Improvements on Eye-blink Detection for iBlink

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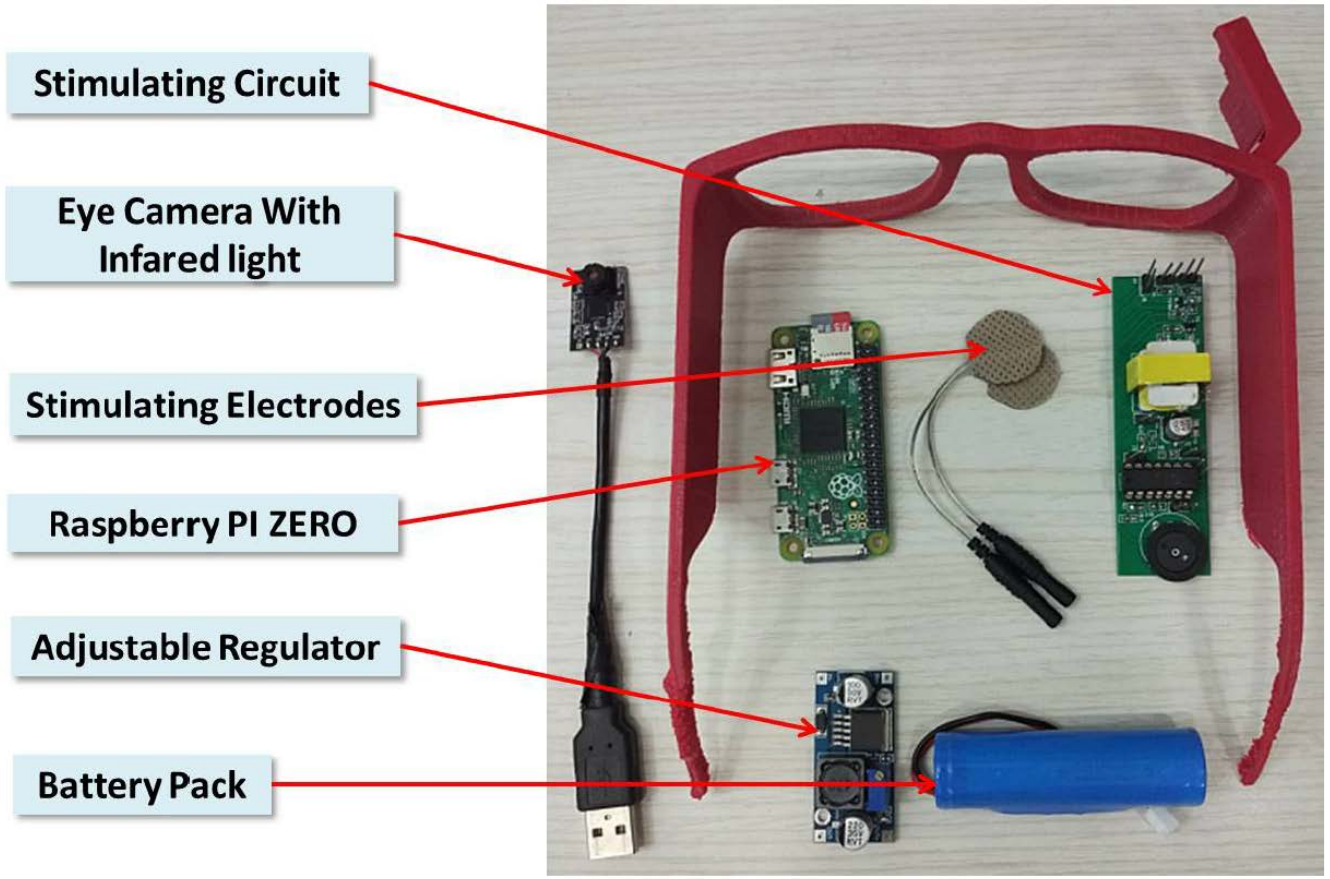
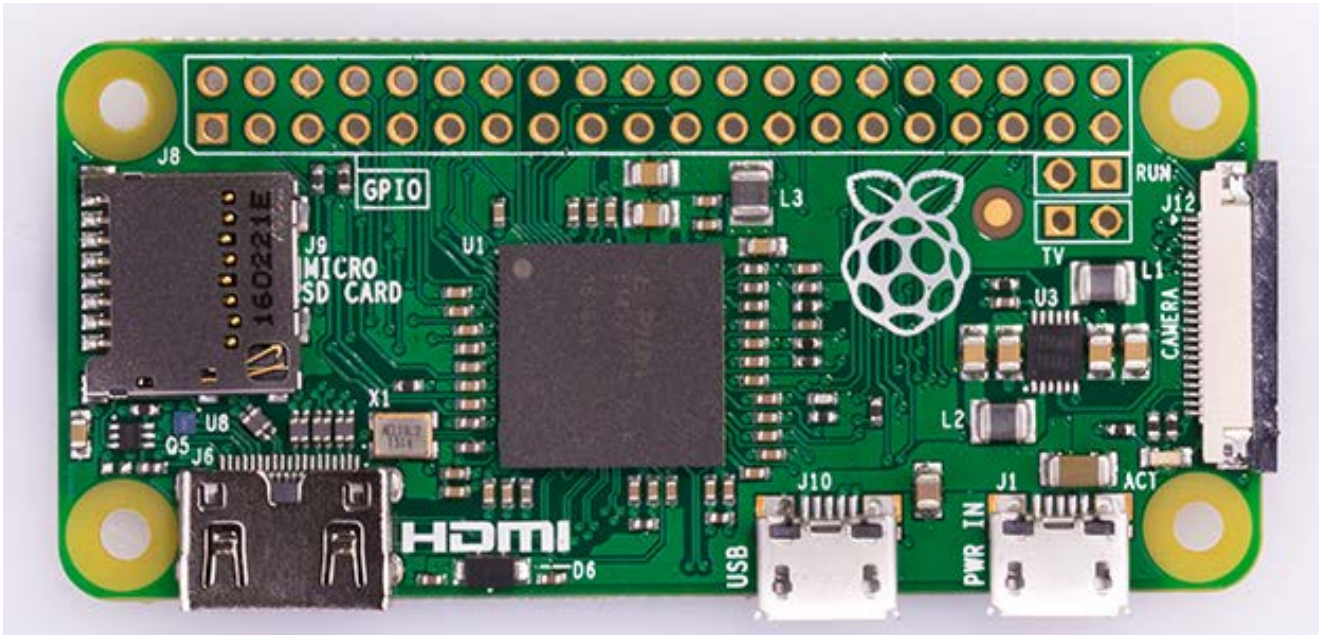
01 Introduction

iBlink for Facial Paralysis



Problems

- High power consumption
- High requirement for computing resources

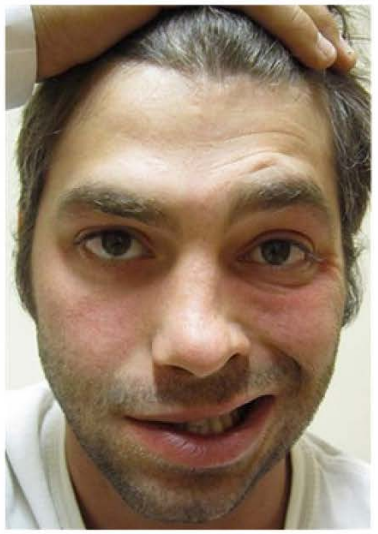


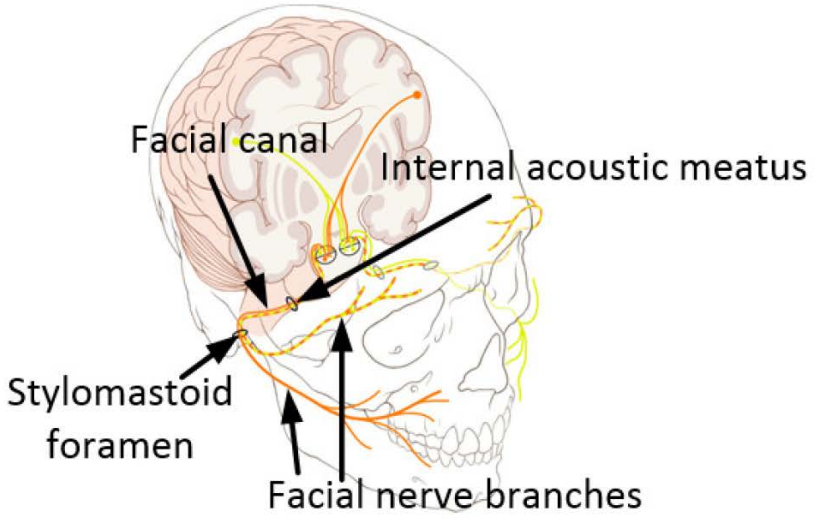
Regressing Local Binary Features

02 Background

Facial Paralysis

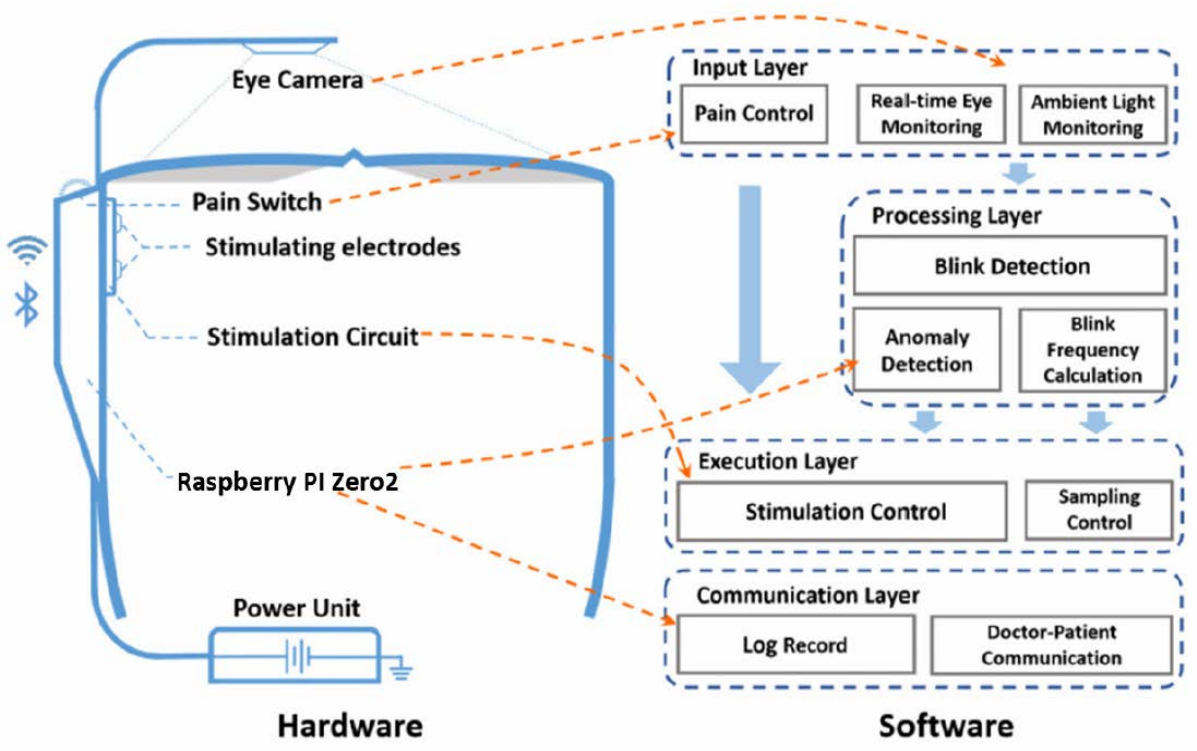
- Bell’s palsy
- Facial rehabilitation
- Electrical stimulation





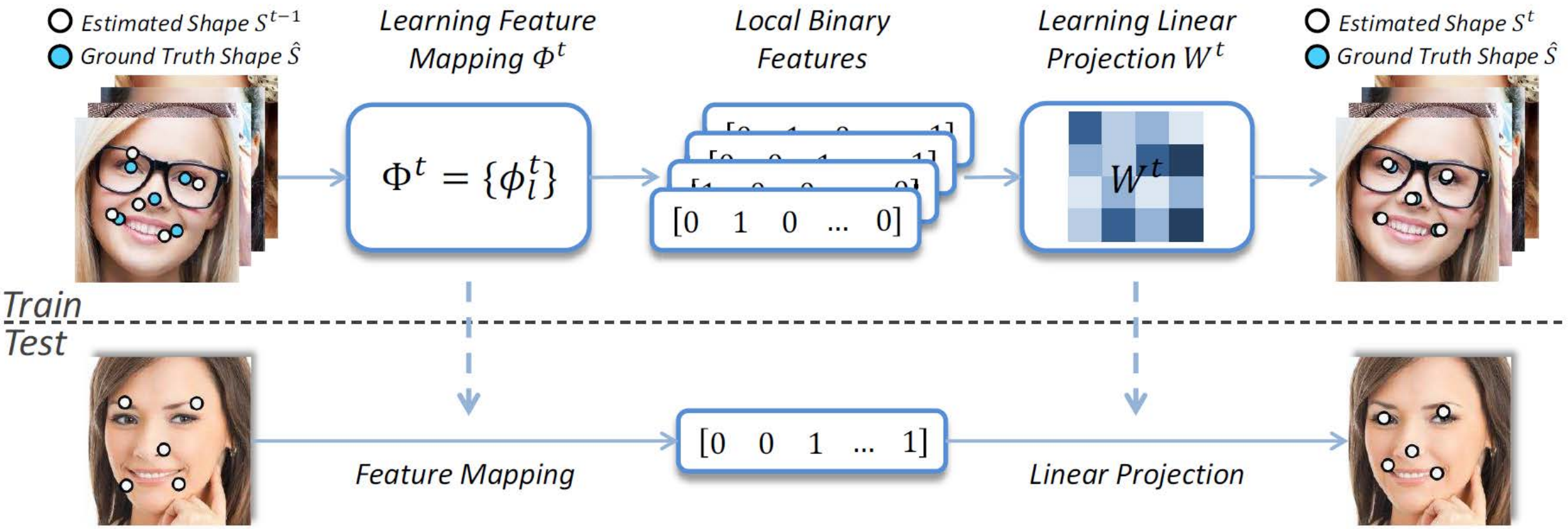
iBlink

- Eye-blink detection
- Automatic stimulation
- System Integration



03 Improvements on eye-blink detection

Introduction to Regressing Local Binary Features



Introduction to Regressing Local Binary Features

S : facial shape
S^0: initial shape
ΔS : shape increment
ΔS^t : shape increment at stage t
I : input image
S^{t-1} : shape from previous stage
Φ^t : feature mapping function
W^t : linear regression matrix

$$\Delta S^t = W^t \Phi^t(I, S^{t-1})$$

Introduction to Regressing Local Binary Features

- $\Phi^t = [\phi_1^t, \phi_2^t, \ldots, \phi_L^t]$ (L is the number of landmarks)

- Each Φ_l^t is learned by independently regressing lth landmark

Learning Local Binary Features Φ^t

- π_l : extract two elements $(2l-1, 2l)$ from vector $\Delta\widehat{S}_i$
- $\pi_l \circ \Delta\widehat{S}_i$: ground truth 2D-offset of lth landmark in ith training sample

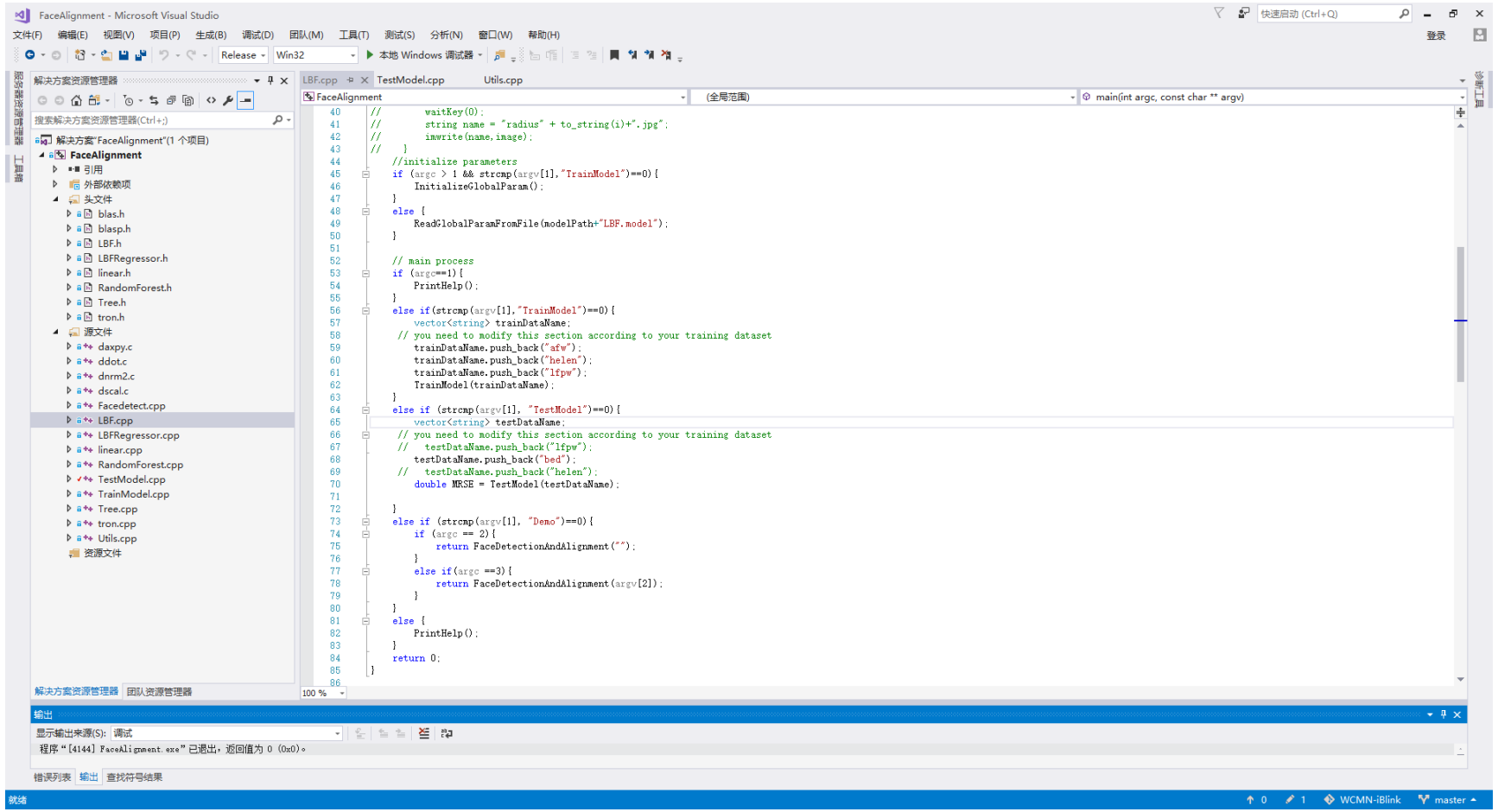
$$\min_{\omega^t, \phi_l^t} \sum_{i=1} ||\pi_l \circ \Delta\widehat{S}_i - \omega_l^t \phi_l^t \left(I_i, S_i^{t-1}\right)||_2^2$$

Learning Global Linear Regression W^t

$$\min_{W^t} \sum_{i=1}^{N} ||\Delta\widehat{S}_i - W^t \Phi^t\left(I_i, S_i^{t-1}\right)||_2^2 + \lambda||W^t||_2^2$$

- L2 regularization on W^t

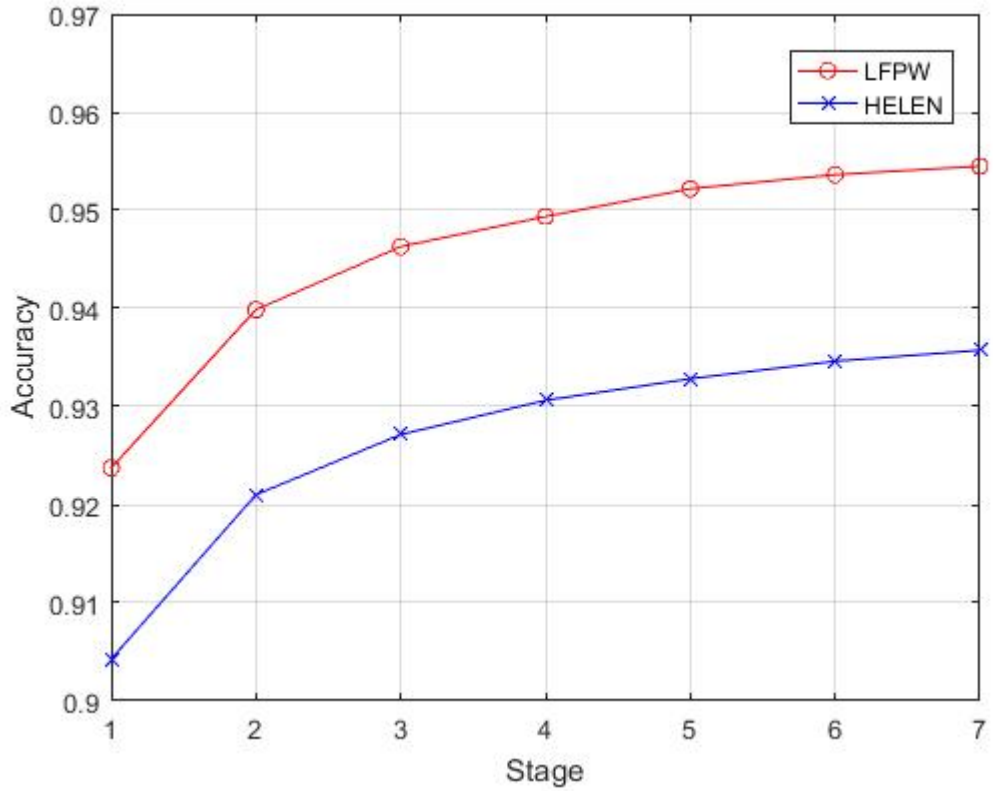
Implementation



https://github.com/AlexChang/WCMN-iBlink

04 Performance evaluation

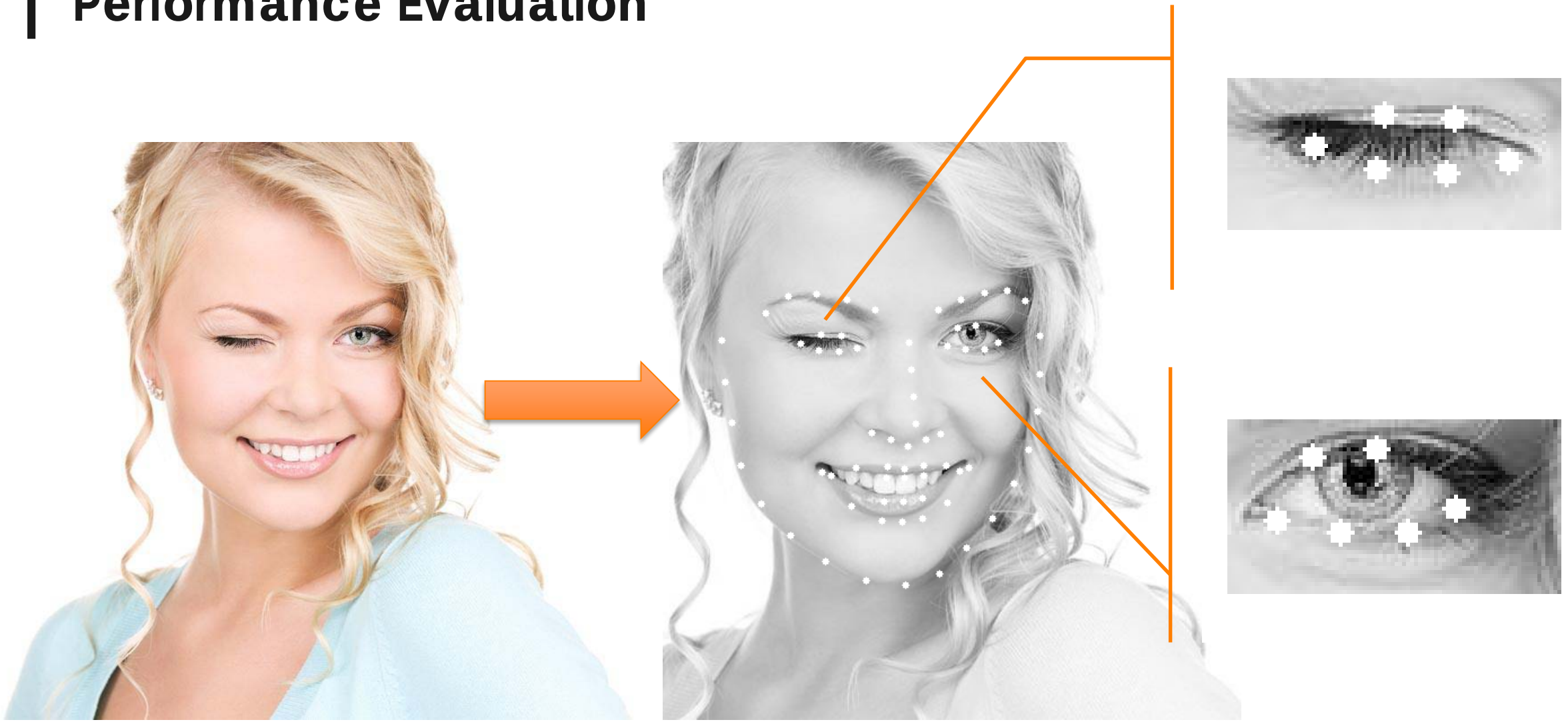
Performance Evaluation



- *LFPW* (68 landmarks)
  - 811 train images
  - 225 test images
  - 9.8374ms (102FPS)

- *HELEN*(68 landmarks)
  - 2000 train images
  - 330 test images
  - 12.8639ms (78FPS)

Performance Evaluation



05 Conclusion & future work

Conclusion & Future Work

- High accuracy and efficient LBF algorithm
- Integrate with iBlink

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