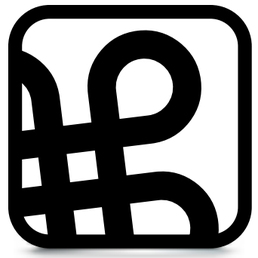


Macoun’11

Visuelle Gestenerkennung

Andy Abgottspon
www.aaweb.ch
@aaweb

Inhalt

- Einleitung
- Von der Theorie zur Praxis
- Demo 1: Simple App
- Demo 2: 3D Game
- Schlusswort

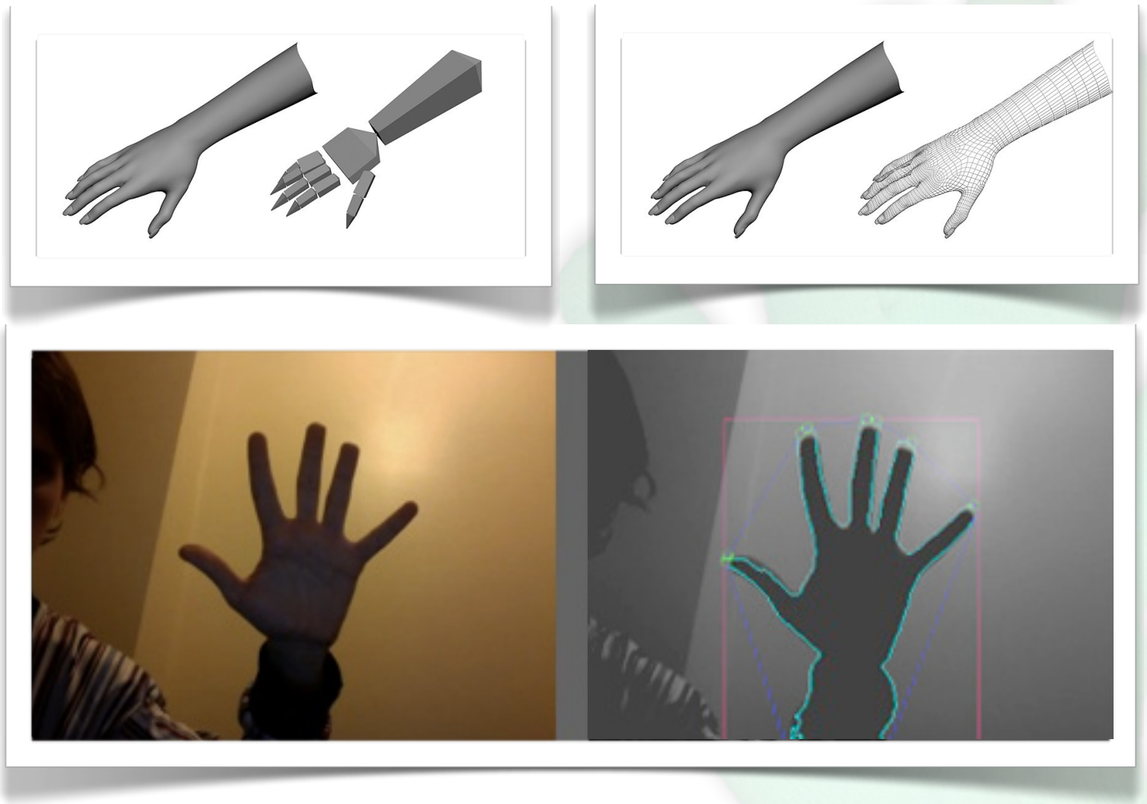
Einleitung

Visuelle was ...?

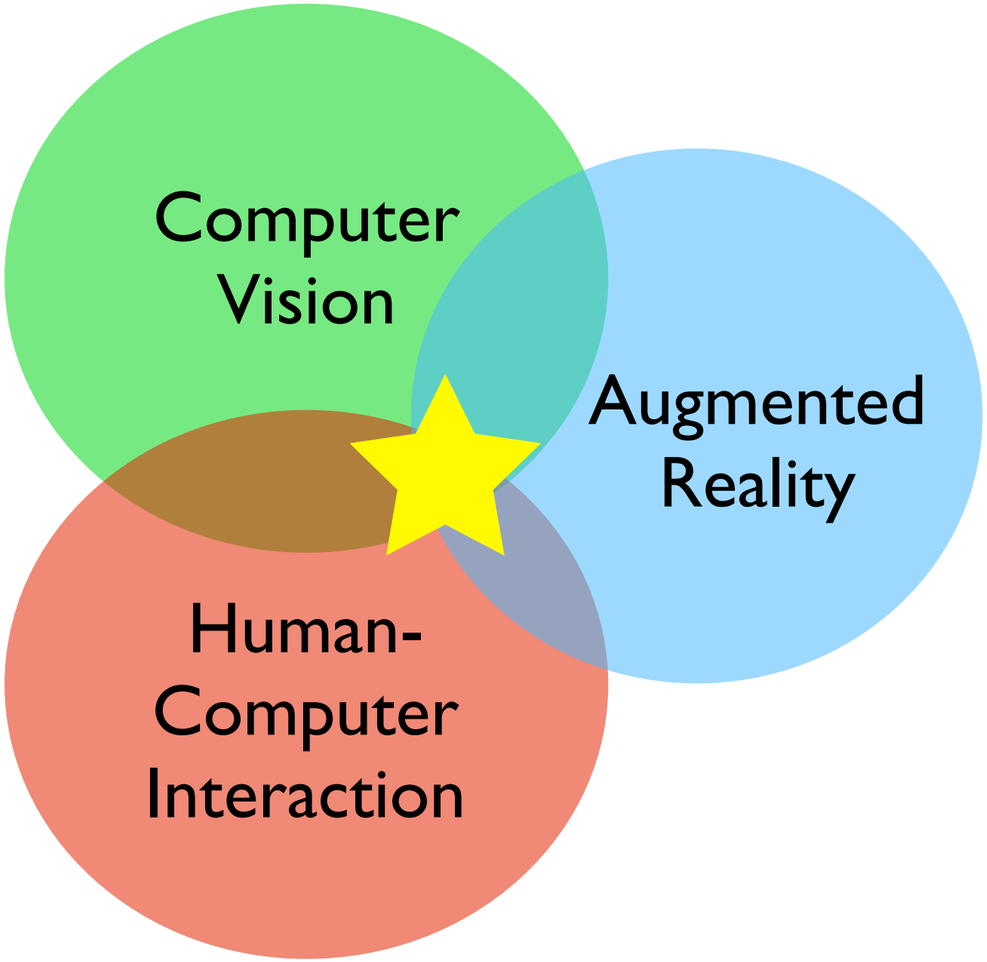
- Handgesten
- Eingabegeräte
  - Controller: von Konsole, Wired gloves
  - Stereo-Kamera: Xbox Kinect
  - Einzelne Kamera: Webcam, iPad 2

Methoden zur Gestenerkennung

- Repräsentation
  - 3D-Modell (Skelett, Volumetrisch)
  - Appearance-based
- Evtl. Hilfsmittel
  - Farb-Handschuh
  - High-Tech Equipment

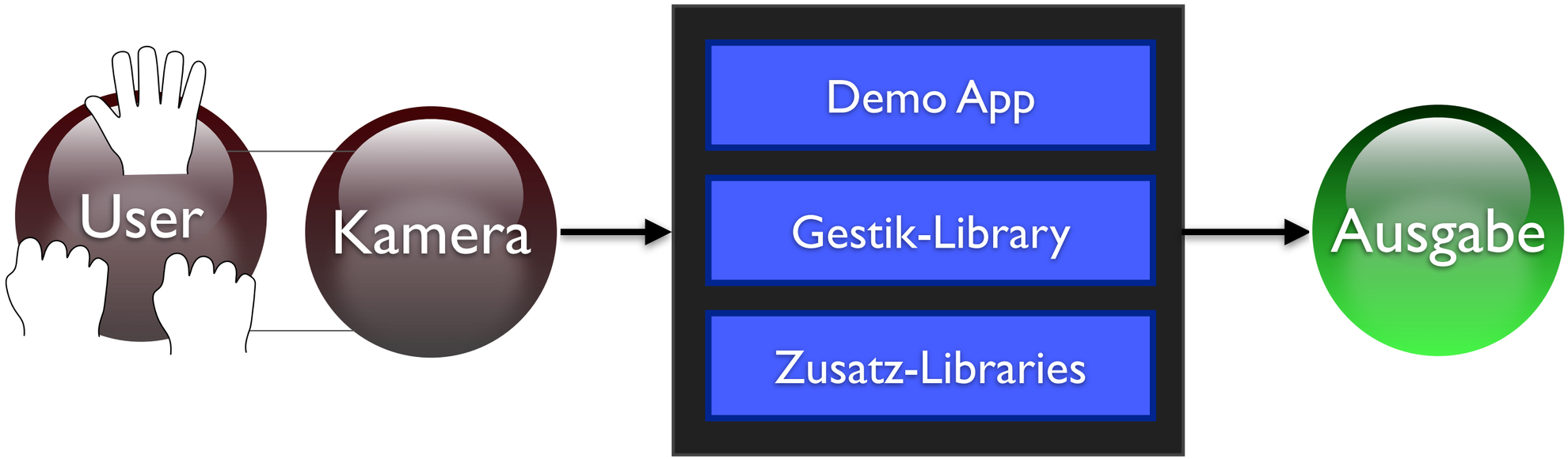


Video see
http://vimeo.com/aaweb/gesture-library-ipad2-update


Computer
Vision
Augmented
Reality
Human-
Computer
Interaction

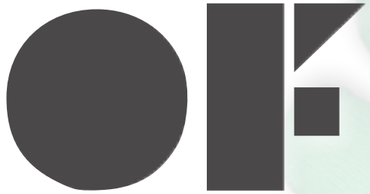
Von der Theorie ...

Systemüberblick

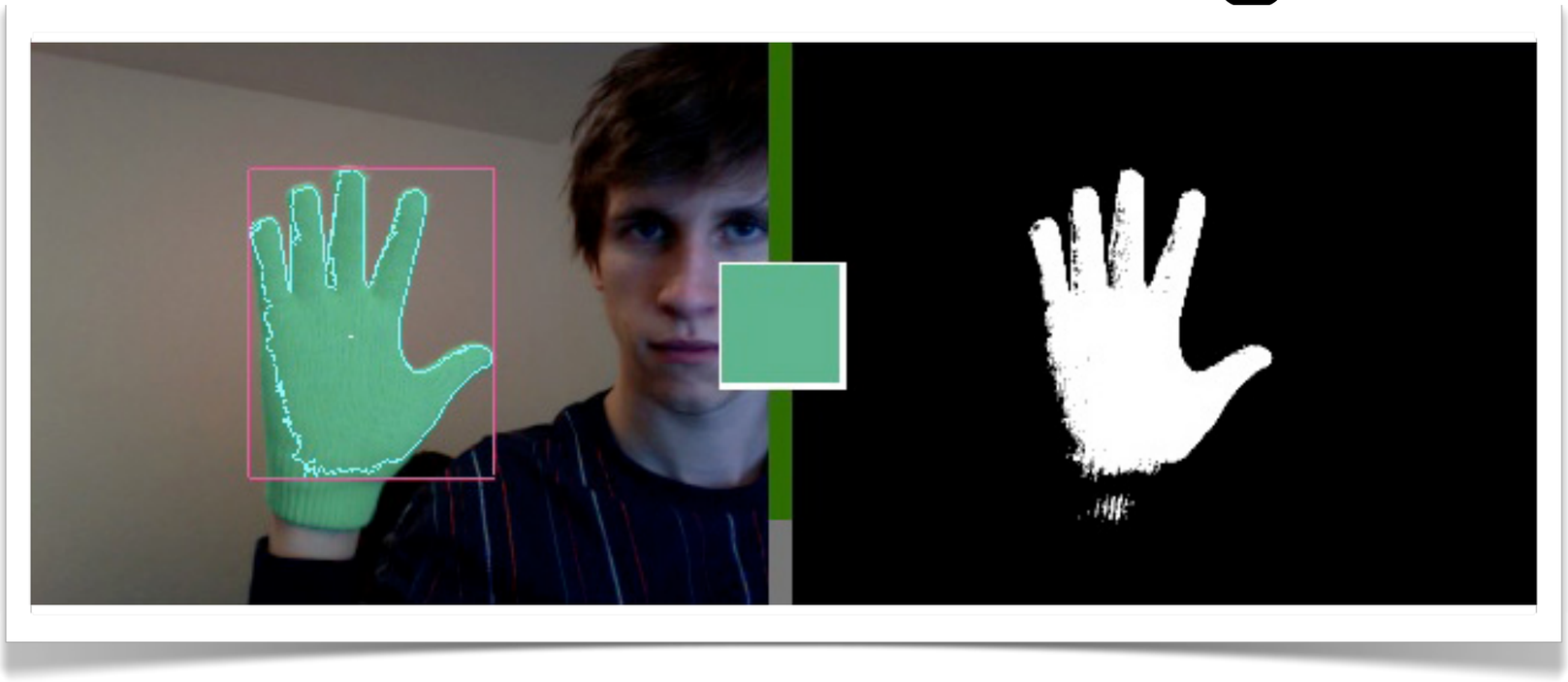


Implementation

- openFrameworks (C++)
  is an open source C++ toolkit for creative coding.
- OpenCV
  (Open Source Computer Vision) is a library of programming functions for real time computer vision.
- Port auf iPad 2 (Objective-C)



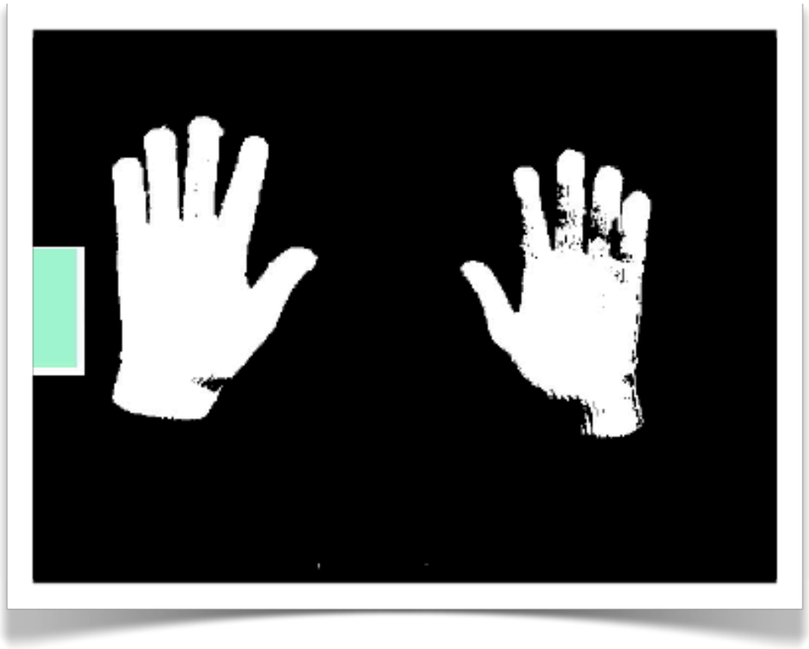
Hand-Erkennung



Initialisierung → S/W-Maske → Konturenerkennung (OpenCV)

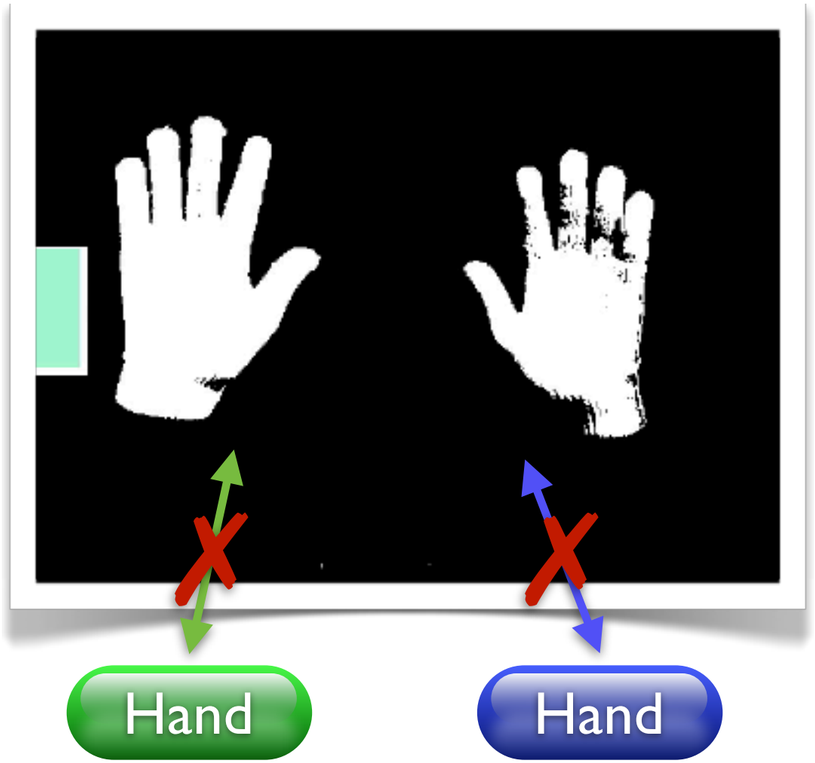
```
int cvFindContours(CvArr* image, CvMemStorage* storage ...)
```

Some “handy” tricks
(for more than one hand)



1. Konturen-Zuweisung für alle Hände löschen
2. Naheliegendste Kontur der Hand zuweisen

Some “handy” tricks
(for more than one hand)



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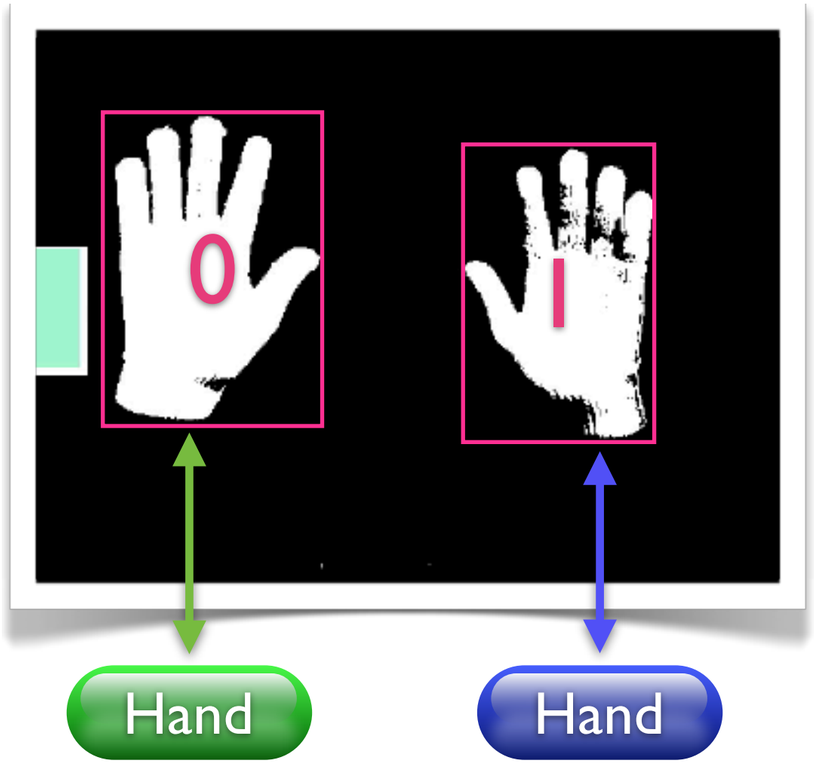

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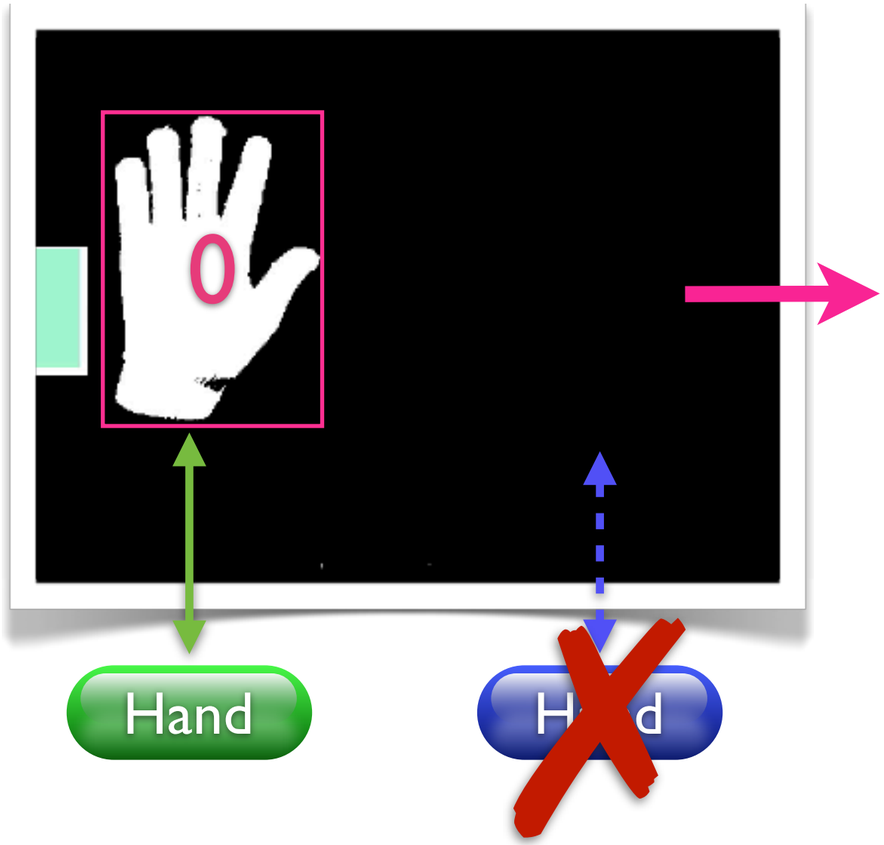
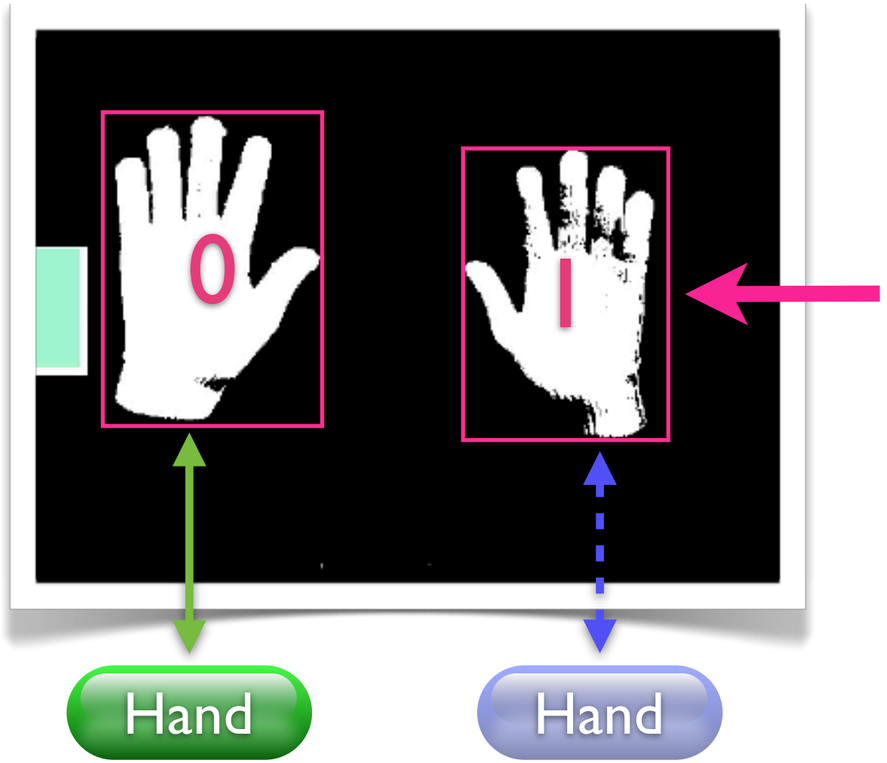


3. Nicht verwendete Hand-Instanzen löschen
4. Neue Hand-Instanzen erstellen (wenn nötig)

Some “handy” tricks

(for more than one hand)



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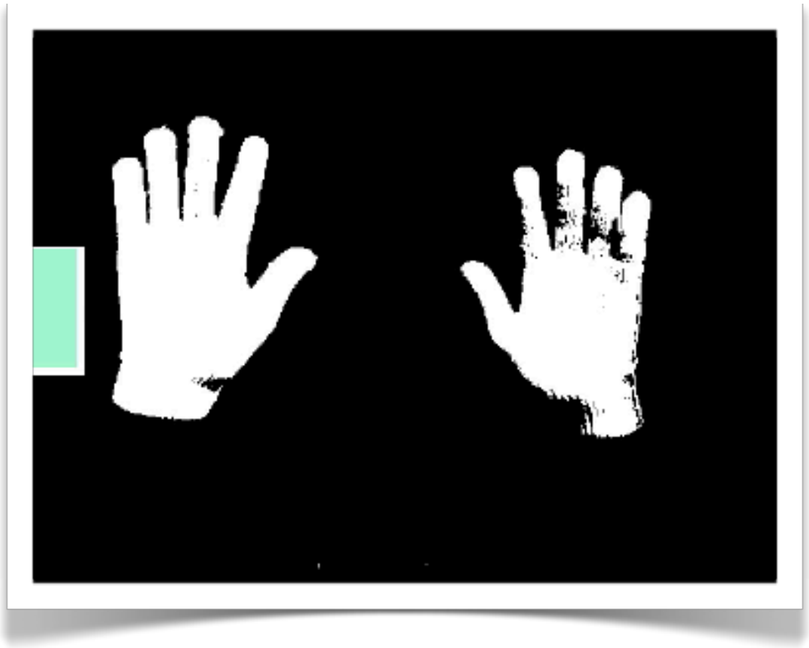
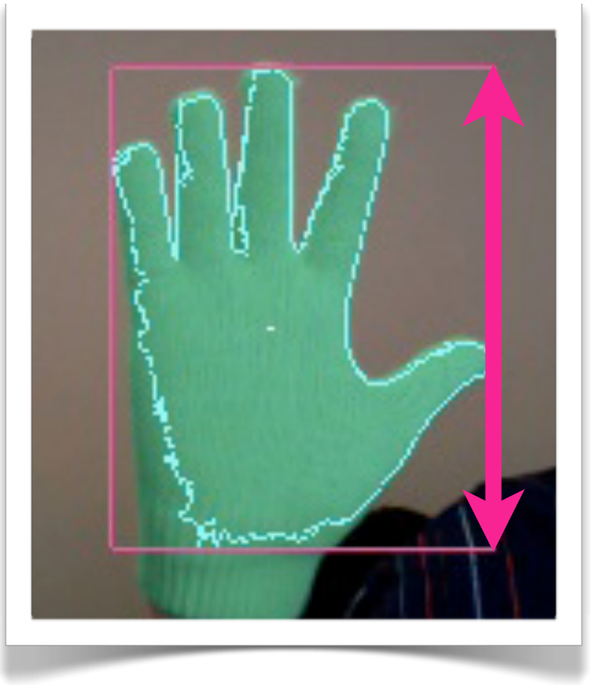
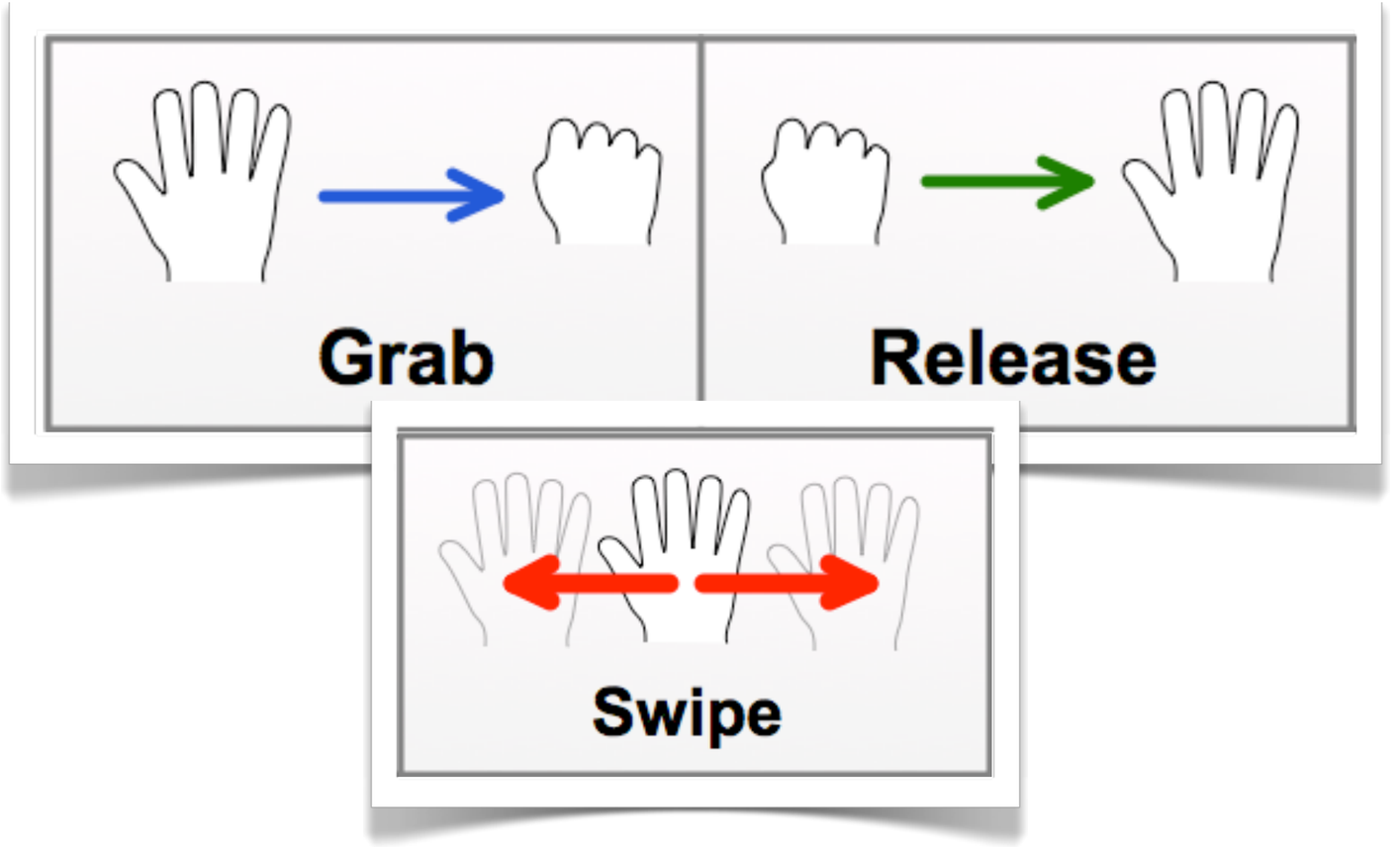


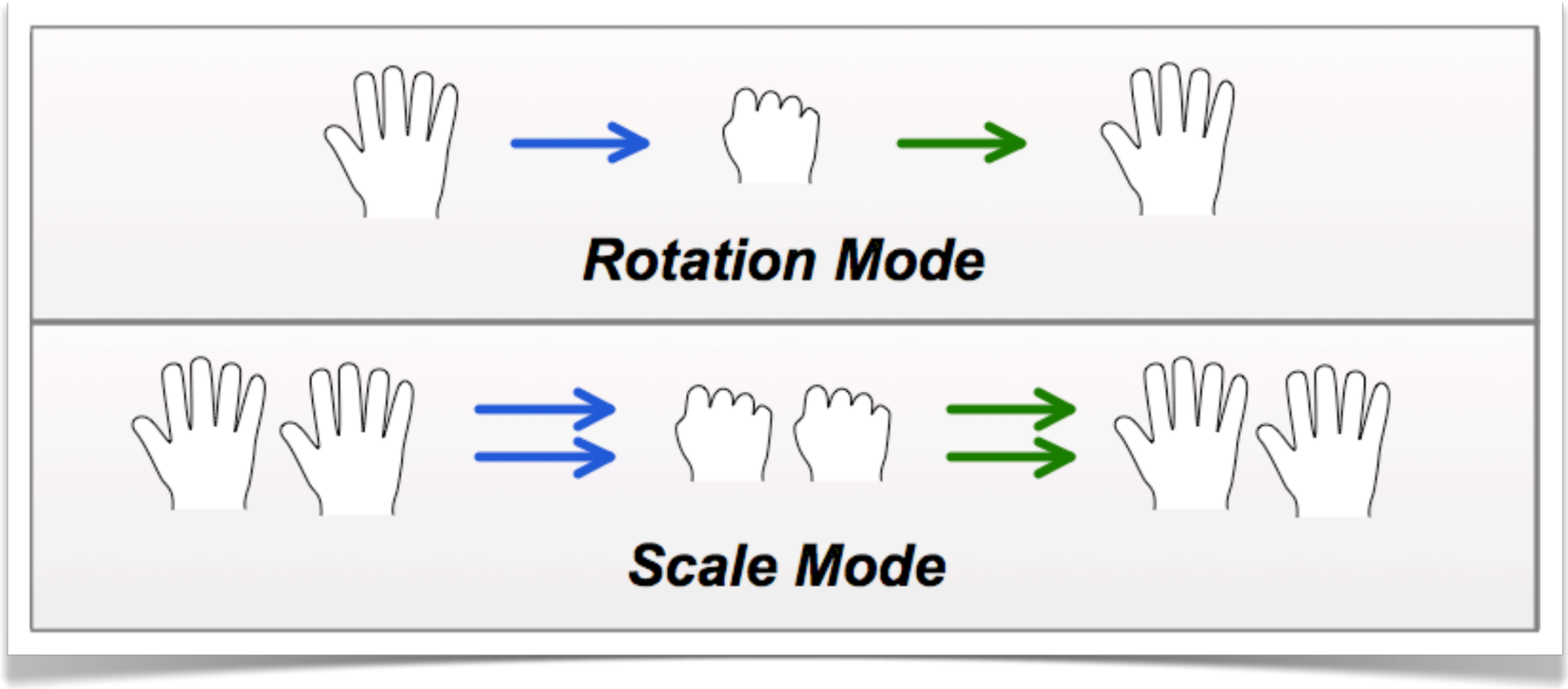
5. Einzelgesten erkennen
6. Doppelgesten erkennen

Gesten-Erkennung





Veni, Vidi, Modi.

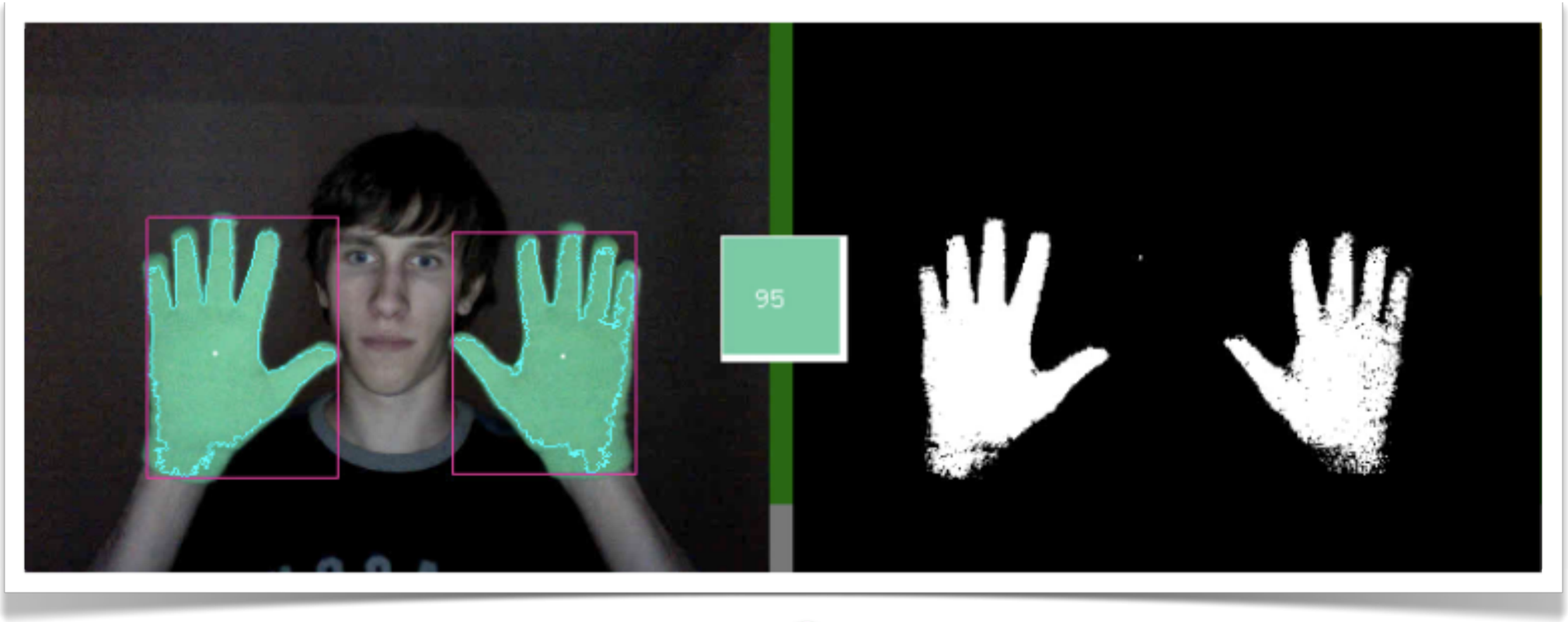


Bitte nicht den Kopf verlieren!

- Head-Tracking (3D-Perspektive)
  via OpenCV
- Vergleichbare Projekte:
  Francone, J., Nigay, L., 2011. 3D displays on mobile devices: HCP. PhD Thesis.
  http://iihm.imag.fr/en/demo/hcpmobile/

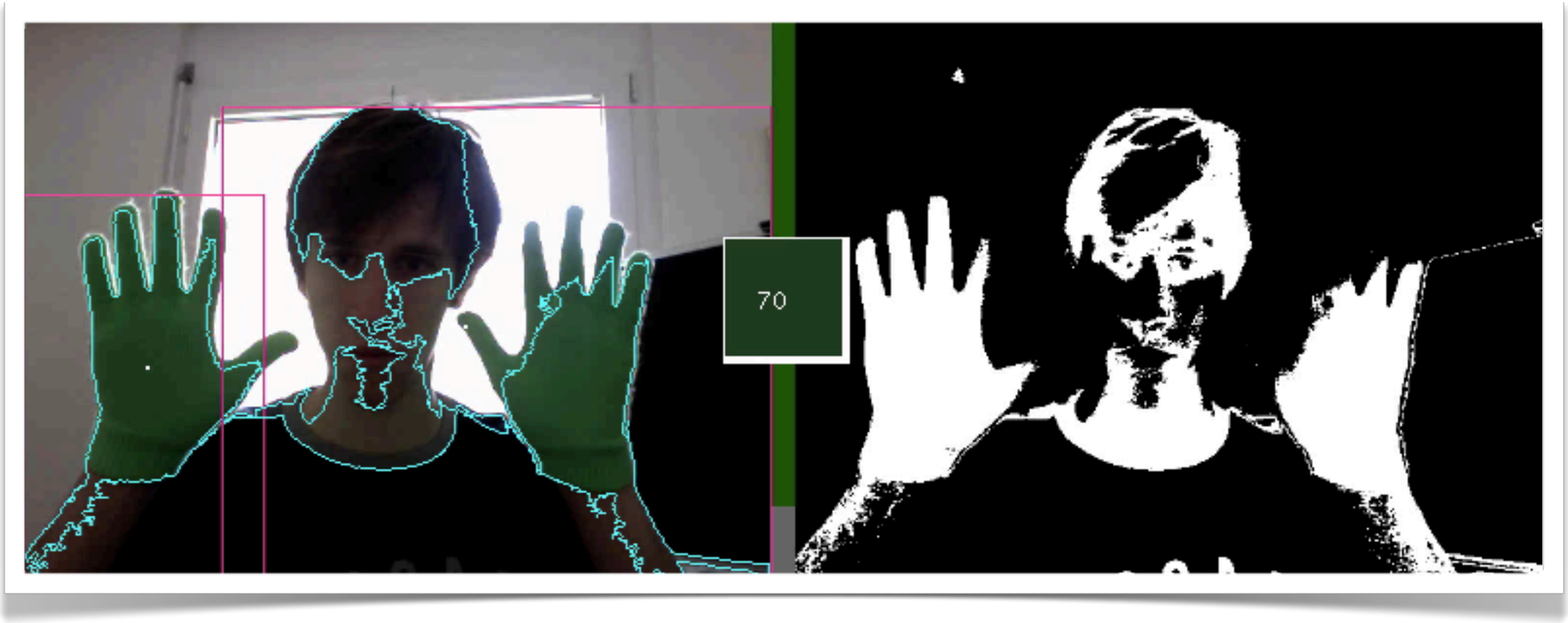
```
CvSeq* cvHaarDetectObjects(CvArr* image, CvHaarClassifierCascade* cascade,
CvMemStorage* storage, double scale_factor=1.1, int min_neighbors=3,
int flags=0, CvSize min_size=cvSize(0, 0))
```

“Umgebungsvariable” Licht :-)



✓

“Umgebungsvariable” Licht :-(



✗

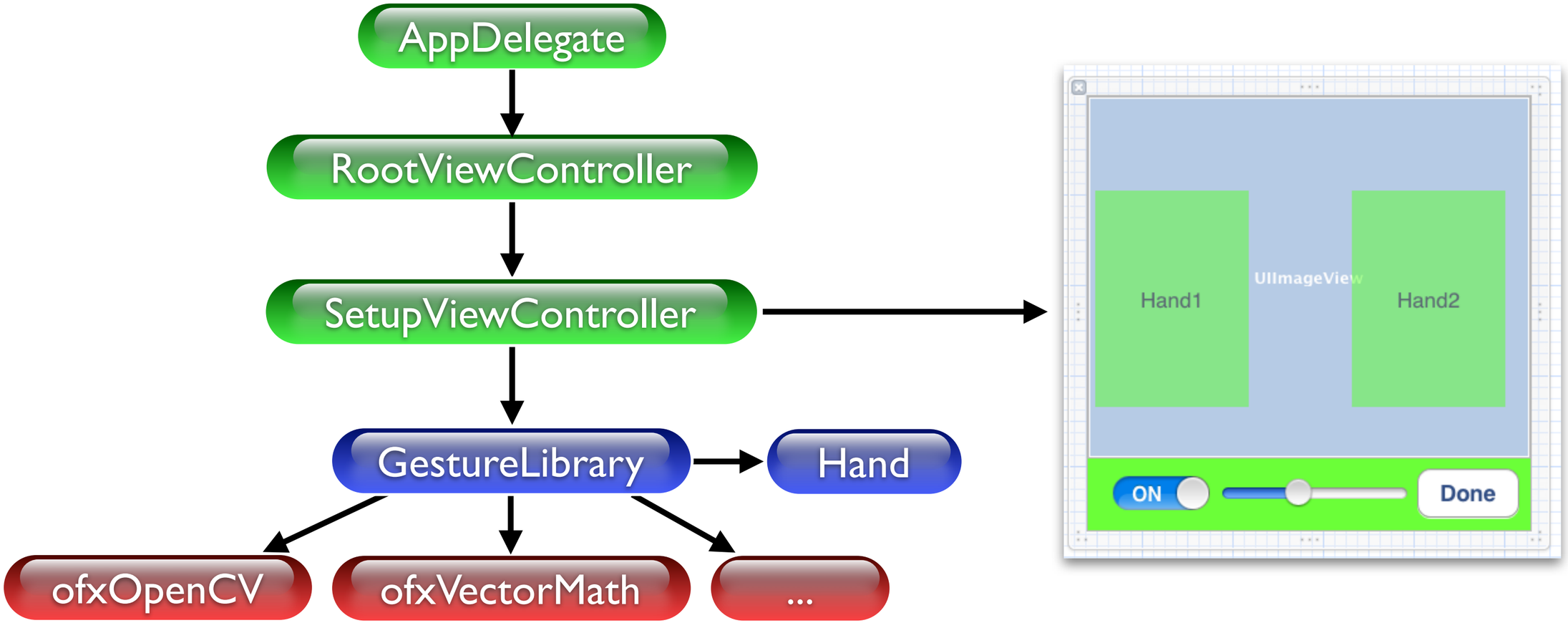
Der Gorilla-Arm ...

... und weitere Herausforderungen:

- Licht und Umgebung
- Performance
- Genauigkeit
- Bildqualität

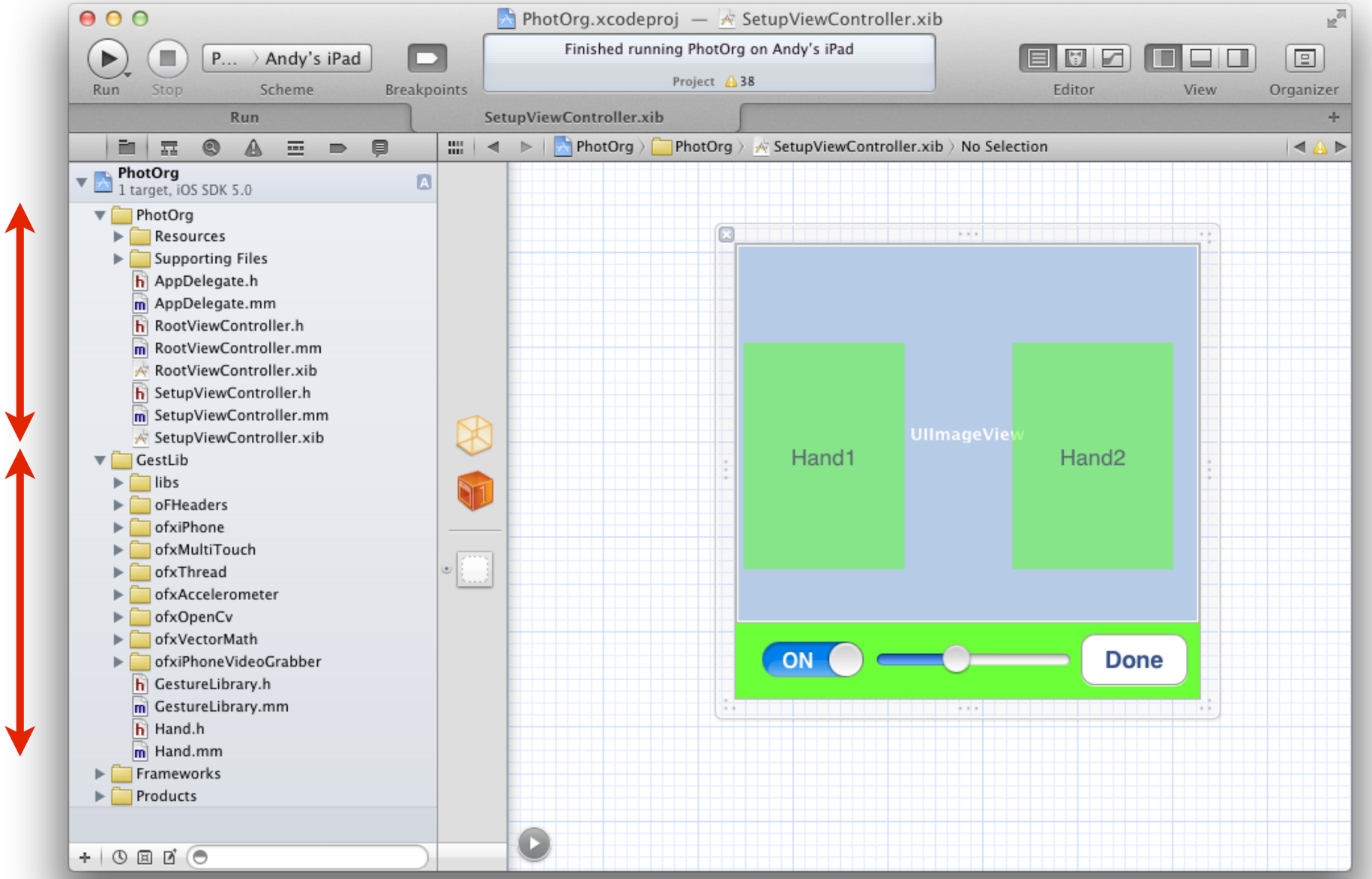
… zur Praxis

Integration



Your app

GestLib,
oF, OpenCV



SetupViewController

```
- (void)viewDidLoad
{
    [super viewDidLoad];

    // Initialise video dimensions
    videoWidth = 640;
    videoHeight = 480;

    // Setup gesture library with parameters
    gestLib.setup(videoWidth, videoHeight,
            [thresholdSlider value]);

    // Set initial hand color
    gestLib.setHandColor(0.0, 255.5, 216.0);

    ...
}
```

SetupViewController

```
- (void)update
{
    // Update gesture library (hand and gestures)
    gestLib.update();

    // Process gestures in library now
    bool gestureDone = gestLib.processGestures();

    // Get number of hands
    int nbOfHands = gestLib.getHands().size();

    ...


}
```

SetupViewController

```
- (void)update
{
    ...
    // Process hands
    for(int i=0; i < nbOfHands; i++)
    {
      switch ( gestLib.getHands()[i].getGesture() )
      {
        case GEST_GRAB:
          handLbl.text = @"Grab";
          [rootVC grabEvent:i];
          break;
        ...
      }
    ...
}
```

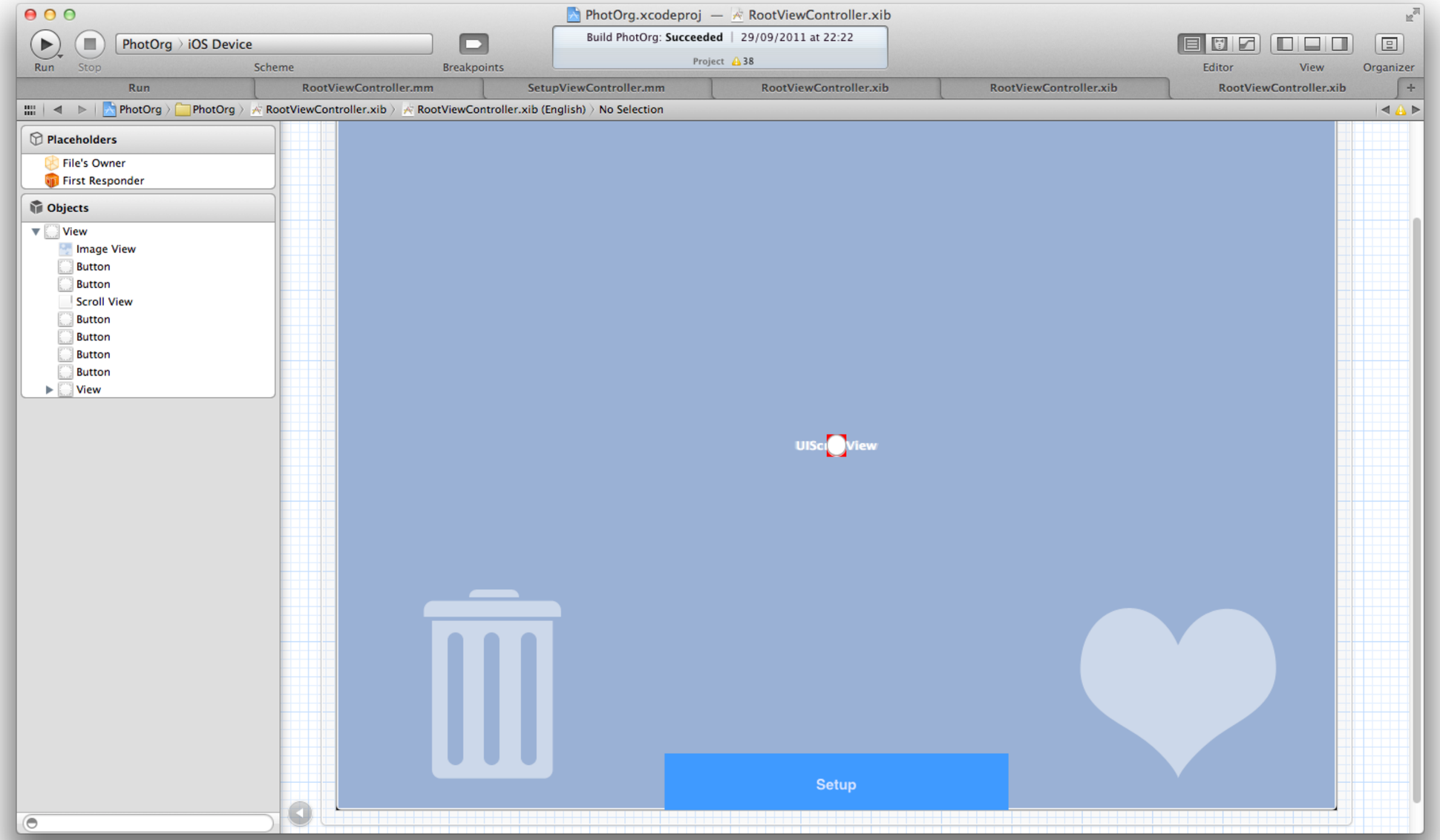
SetupViewController

```
camViewScale = camImg.frame.size.width/(float)videoWidth;

- (void)update
{
    ...
    ofRectangle handRect = gestLib.getHands()[i].getRect();

    handLbl.frame = CGRectMake(
      handRect.x*camViewScale + camImg.frame.origin.x,
      handRect.y*camViewScale + camImg.frame.origin.y,
      handRect.width*camViewScale,
      handRect.height*camViewScale);

    ...
}
```


PhotOrg.xcodeproj — RootViewController.xib
PhotOrg › iOS Device
Build PhotOrg: Succeeded | 29/09/2011 at 22:22
Project 38
Run
Stop
Scheme
Breakpoints
Editor
View
Organizer
RootViewController.mm
SetupViewController.mm
RootViewController.xib
RootViewController.xib
RootViewController.xib
PhotOrg › PhotOrg › RootViewController.xib › RootViewController.xib (English) › No Selection
Placeholders
File's Owner
First Responder
Objects
View
Image View
Button
Button
Scroll View
Button
Button
Button
Button
View
Setup

Demo 1

Hands on!
(pun intended)

Demo 2


METEORA

Schlusswort

Einsatzgebiete

- Als Ersatz oder komplementär
- Games
  - Steuerung, Perspektive, Shooter
  - Navigation, Interaktion
- Bildung, Medizin

Fazit

- Die richtigen Techniken anwenden
- Benutzbarkeit geht vor
- “Remember the gorilla arm!”
  aka “How is this going to fly in *real* use?”
- Neuland: Seid kreativ!

"**Ideas** are like **rabbits**. You get a couple and **learn** how to handle them, and pretty soon you have a dozen."

John Steinbeck

Fragen?

Andy Abgottspon
www.aaweb.ch
@aaweb

Vielen Dank

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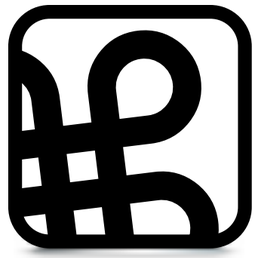

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