap homemade drawn input devices
- Detection of drawn input device
- Interfacing the user's hands and fingers with the drawn input device

# Drawn Input Devices Detection

## Line Edge Detection via Phase Congruency

- Traditional edge detectors fail with line edges
- Phase congruency of edges



# Drawn Input Devices Detection

## Grouping of Connected Components

Observation - Device elements have these properties:

- Well connected
- Convex
- Large area

Conclusion – Find connected components and remove small ones

# Drawn Input Devices Detection

Convex Hull as a Convex Shape Sparse Representation

Observation – A convex shape's convex hull is a sparse representation of that shape

Observation – Device elements are mostly convex

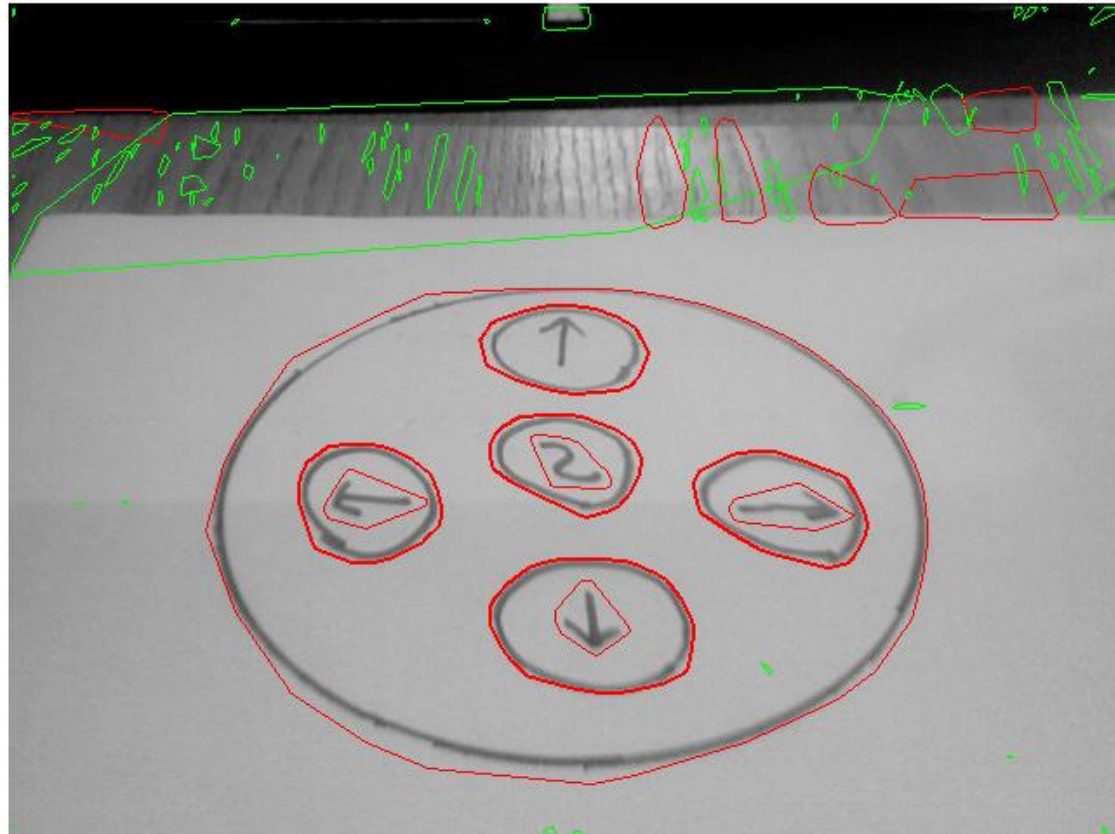
Conclusion – Use convex hulls to represent device elements and gain the benefits of sparseness

(Quick and easy model fitting!)

# Drawn Input Devices Detection

## Shape Fitting and Device Construction

- Model fitting using the convex hull
- Finding the body/buttons and button's actions
- OCR?



# Click Detection

## Hand Detection – Background Subtraction

- Motivation – Moving objects extraction
- Gather pixel statistics over 30 frames
- Creates a mean based background model
- Can discern BG & FG regardless of illumination
- Threshold based

# Click Detection

## Hand Detection – Skin Color Segmentation & Enhancements

- We used a ready-made algorithm that checks a pixel's probability of being skin colored against a DB obtained by thermal imagery
- Image morphologies



(a) Vis



(b) IR



(c) Detected skin



(d) Bounded HSV.



(e) Bounded IR.



(f) Detected skin



# Click Detection

## Fingertip Detection via K-Curvature

- Fingertip candidates by K-Curvature
- Filtering by choosing candidate's mean-point
- “Good” vs. “Bad” angles



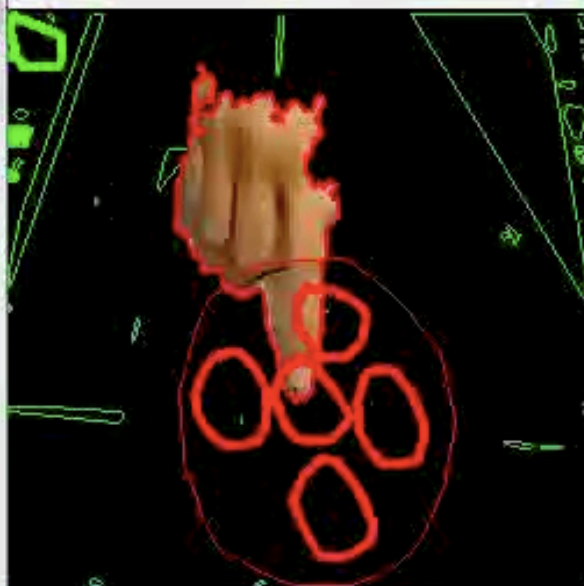
# Click Detection

## Identifying a Click

- Click by concealment
- Optical flow ?

Stop Camera

Stop Tracking



Tau CD 200000

Tau Alpha low -20

Tau Alpha 1 6

Tau Alpha 2 -6

K value 50

Angle 40

lower Hysteresis 0.1

higher Hysteresis 0.15

Update Constants

Untitled - Notepad

File Edit Format View Help

Down Left Right Right Down Space |