Passive Face Recognition For Immigration Exit

Satisfying System-Level Constraints

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Biometric Exit : Constraints on Solutions

Technical

- Accuracy (FRR, FTE)
- Capture, transaction time
- Network transmission time
- Backend processing time

Organizational

- Impact on carrier IT
- Impact on carrier staff
- Impact on boarding
- Impact on travelers
  - In-scope
  - Out-of-scope

DHS + Policy

- Entry requirements
- Collection and recognition on US Citizens + ex-scope travelers
- Capital cost
- Transactional cost
- Specifying requirements is difficult
- Procurement risk

Influential variables

- Modality selection
- Number of fingers, eyes, images
- Sensor, matcher selection
- Human factors design
- Real time response + recapture

Influential variables

- Boarding pass modification
- Interfaces, common use
- Boarding process
- Physical space

Influential variables

- 1:1 with token, or 1:N without
- Modality already available from visa or Entry record?

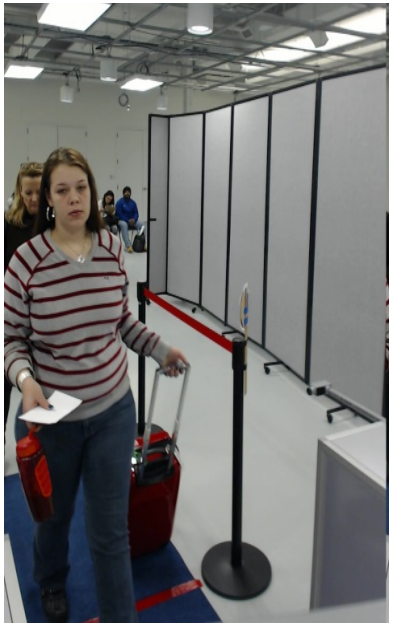
Passive Face Collection + Matching

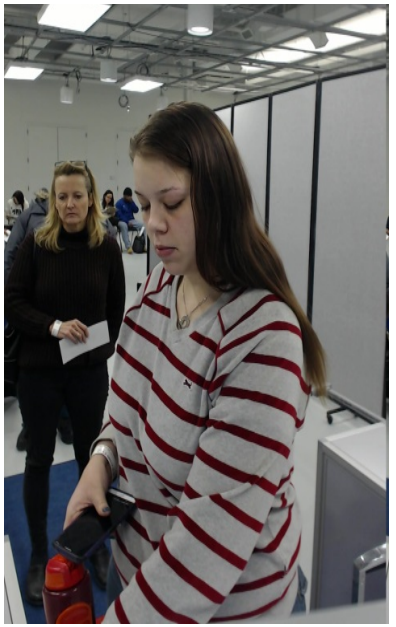
Case Study 1 of 2: Self-boarding Gate

Passive face collection requires no traveler interaction with airline systems:

- No delays over existing process
- No (explicit) connection between airline + DHS systems
- Traveler paused to look at instructional monitor
- Passive face collection using webcam

Self-Boarding Gate: Face capture is passive, without cooperation or awareness of traveler





Conclusions: No-Delay Face at Self-Boarding Gate

Performance results

- High level of accuracy achievable, highly dependent on placement of camera and attractor
- Low transaction times, minimal if any impact to current boarding times
- Video frames verified against prior visa or Entry image

Caveats + comparison to other CONOPs

- Video data is larger than fingerprints, iris
  - Payload = 5.4MB (mean per person)
  - Finger = 10KB, Slap = 120KB
  - Iris = 30KB
- Face recognition algorithm selection is critical
  - Degradation from 1st to 2nd best
- Dependent on high quality enrollment sample from Entry, visa or passport image

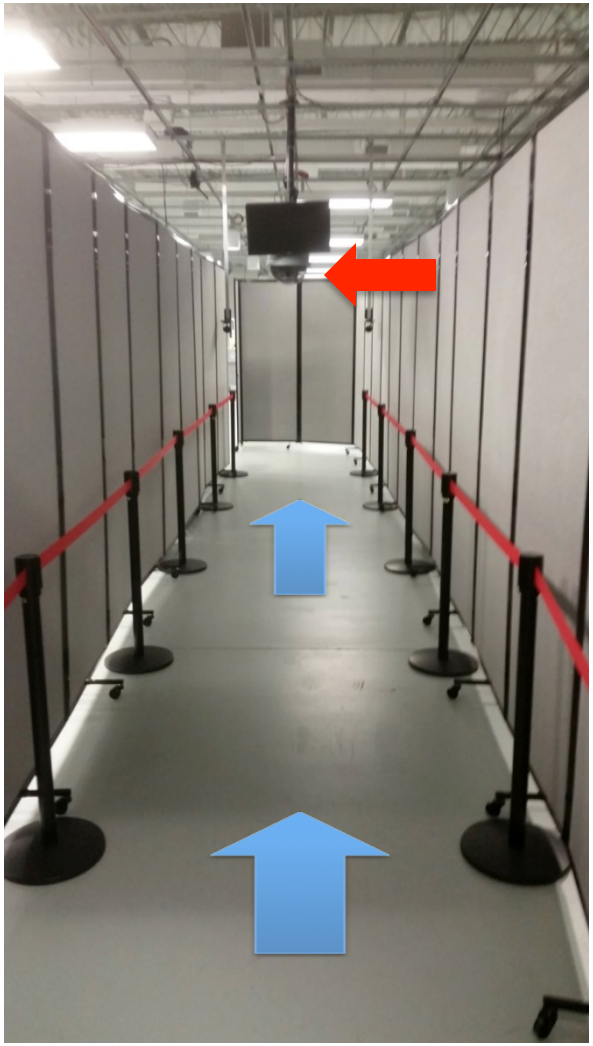
Passive Face Collection + Matching

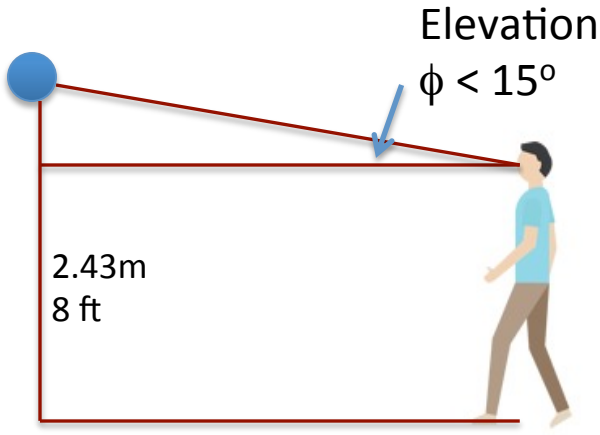
Case Study 2 of 2: Passenger Loading Bridge

Passive face collection requires no explicit traveler interaction with airline systems:

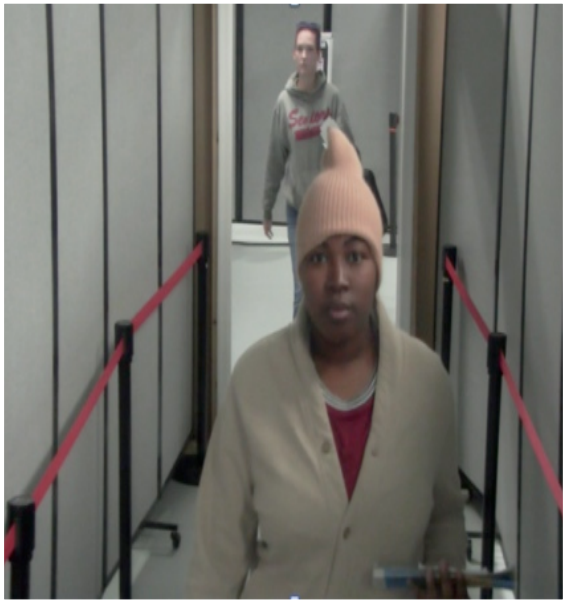
- No delays over existing process
- No connection between airline and DHS systems
- Interaction with DHS face cameras is non-cooperative

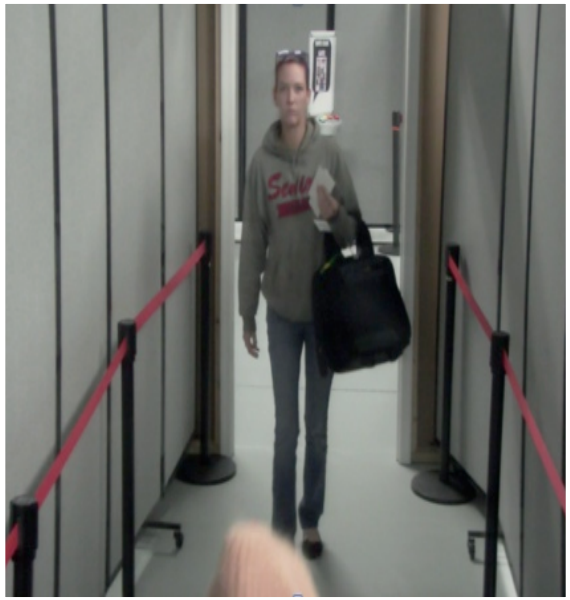
Passenger Loading Bridge: Surveillance mode capture





Passenger loading bridge: Example frames from video





Video vs. Frontal Stills

Population ~ 40
Duration ~ 15 mins, single clip
Pitch ~ 15° at 2 meters. Peak IOD ~ 70 pix.

Passenger loading bridge: Accuracy and computation speed

Performance results

- Exit confirmation impeded by:
  - Lack of visual attractor
  - Webcam enrollment images
  - Duration in view
  - Hats, cellphones
  - Weak matching algorithms
- Significant CPU processing time per person, amplified if PLB line is stalled
- Video stream size is 4GB for time it takes to board 350 person aircraft.

Caveats + comparison to other CONOPs

- Accuracy below
  - The 97% congressional requirement
  - That from single finger, iris, or passive face at self-boarding gate
- Biometric recognition processing duration is x100 slower
  - Template generation slow
  - 1:N comparison time is negligible
- Video payloads are larger than other biometrics. Per person:
  - 1500 times larger than single finger
  - 100 times larger than slap fingers

The AEER Team: Funding from DHS S&T

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MdTF

Thank You

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