BIOMETRICS TECHNOLOGY & STANDARDS: COMMENTS ON BIOMETRIC FUSION AND IRIS BIOMETRICS

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Outline

- Context
- Biometric fusion
  - Motivation
  - Definitions
  - Levels and strategies
- Advances in iris biometrics
- Summary

Context

- Beware: this is an academic's view
- Some real success stories for biometrics
  - deployments
  - broadening familiarity
  - healthy discussions of privacy, etc.
  - strong series of technology evaluations

Context (ctd.)

- Some challenges
  - No national-scale deployments or conversions (plans yes, deployments no; controversies, etc.)
  - Thus, many "local" decisions about technologies and systems
  - Unclear what (other than capture) is going on in some deployments
  - A LOT of ongoing debate about "who's best", "who's fastest", etc.
  - R&D resourcing landscape is… complex

Motivating biometric fusion

- FTA/FTE circumstances
  - Iris: aniridia, strabismus, nystagmus, albinism
  - Finger: acid burns, mechanical wear (masonry)
  - Face: missing features, detection errors, cultural constraints
  - Other technology problems (lighting, power, heat, dust, lack of maintenance, etc.)

Motivating biometric fusion (ctd.)

- Biometric traits are assumed to be "stable" – what if they're not?
  - Face: hair growth or loss, scars/tattoos, weight gain or loss, expression variation
  - Iris: nevi, pigmentation change, ocular surgery, loss of organ, disease
  - Finger: tip distortion at time of impression

A. Jain

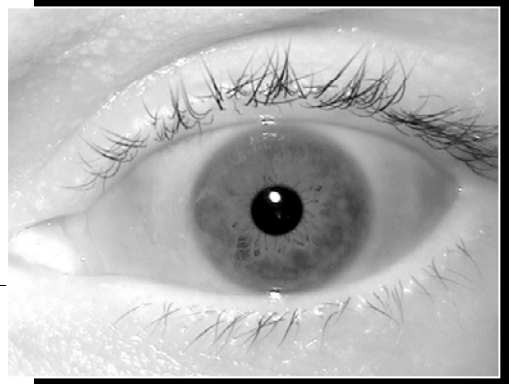
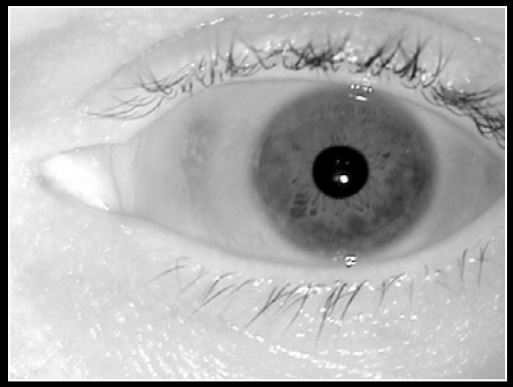
Definitions

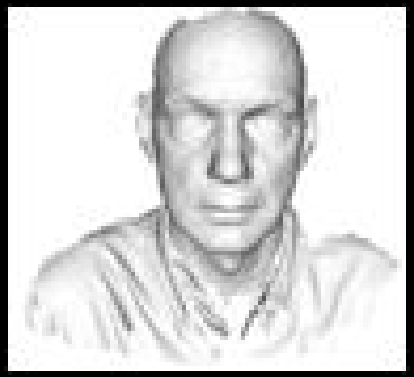
- Multibiometrics: many definitions
  - The **use** of multiple **samples** to improve biometric system **performance**
- Assumption: multiple samples can "cover" for one another

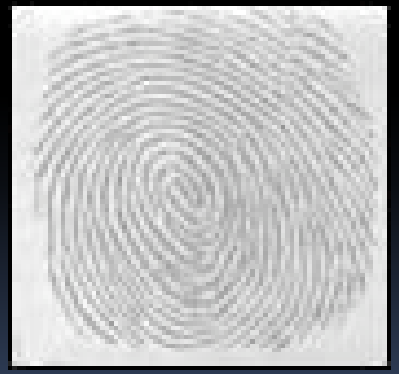
Definitions (ctd.)

- Samples
  - Mode (visible, IR, 3D, still/video)
  - Site (face, finger, ear, palm)
  - Count (1 still → *n* stills → video?)
- Performance
  - Speed (matches per second)
  - (preprocessing time)
  - Accuracy (FAR/FRR, EER, R1R)

Samples, sites, and modes



Multibiometric fusion

- Use: you have all of these samples… And you want one decision
- Assumption: for each sample, there is a matching "box" that computes a match score from the probe sample and a gallery sample
- Fusion levels
  - Signal, feature, score, rank, decision

Fusion: typical approaches

- Signal level: sample concatenation, e.g. pairs of face images processed as a single entity
- Feature level: construct hybrid signature from features of multiple samples
- Score level (most popular)
  - Compute a function of all scores
  - Max, min, sum, etc.
- Rank level: synthesize composite rank
  - E.g.: Borda count

Fusion: considerations

- All matchers are not created equal
  - Characterization of performance (in typical conditions) highly useful
  - Approach broad performance claims with skepticism
- Consider cost/benefit tradeoffs prior to investment in multibiometrics
  - 2 samples of one mode/site may perform as well as one sample from each of two modes or sites… and will likely be much cheaper
  - But the future will be multibiometric (for coverage)

Advances in iris biometrics

- Iris: a high-performing biometric trait…
  - With cooperative subjects
  - Imaged by good optics
  - Illuminated by "good lights"
- Rennaissance in iris recognition research since 2004
  - Relaxation of constraints
  - Large open databases and challenge problems
  - New technologies

Iris: Considerations

- Sample quality (improved definitions)
  - Motion blur, focus, occlusion
  - Illumination, interlace
  - pupil size, inherent contrast
- Template age (controversy)
- Video processing (not just stills)
- Liveness detection and anti-spoofing
- Spectrum (visible light instead of NIR)
- Standoff

Iris: near future

- For procurers/deployers: possibly an increase in size of vendor space?
- For vendors: large-scale tests, constraint relaxation
- For researchers: many areas to explore
  - Headroom for improvement vs. sample sizes needed for statistical rigor

Parting shots

- The future is multibiometric
- Iris recognition (once thought mature) may expand its footprint into less-controlled acquisition contexts
- Impact on standards?
- Uptake speed?