Fachhochschule Graubünden
University of Applied Sciences

Face Recognition

Udo Birk

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graubünden Bildung und Forschung

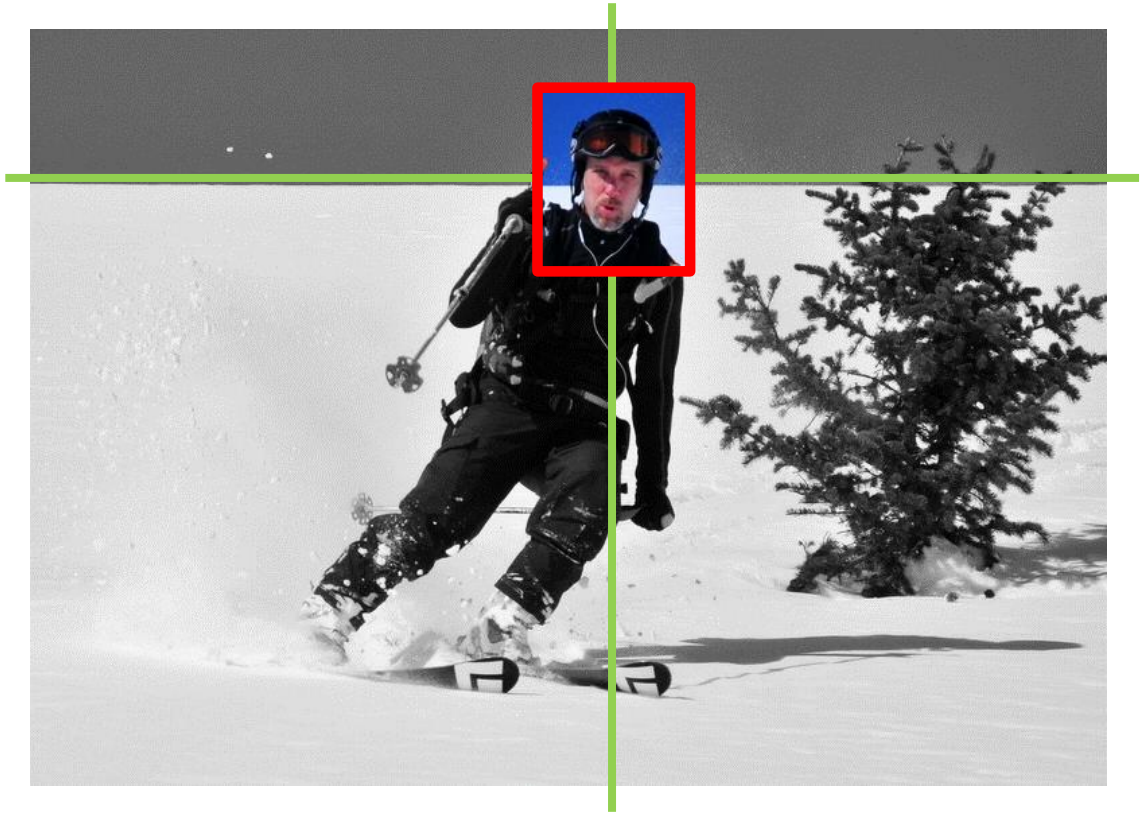
Outline

- Aims of Face Recognition
- Face Recognition Process
  - Face detection
  - Face identification
- Recognizing faces live or from photos

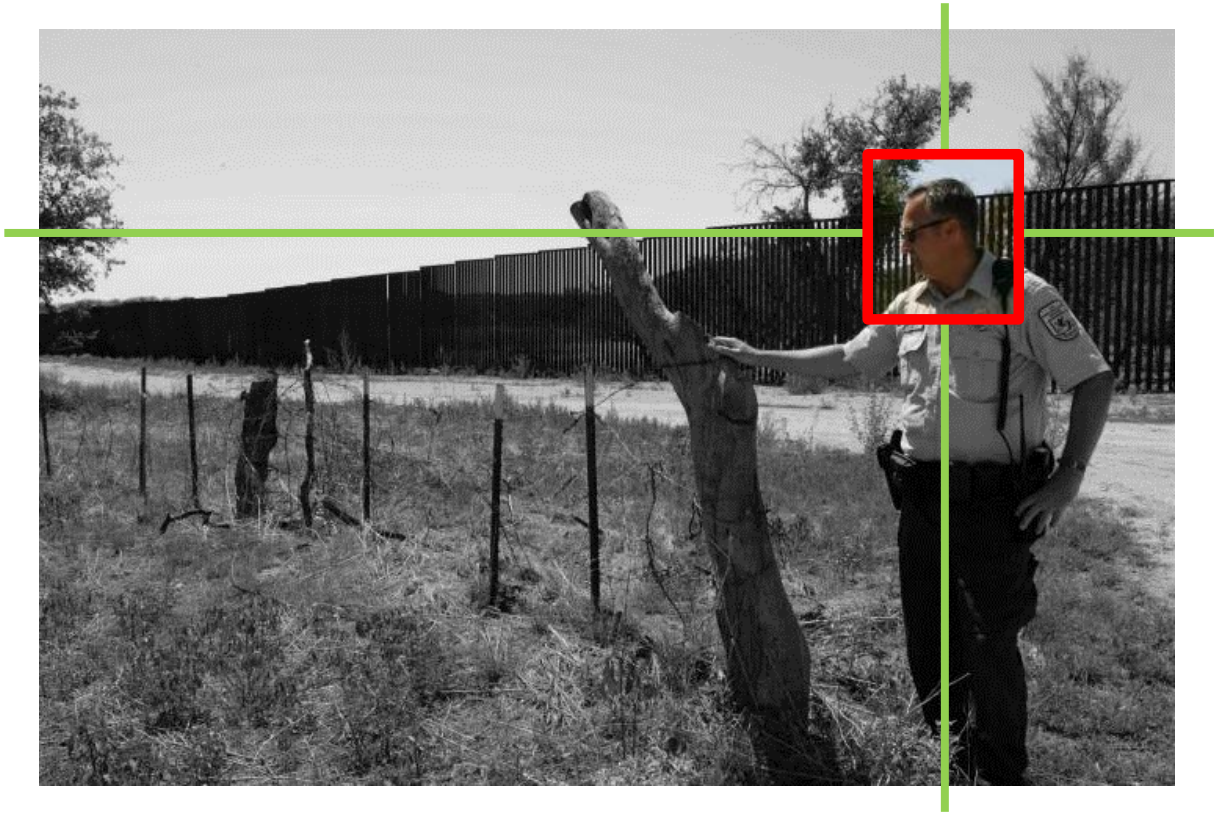
Source: https://blog.htwchur.ch/blog/der-pin-hat-ausgedient-heute-gilt-die-gesichtserkennung/

Face detection

- Is there a face in the image?



- Where in the image is the face?



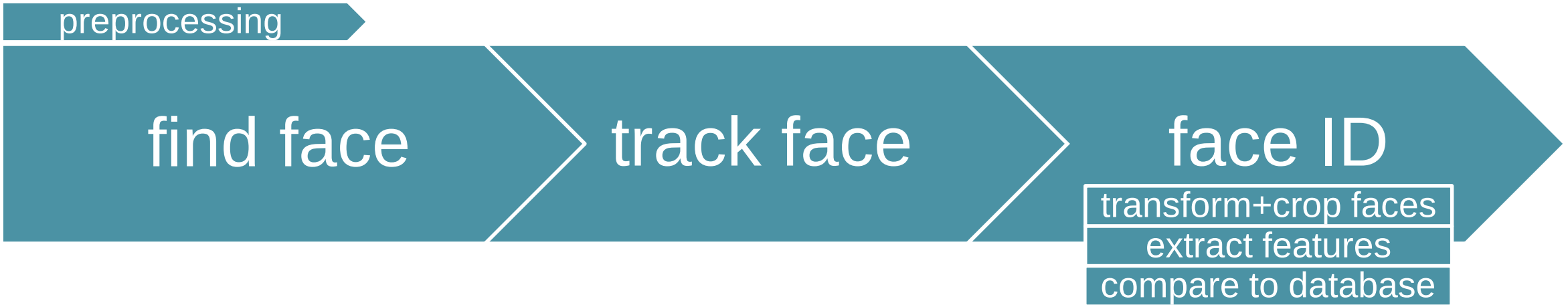
Source: wikimedia

Aims of Face Recognition

Decision making

Face detection: Is there a face in the image? Where is it?

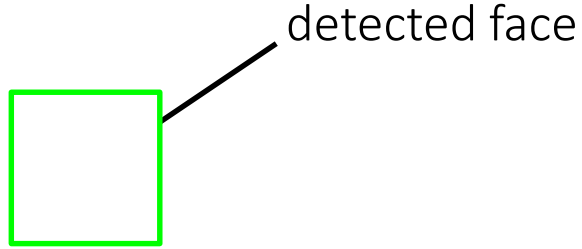
Face identification: Which person does it belong to?



Face Detection

Standardized input image

high detection rate with any algorithm



Face detected with all 4 tested algorithms

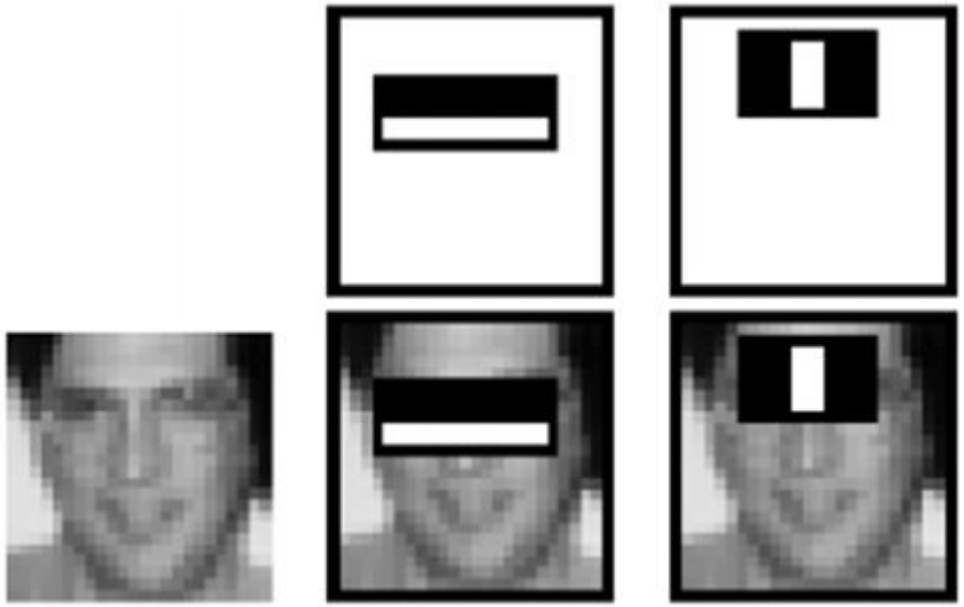
Source: stva.zh.ch

Face Detection

Efficiency

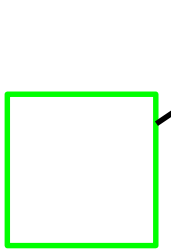
Search for predominant intensity patterns

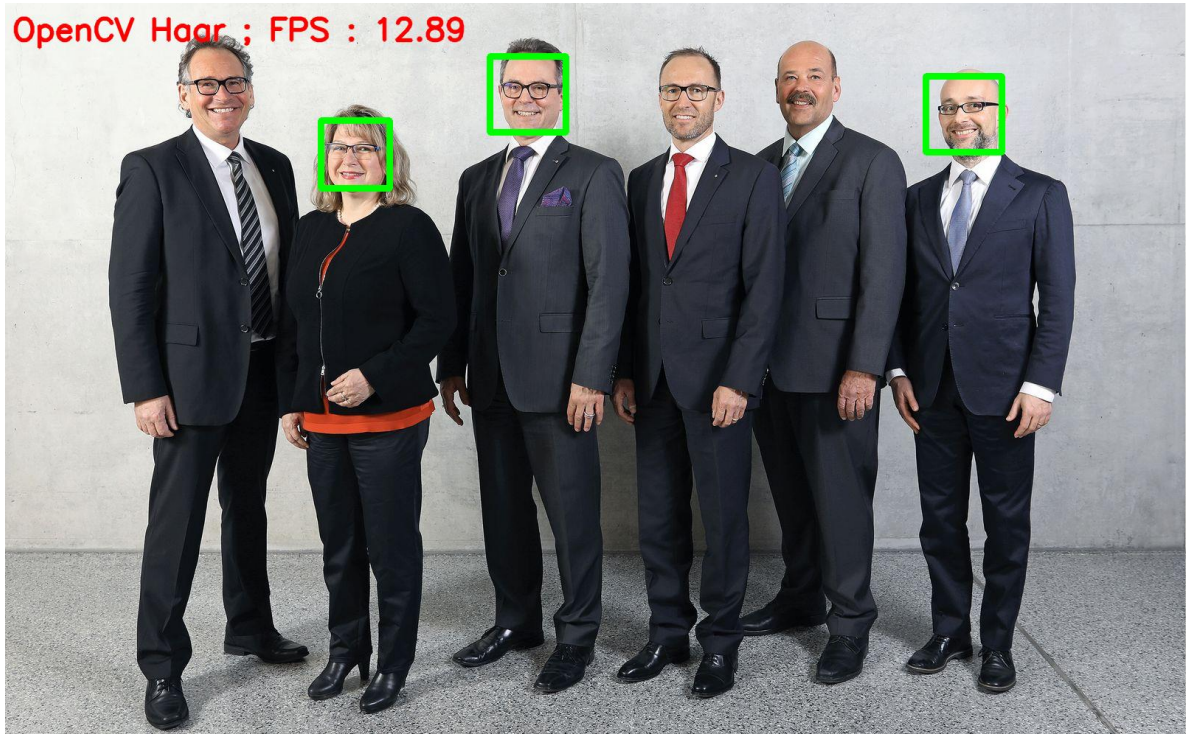
Viola Jones, Haar features



[1]

3 out of 6 faces detected

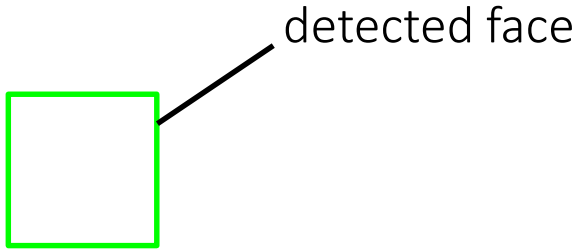




[2]

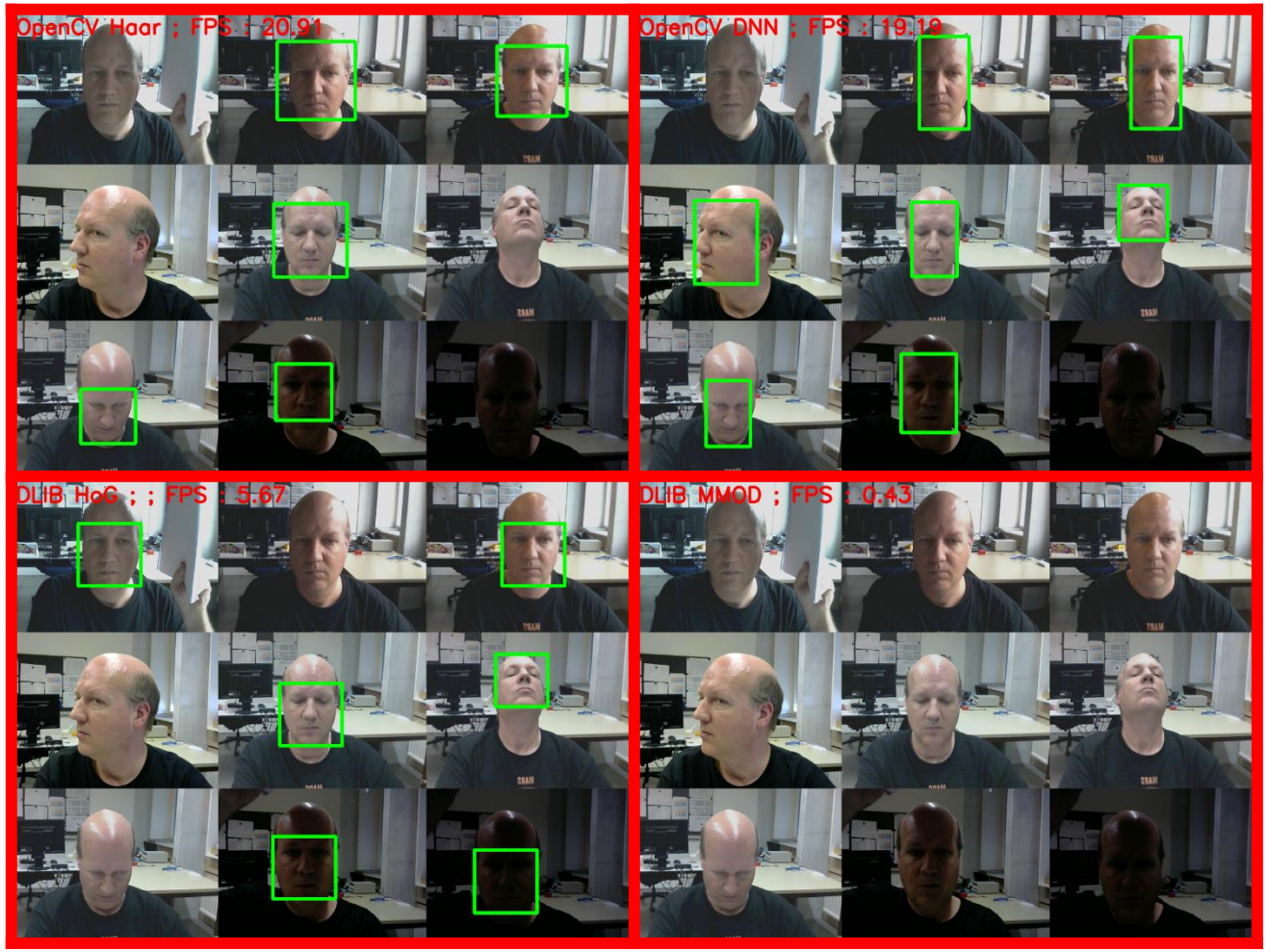
Source: [1] Viola and Jones, CVPR, 2001 [2] www.htwchur.ch
Birk and Roebrock, Proc. SPIE 11041, Machine Vision Applications, 110410J (2019)

Face Detection: Comparison of 4 Algorithms



Lighting, viewing direction

Haar Features



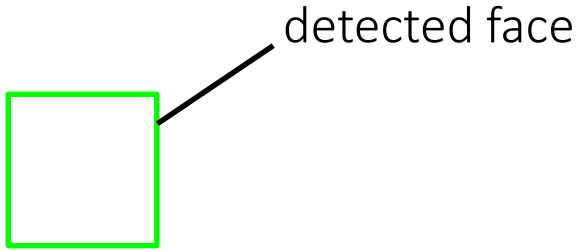
Deep Neural Net
(ResNet-10 based)

Histogram of Gradients
(Support Vector Machine)

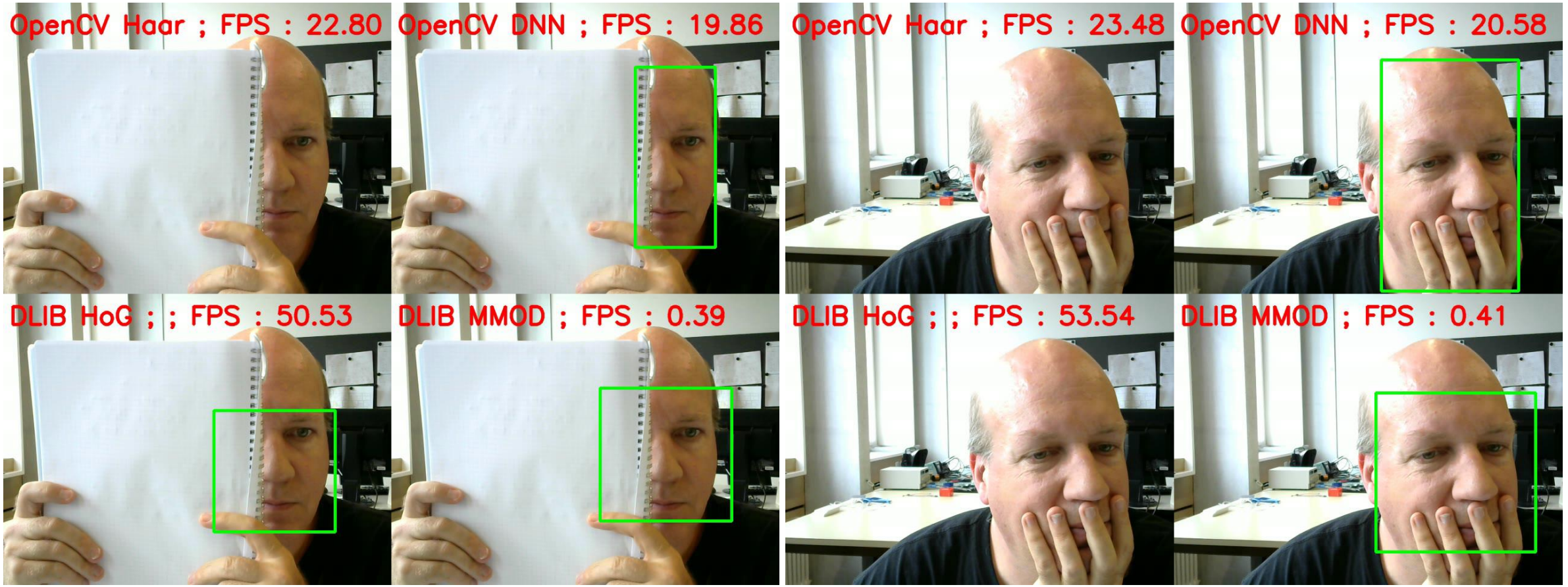
Convolut. Neural Net
(Max-Margin Object Detection)

FH GR

Face Detection: Comparison of 4 Algorithms

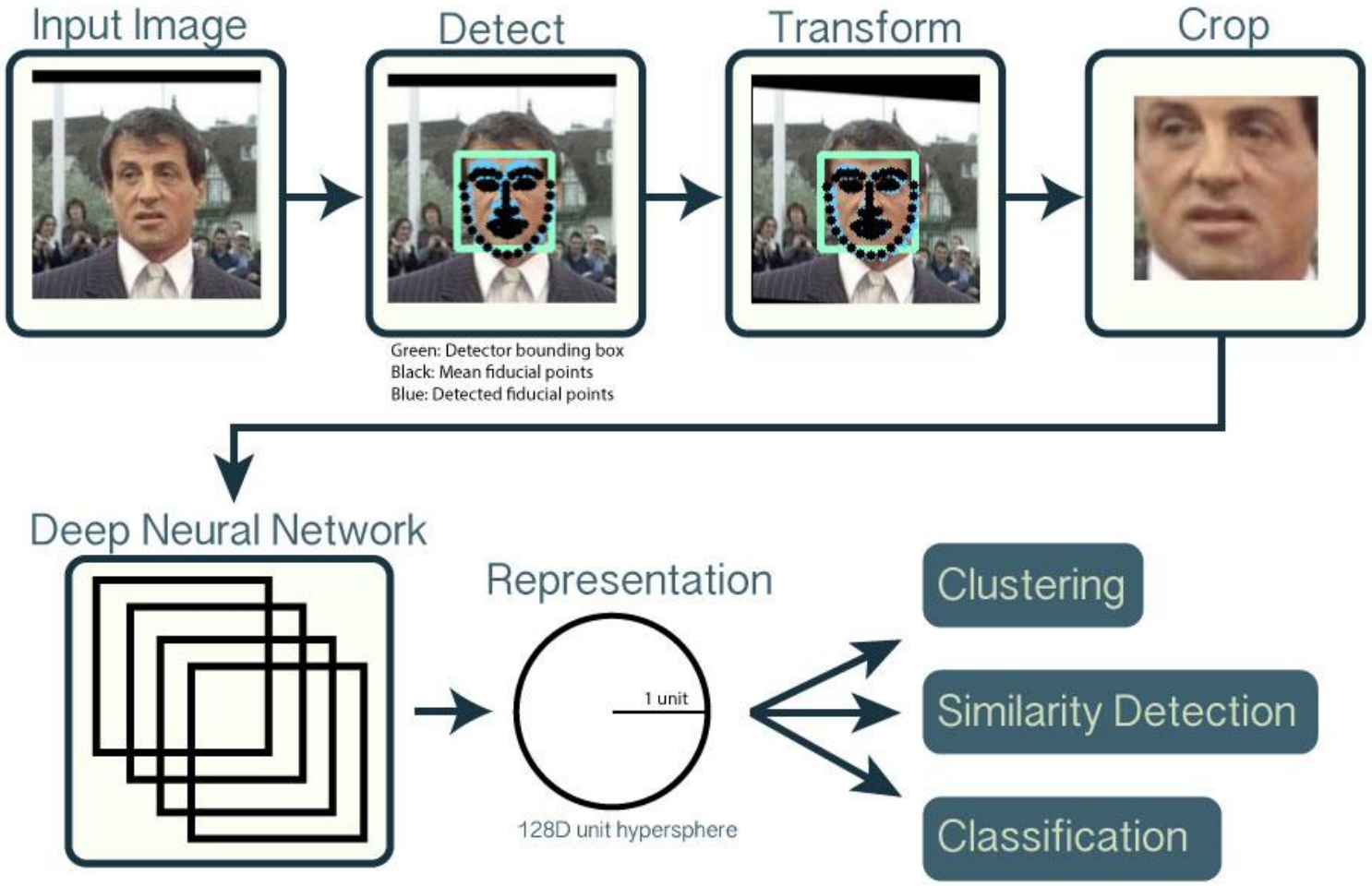


Occluded Face



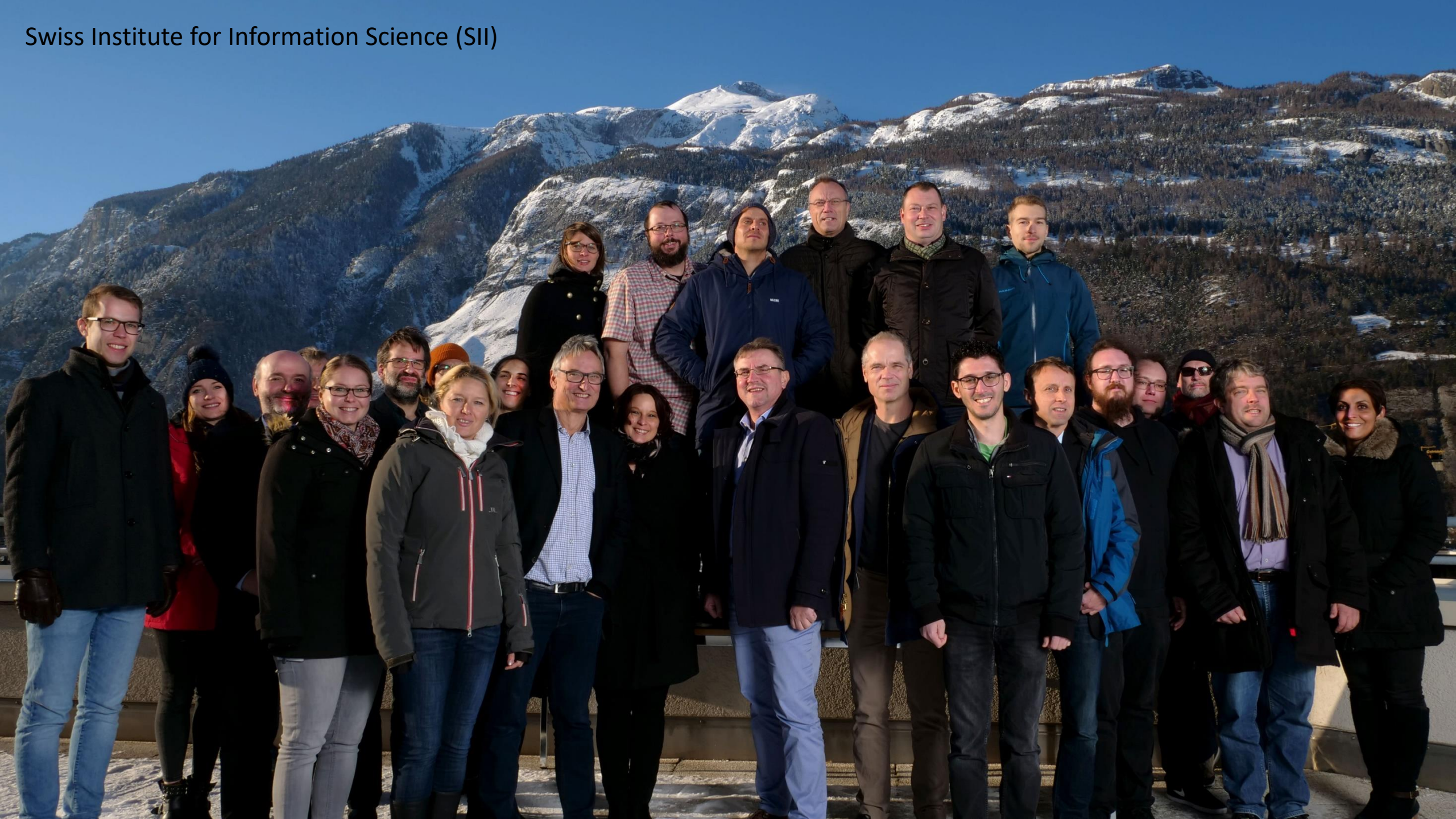
Face Recognition: Typical Detection and Identification Process

Extract feature vector (128 elements) = numerical representation of given face

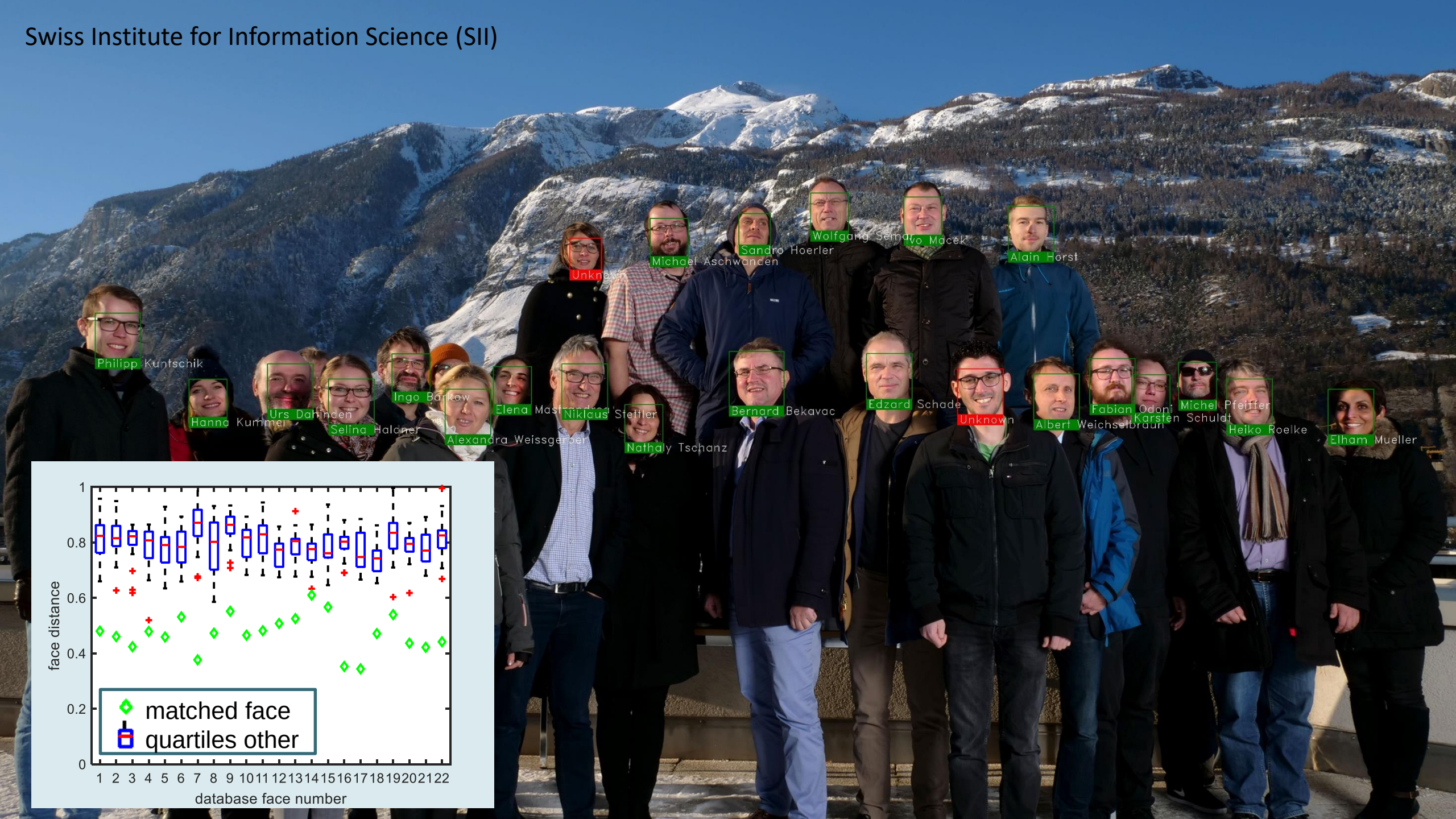


Source: OpenFace https://cmusatyalab.github.io/openface/

Swiss Institute for Information Science (SII)



Swiss Institute for Information Science (SII)

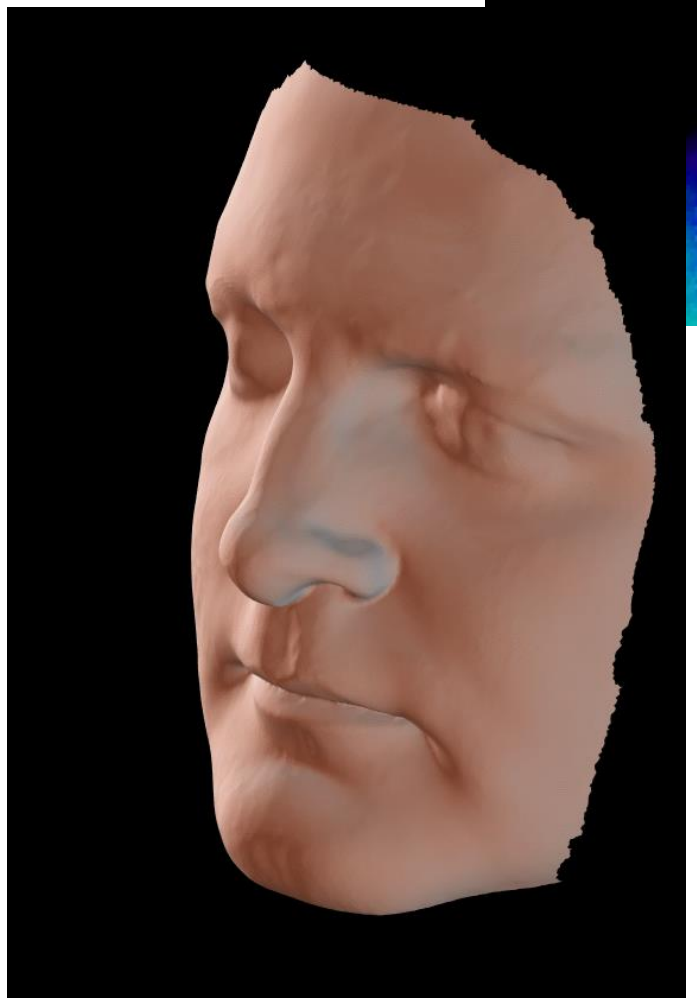


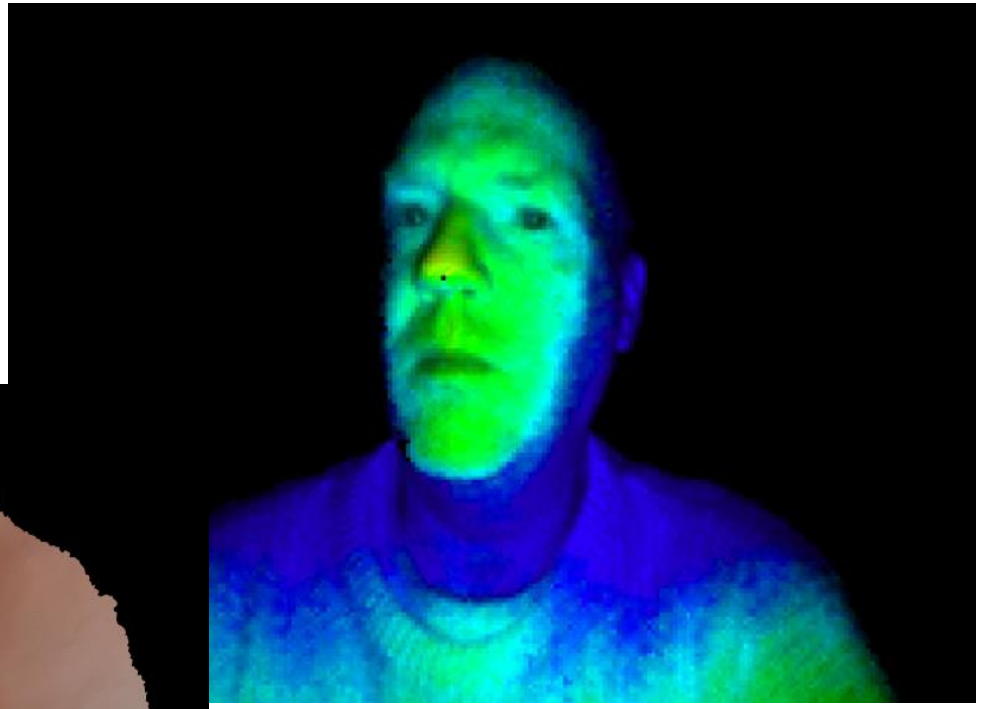
Requirement Engineering for Face Recognition

Target Challenges

Hardware Requirements
- processing speed
- memory
- energy consumption

Recognition Challenges
- selection of algorithm and model
- face size (minimum number of pixels)
- side view / tilted head
- occlusion
- lighting
- algorithmic bias (race, gender, ...)





Source: Gesichtserkennung statt PIN?, SwissEngineering STZ, Apr 2018

Add 3D Information
- added accuracy
- added security

Outlook: Some Hot Topics in Face Recognition

Deep Neural Networks

- bias in learning data and algorithms

Big Data

➔ user profile

- private: retail shops, google, facebook, etc.
- government: track interactions
- legal aspects of storing data

Evade Surveillance

- techniques to counter identification