Benchmarking Human Ability to Recognize Faces & People

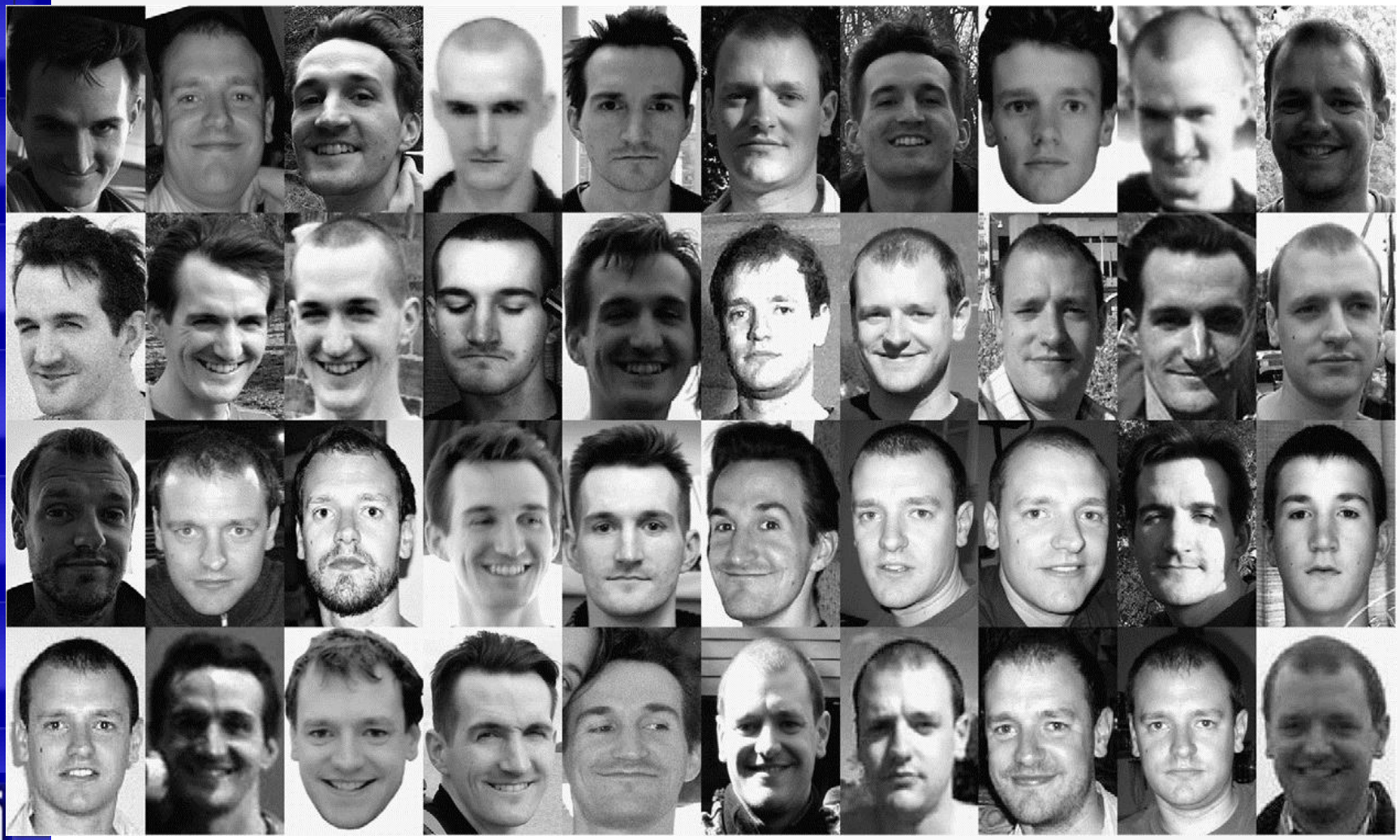
Dr. P. Jonathon Phillips

National Institute of Standards and Technology

Who is this person?

Is this same person?

Unfamiliar Faces: *How many identities here?*



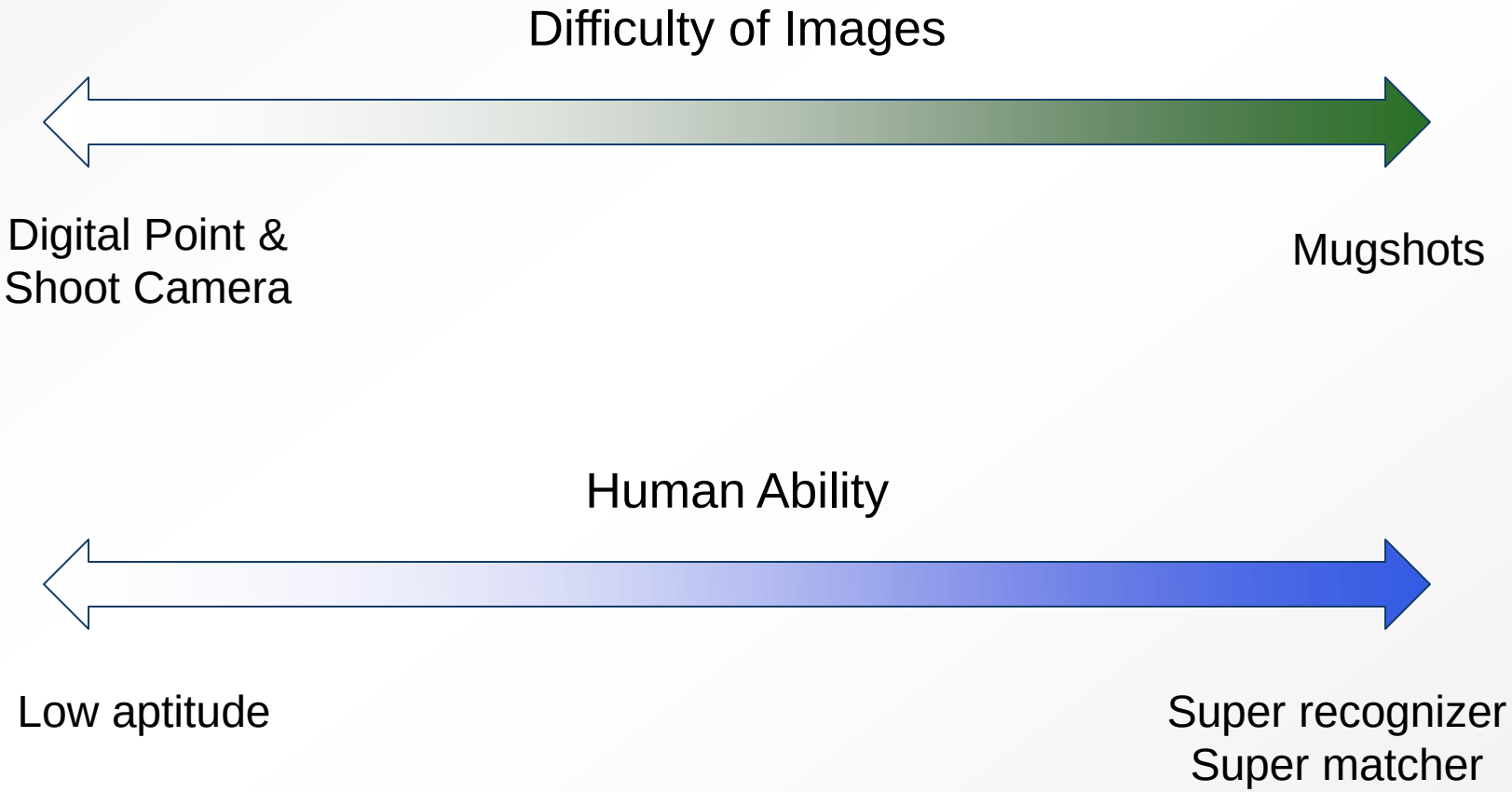
Jenkins et al. (2011)

Key Papers

- P. J. Phillips and A. J. O'Toole, "Comparison of Human and Computer Performance Across Face Recognition Experiments," *Image and Vision Computing,* 32, 74-85, 2014

- A. Rice, P. J. Phillips, V. Natu, X. An, and A. J. O'Toole, "Unaware Person Recognition from the Body when Face Identification Fails," *Psychological Science*, 24 (11), 2235-2243, 2013

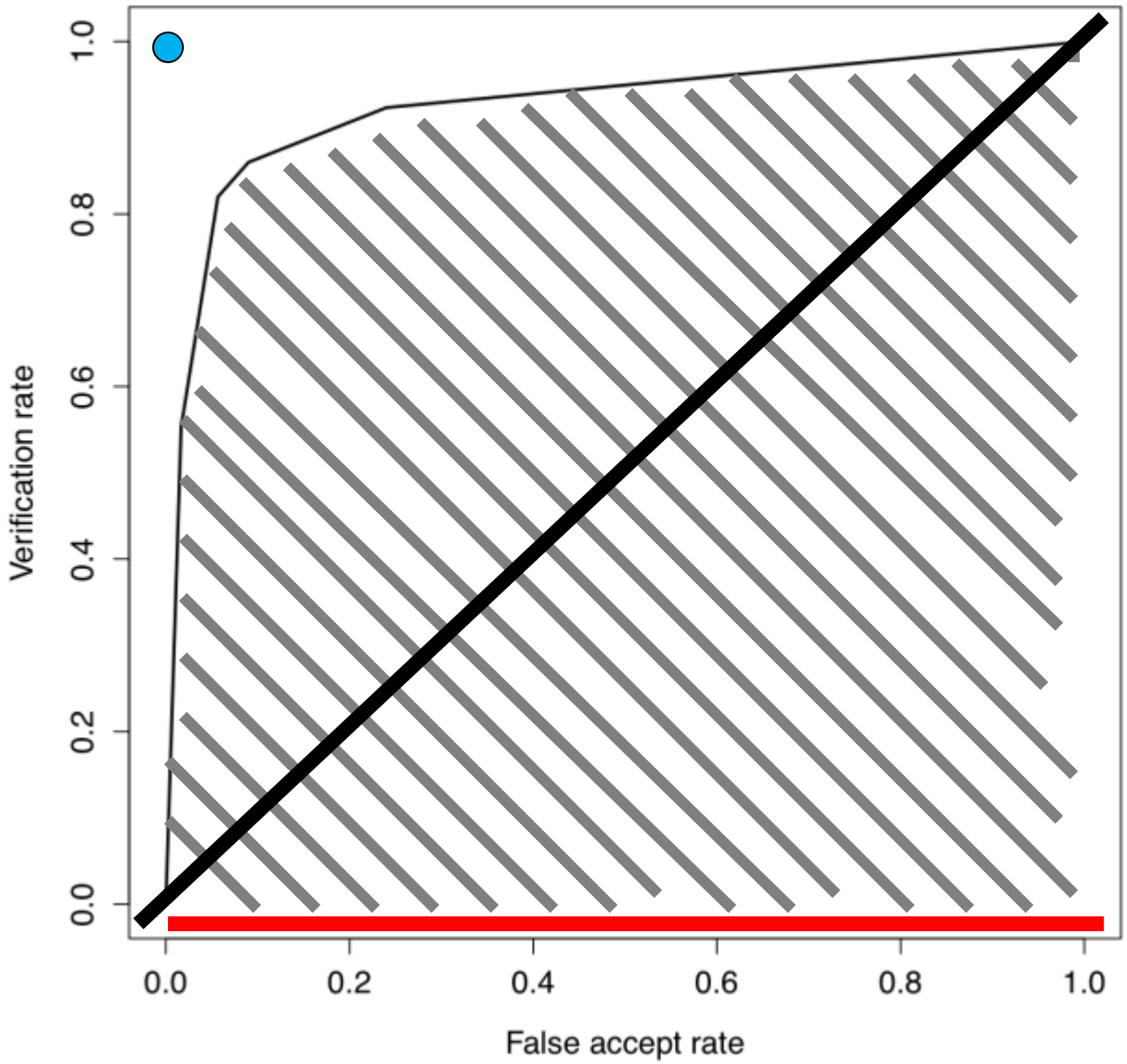
Two Dimensions of Recognition



Measuring Human Performance

- Human subject raters respond…
  - 1. sure they are the same person
  - 2. think they are the same person
  - 3. not sure
  - 4. think they are not the same person
  - 5. sure they are not the same person

Area Under Curve (AUC)



The Good, Bad, & Ugly Face Challenge

- Three performance levels
  - Good
  - Bad
  - Ugly
- Nikon D70-6 Mpixels (SLR)
- Indoor & outdoor images
- Frontal face images
- Taken within one year

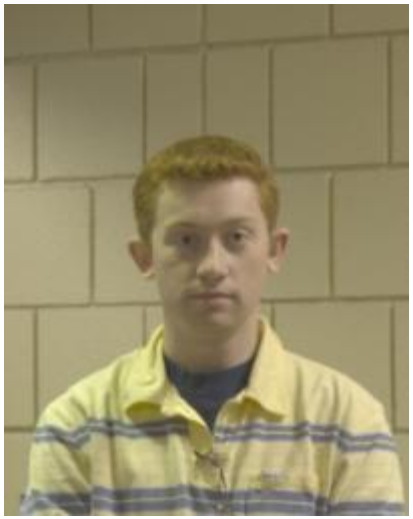
Face Pairs

Good

Challenging

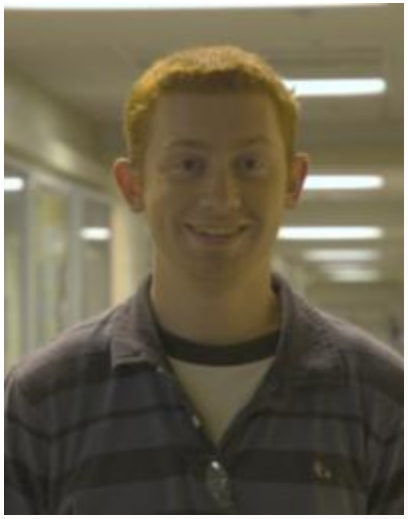
Very Challenging

Face Pairs



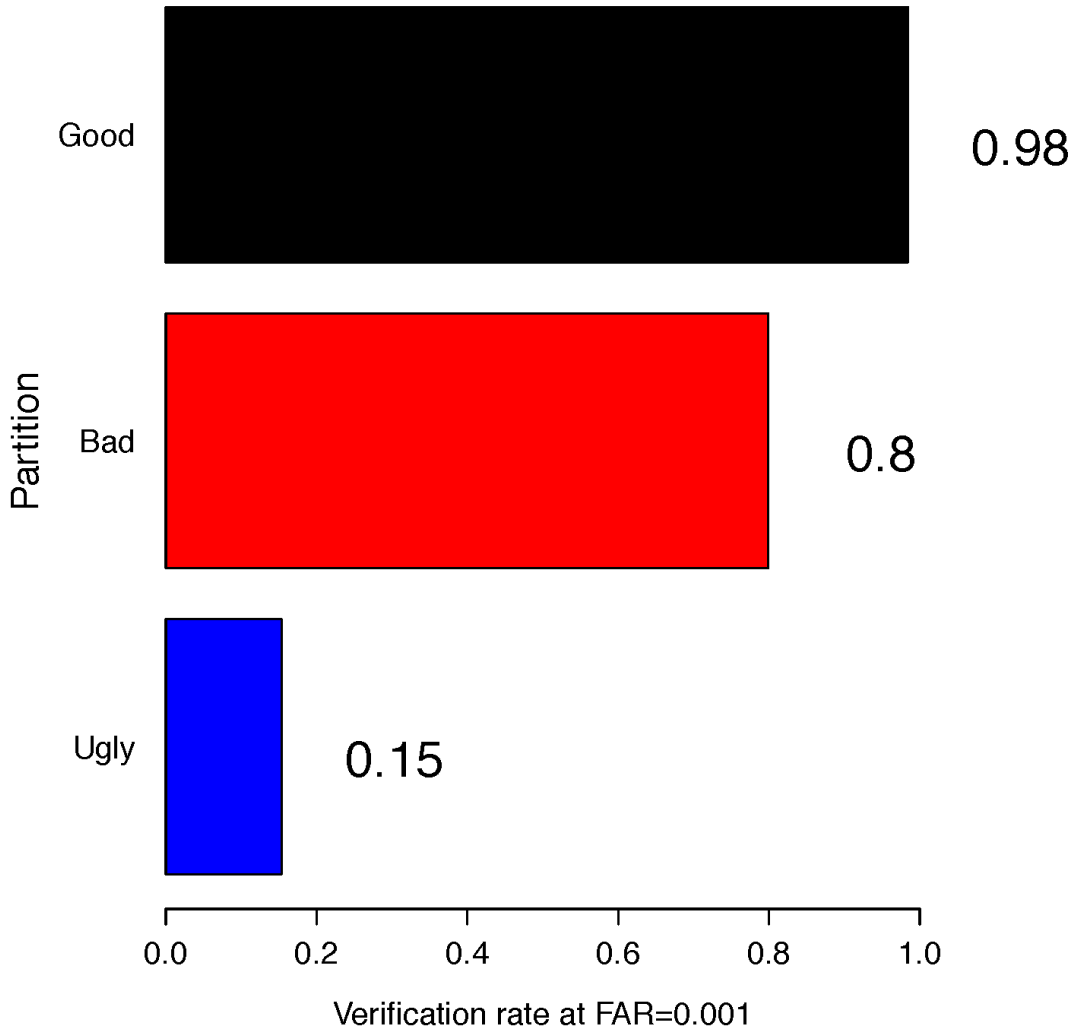
Good

Challenging

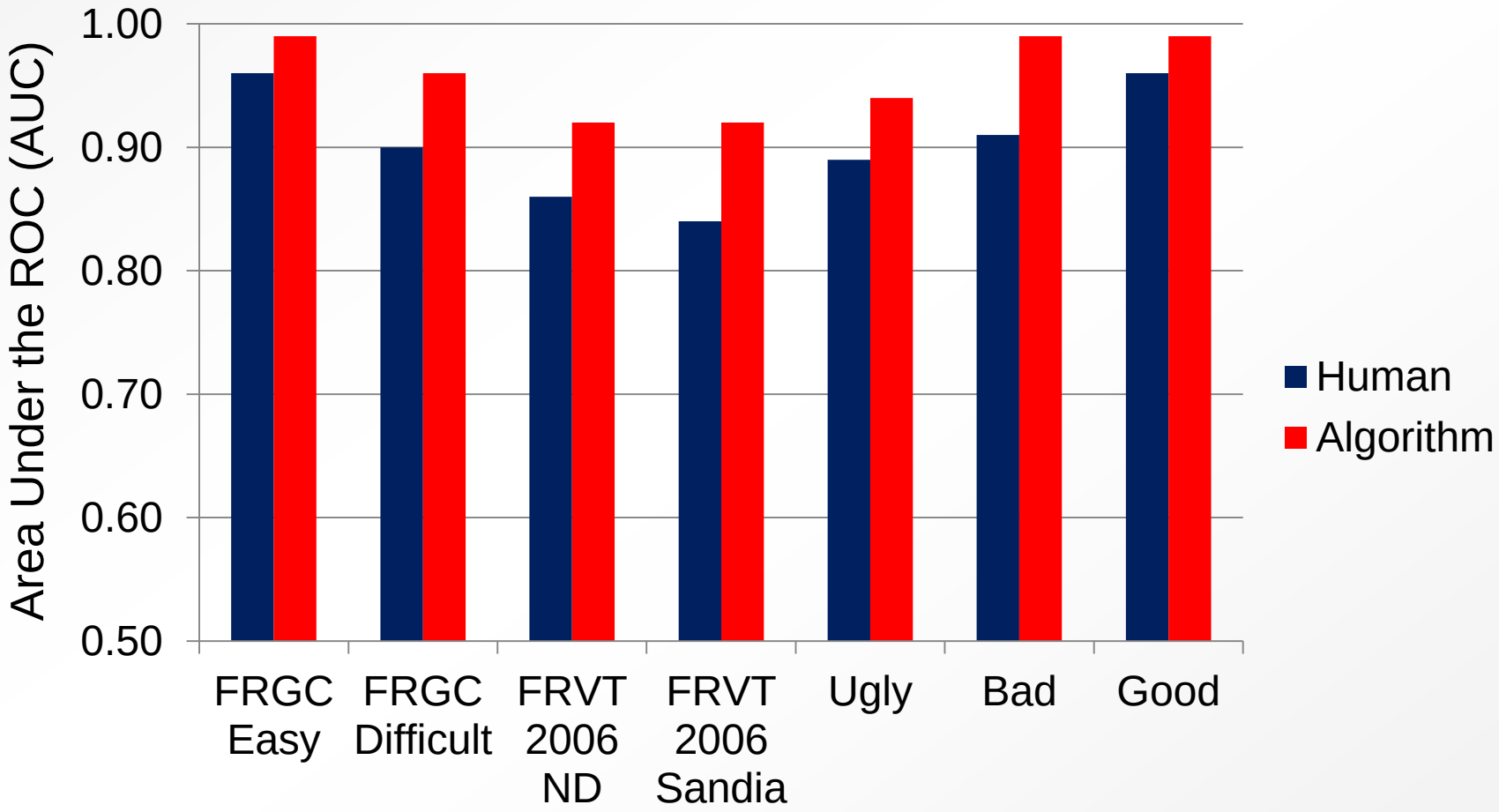


Very Challenging

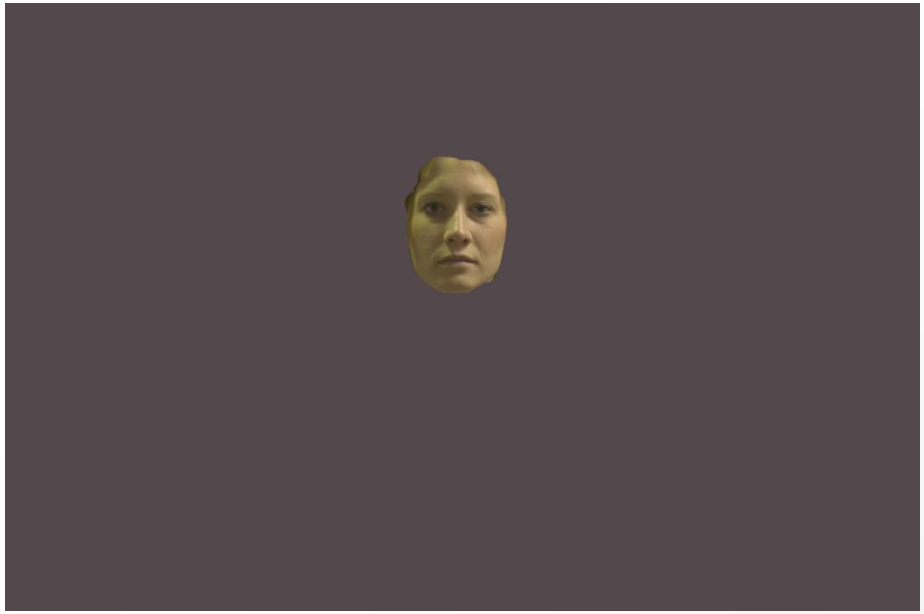
Good, Bad, Ugly Performance



Frontal Still Face Performance



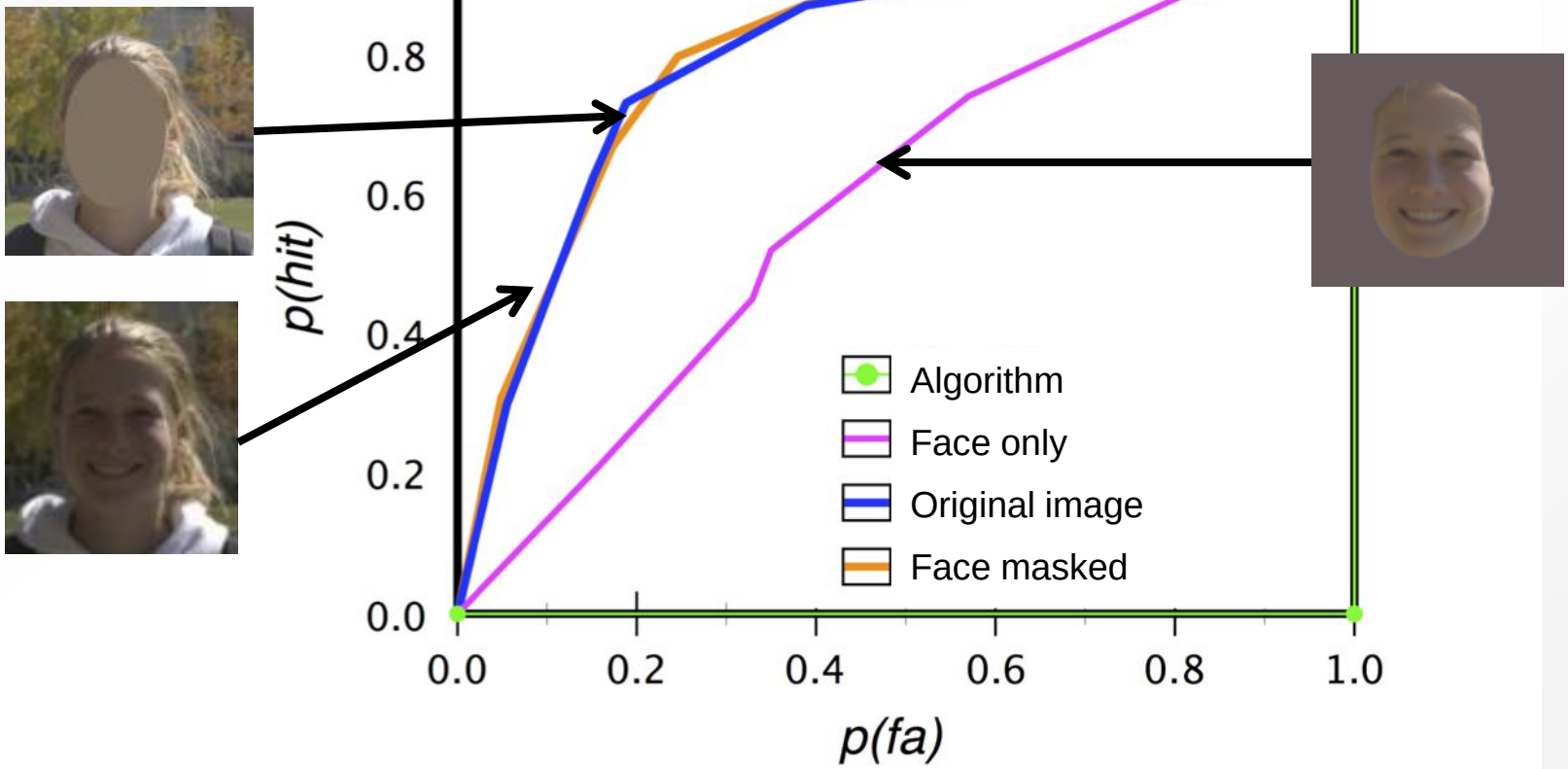
Is this same person?



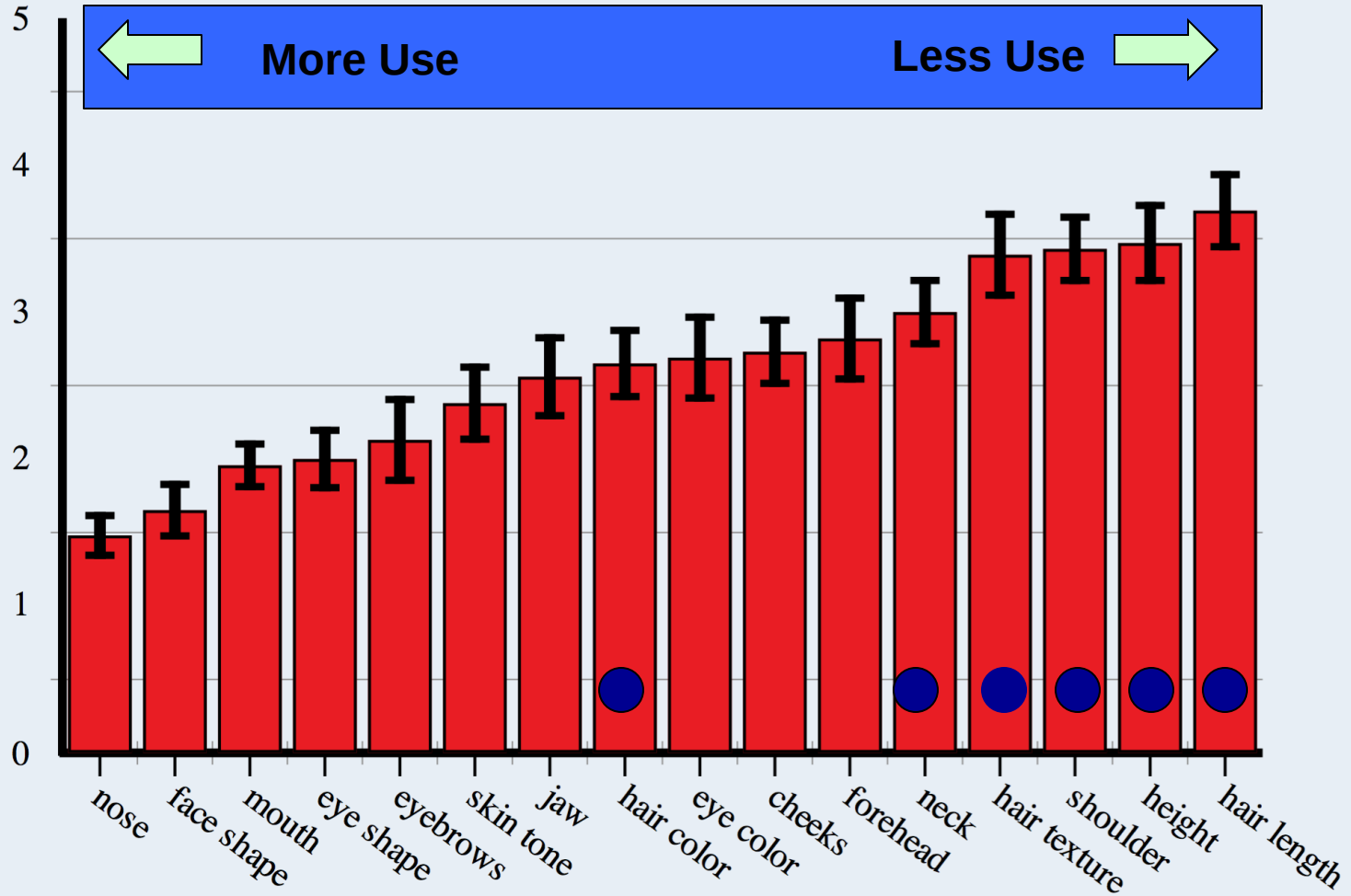
Is this same person?

Is this same person?

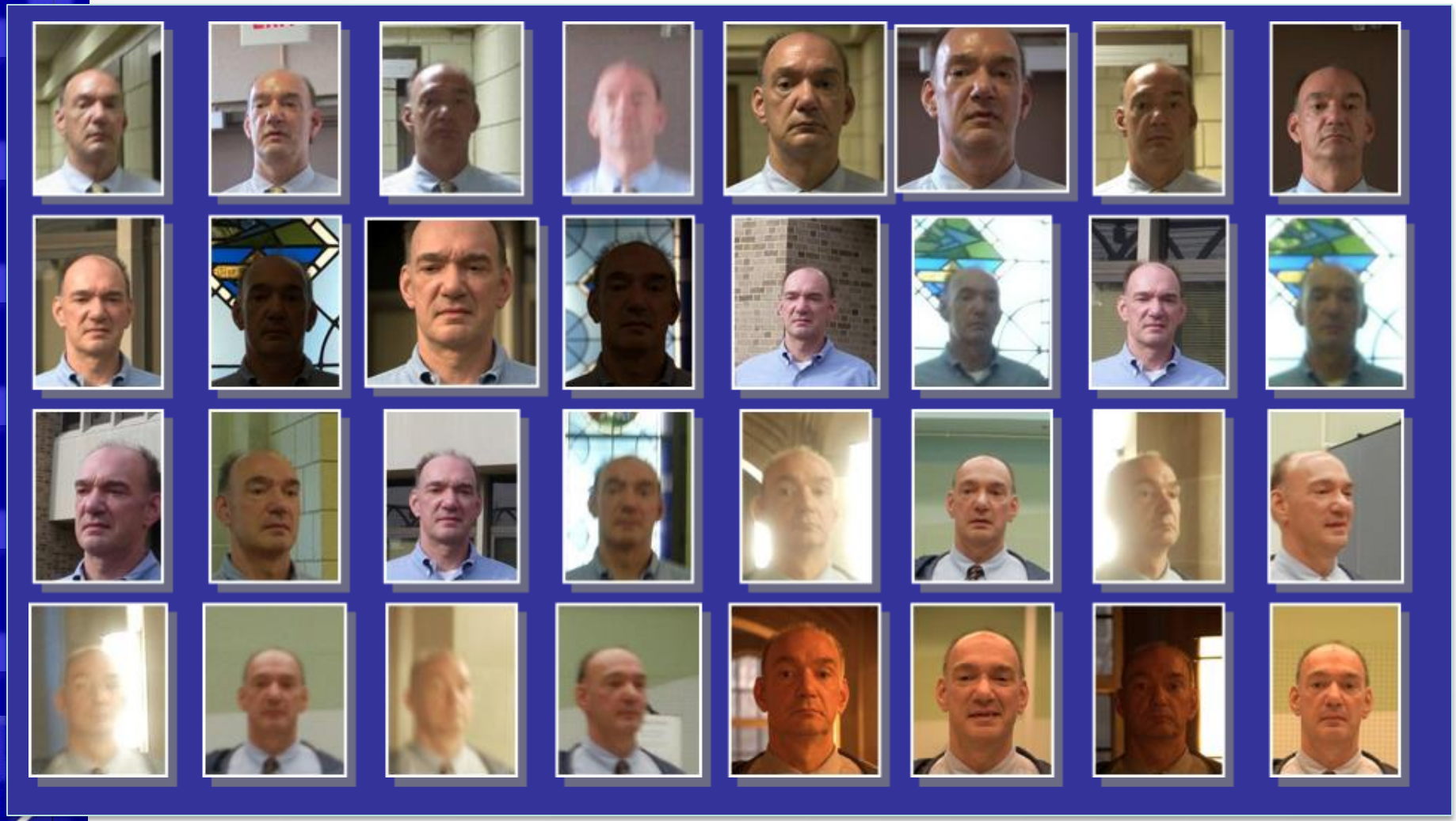
Human Performance on Hard Face-Pairs



Rated Use of Internal and External Features

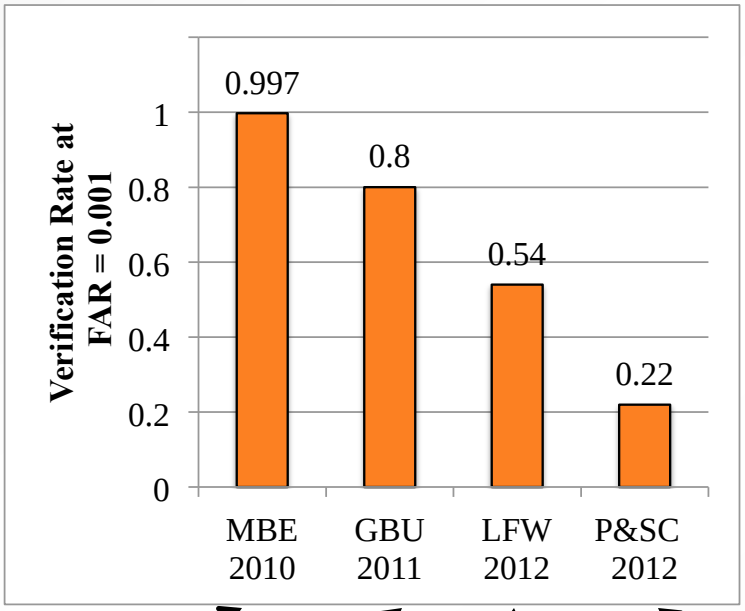


Example of Point & Shoot Face Images



Courtesy PittPatt

Range of Performance



Mugshots

Digital SLR

Web Photos

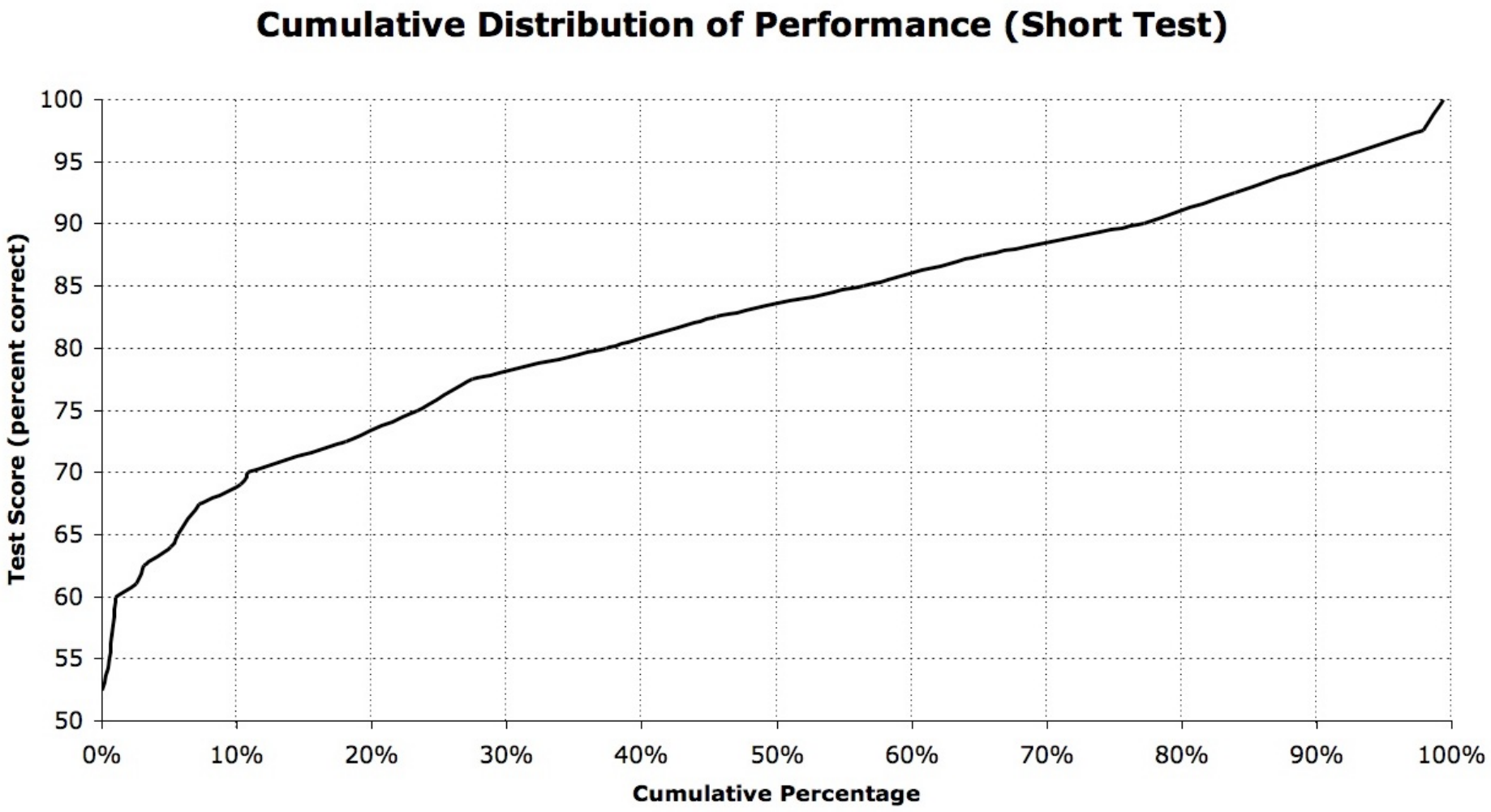
Digital Point & Shoot Cameras

Glasgow Face Matching Test

Same or different?

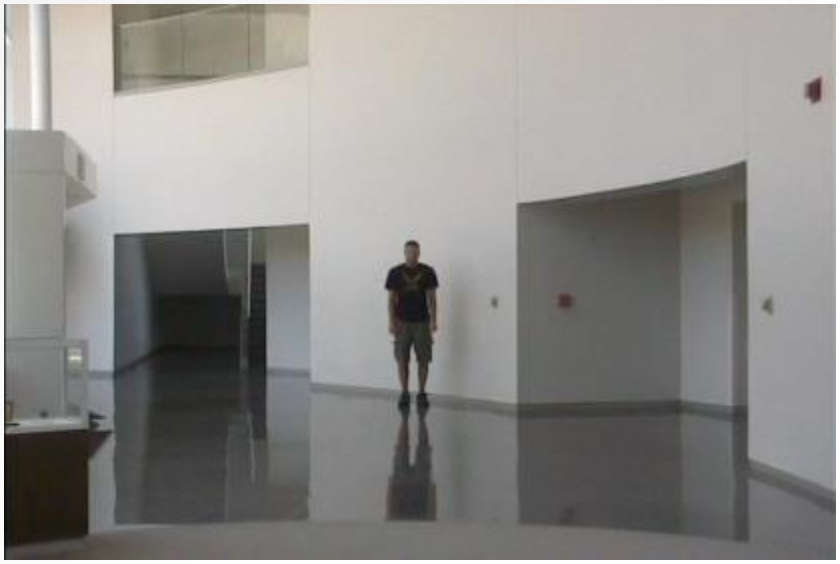
Burton, White & McNeill (2010). *Behavior Research Methods,* 42, 286-291.

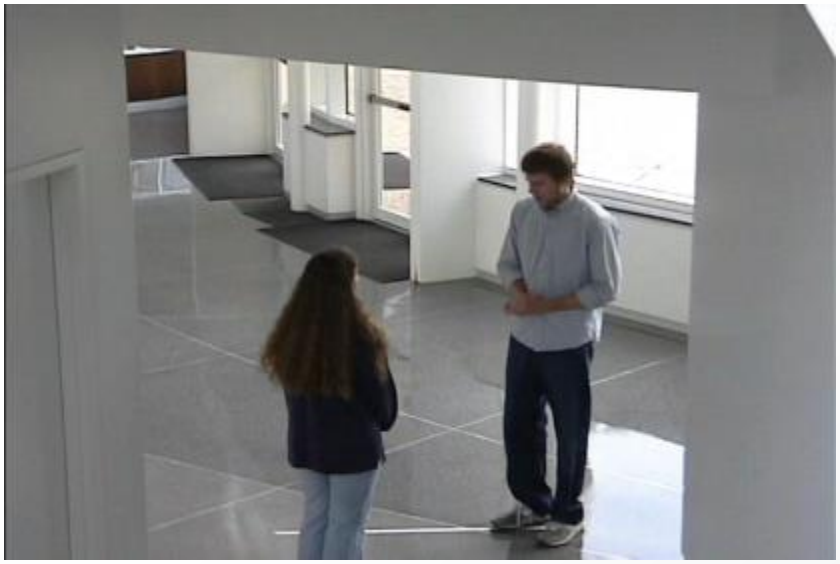
Glasgow Face Matching Test



Burton, White & McNeill (2010). *Behavior Research Methods,* 42, 286-291.

Video: Walking vs. Conversation



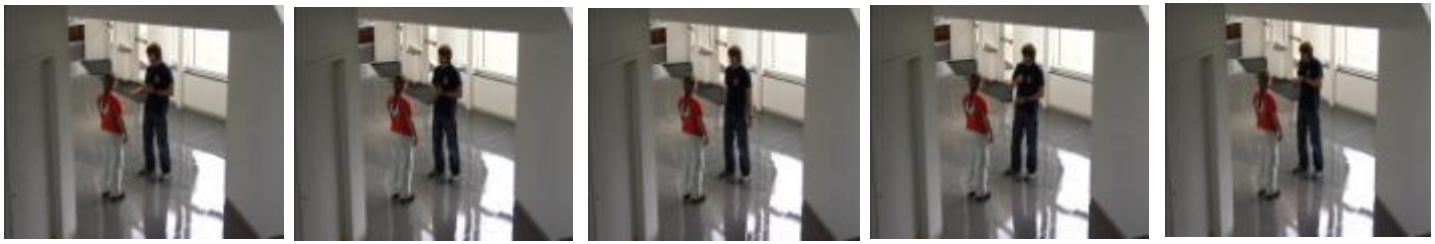


- Human subject raters respond…
  - 1. sure they are the same person
  - 2. think they are the same person
  - 3. not sure
  - 4. think they are not the same person
  - 5. sure they are not the same person

Gait Experiments

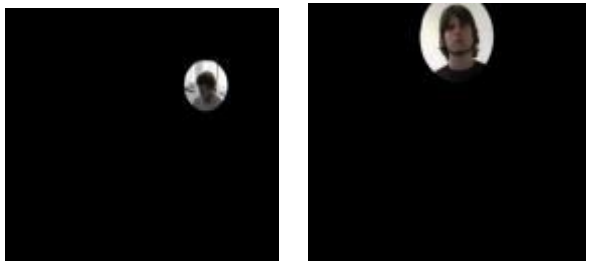
gait video

conversation video



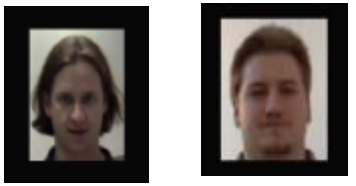
body only

face only

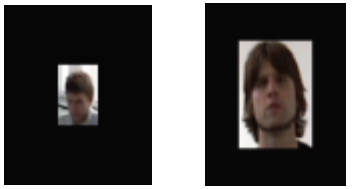


Static Face

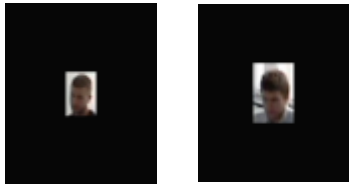
GG



CG



CC



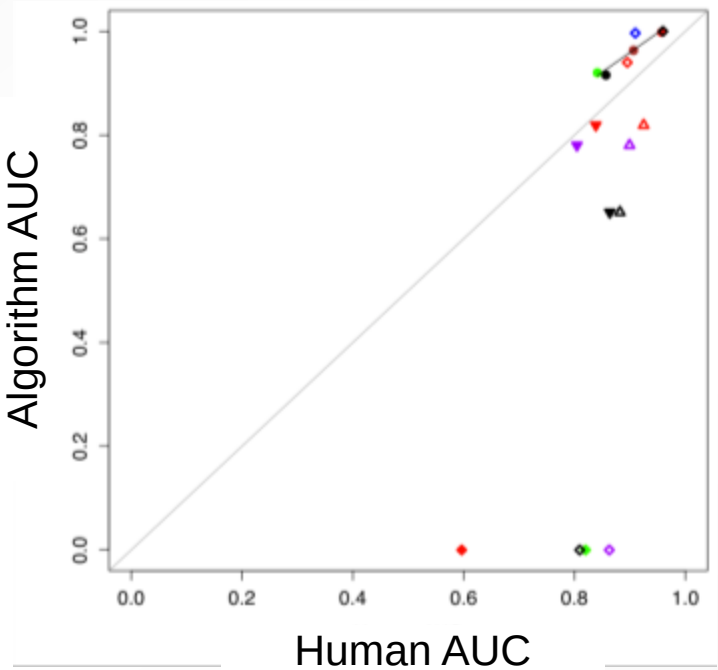
Human and Machine Performance

- For frontal, machine and human performance related
- Algorithms Better (Untrained Humans)
  - Mugshots & Mobile Studio environments
  - Digital Single Lens Reflex
    - Mobile Studio and Ambient Lighting
- Humans Better
  - Non-face identity cues
  - Cross-pose (video—one experiment)
- Not Measured
  - Point and Shot Cameras
  - Change in Pose (in general)

Questions?

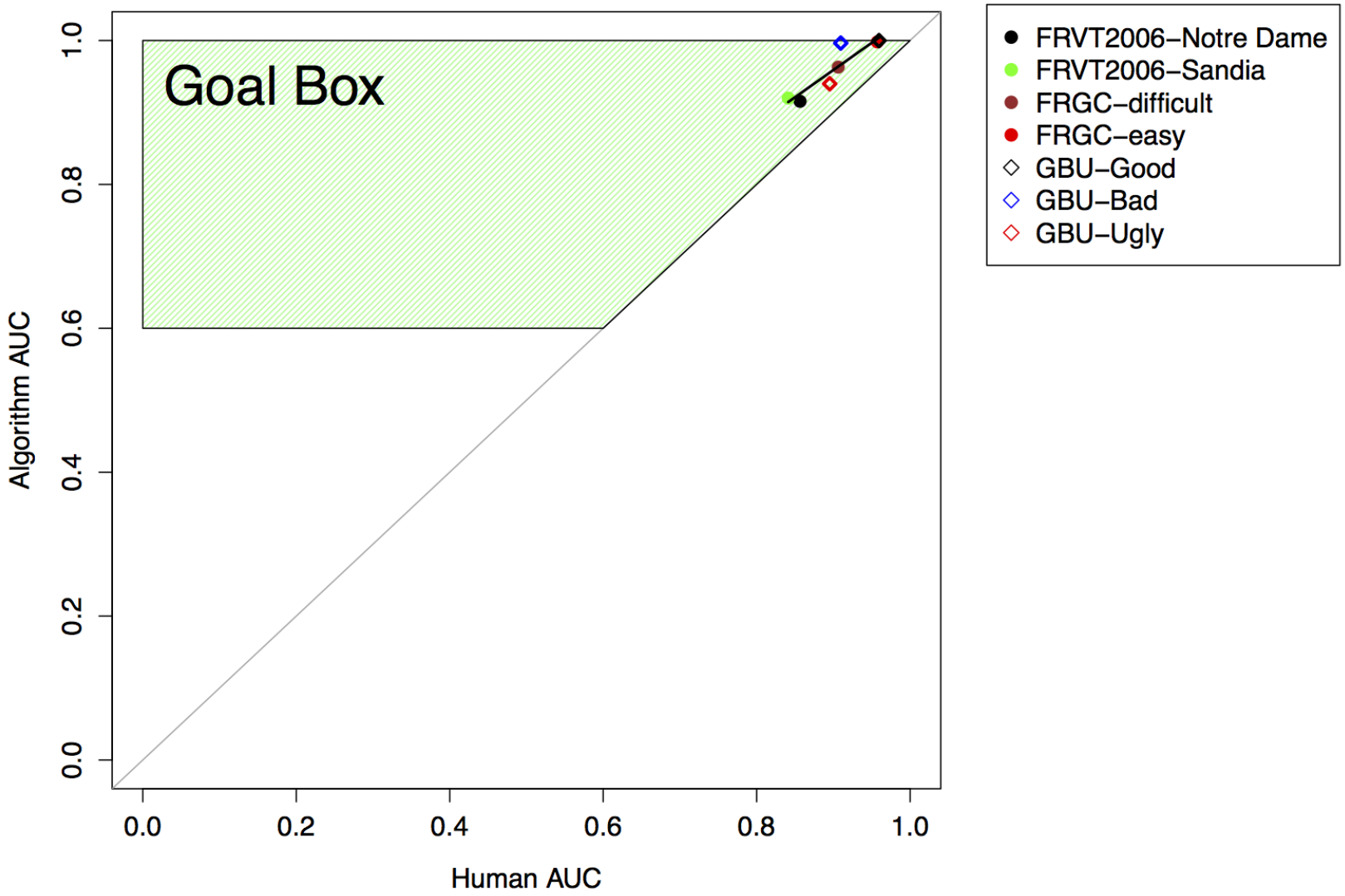
Hurdle: Measuring Success

- Develop structure for comparing human and machine performance

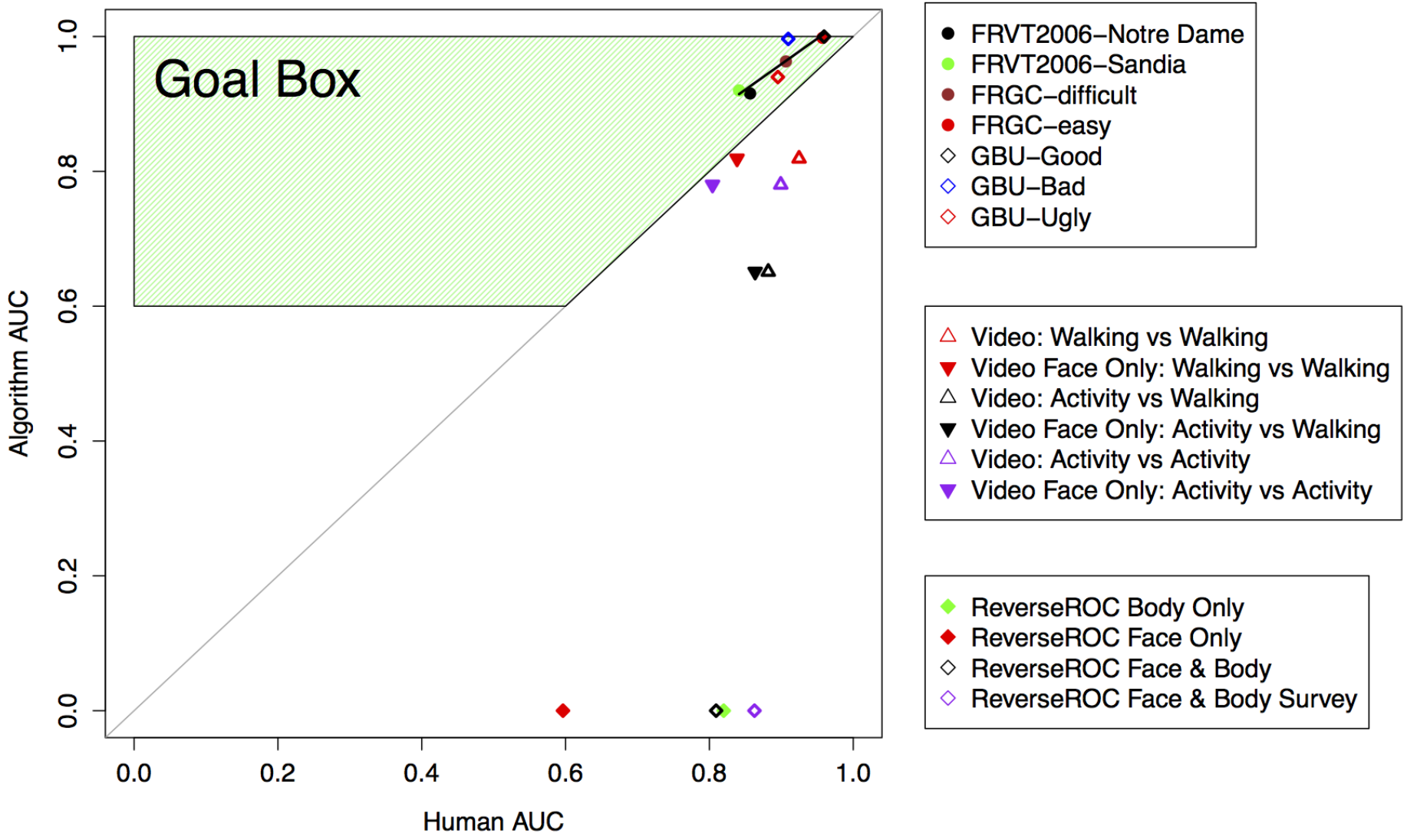


- Adapting recent methods from Neuroscience.

Hurdle: Measuring Success



Hurdle: Measuring Success



The Challenge

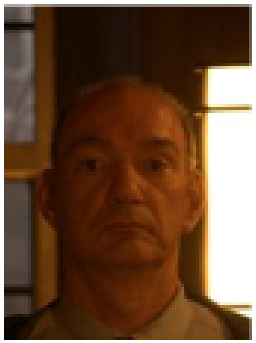
- Problem: Robust Recognition of Unfamiliar Faces
- Goal: Human Level Performance
  - Untrained Humans
  - Trained Professionals
  - Forensic Examiners
- Compare Machine & Human on a Face Performance Index
- Objective: Move Machine Performance into the Goal Box

Robust Face Recognition

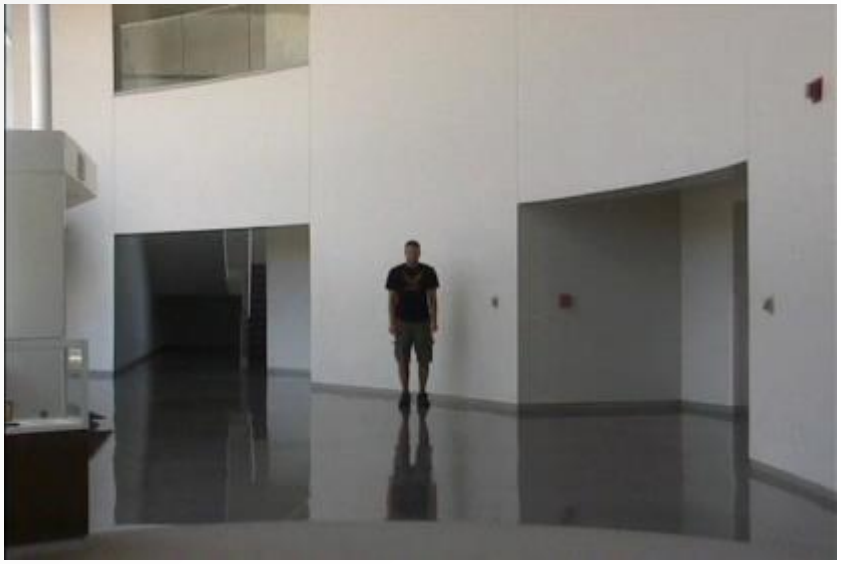


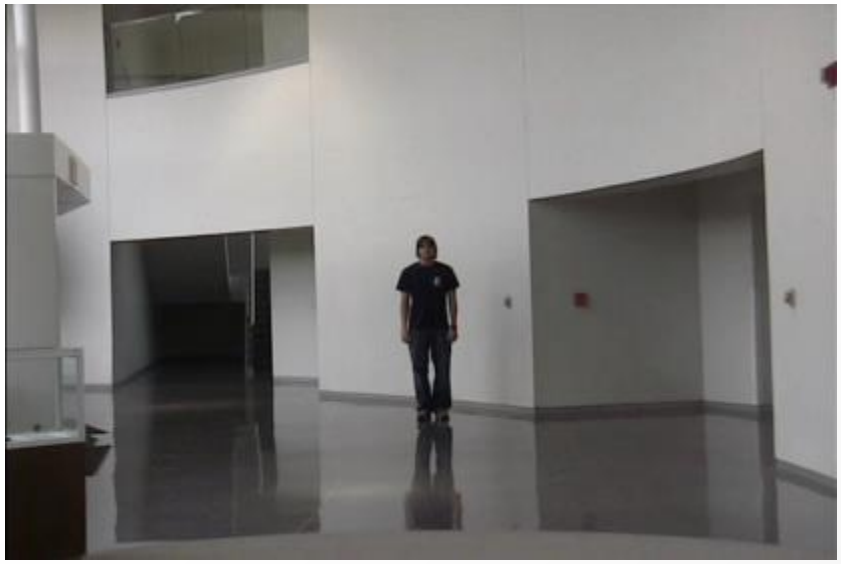






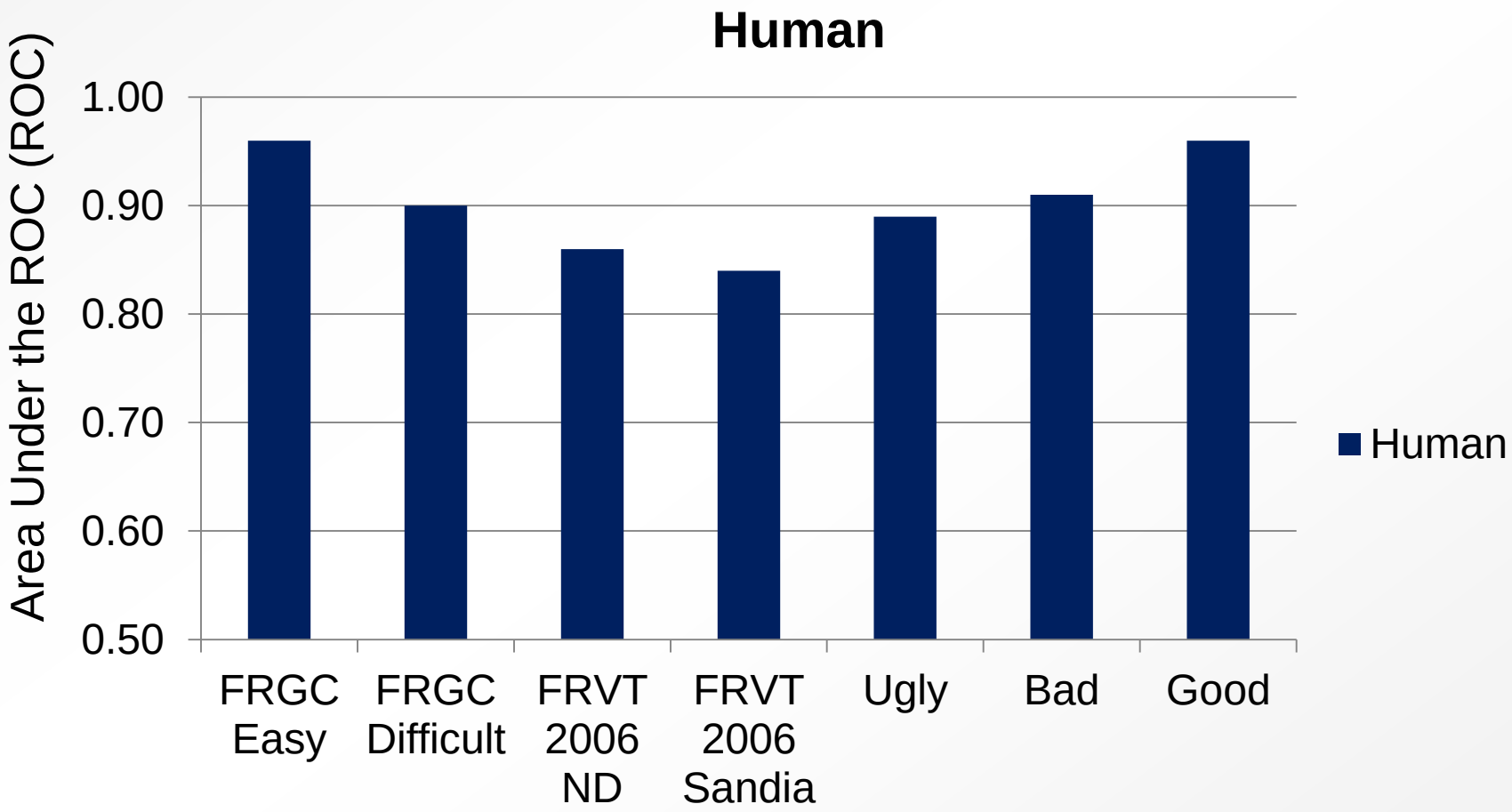

Video: Walking vs. Walking





- Human subject raters respond…
  - 1. sure they are the same person
  - 2. think they are the same person
  - 3. not sure
  - 4. think they are not the same person
  - 5. sure they are not the same person

Frontal Still Face Performance



Human and Machine Performance

- Mugshots & Mobile Studio environments
  - FRVT 2002/2006
  - MBE 2010
- Mobile Studio vs Ambient Lighting
  - FRGC
  - FRVT 2006
- Ambient Lighting (indoor/outdoor)
  - Good, Bad, & Ugly
- Hard Still Cases (reverse ROC)
- Video

Next Directions

- In hard cases (poor viewing conditions), humans take advantage of face, body, still, & video
- Evidence: algorithms do NOT take advantage of face, body, still, & video
- Learn from the human visual system.
  - Functional
  - Perceptual
- Incorporate into algorithm design.