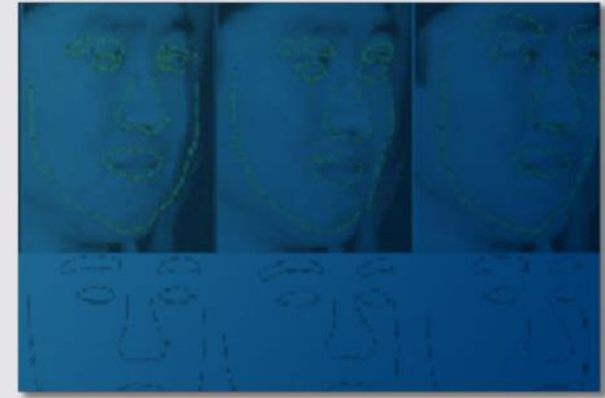
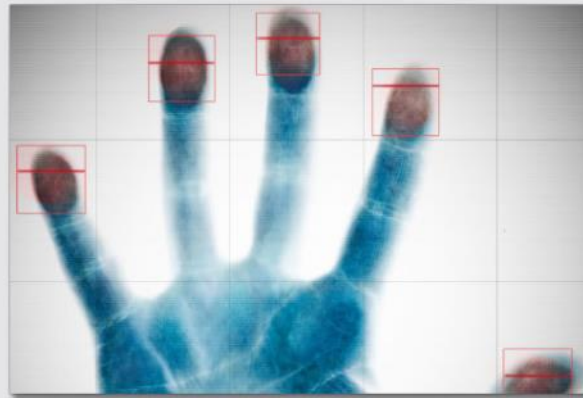


Research Challenges in Biometrics

Matthew Valenti,

Professor and Site Director, West Virginia University
Center for Identification Technology Research

Sept. 15, 2015



Recent Trends That Motivate Academic Research

- Video surveillance
 - Cameras everywhere
- New modalities
 - Gait, vein, ear, ECG
 - Molecular: Rapid DNA, hand bacteria
- Cross modality
 - Matching one modality against another
- Mobile/cloud biometrics
 - Sensors on mobile devices (“BYOD”)
 - Processing in the cloud
- Massive Systems (e.g., UIDAI)
- Privacy concerns and public acceptance



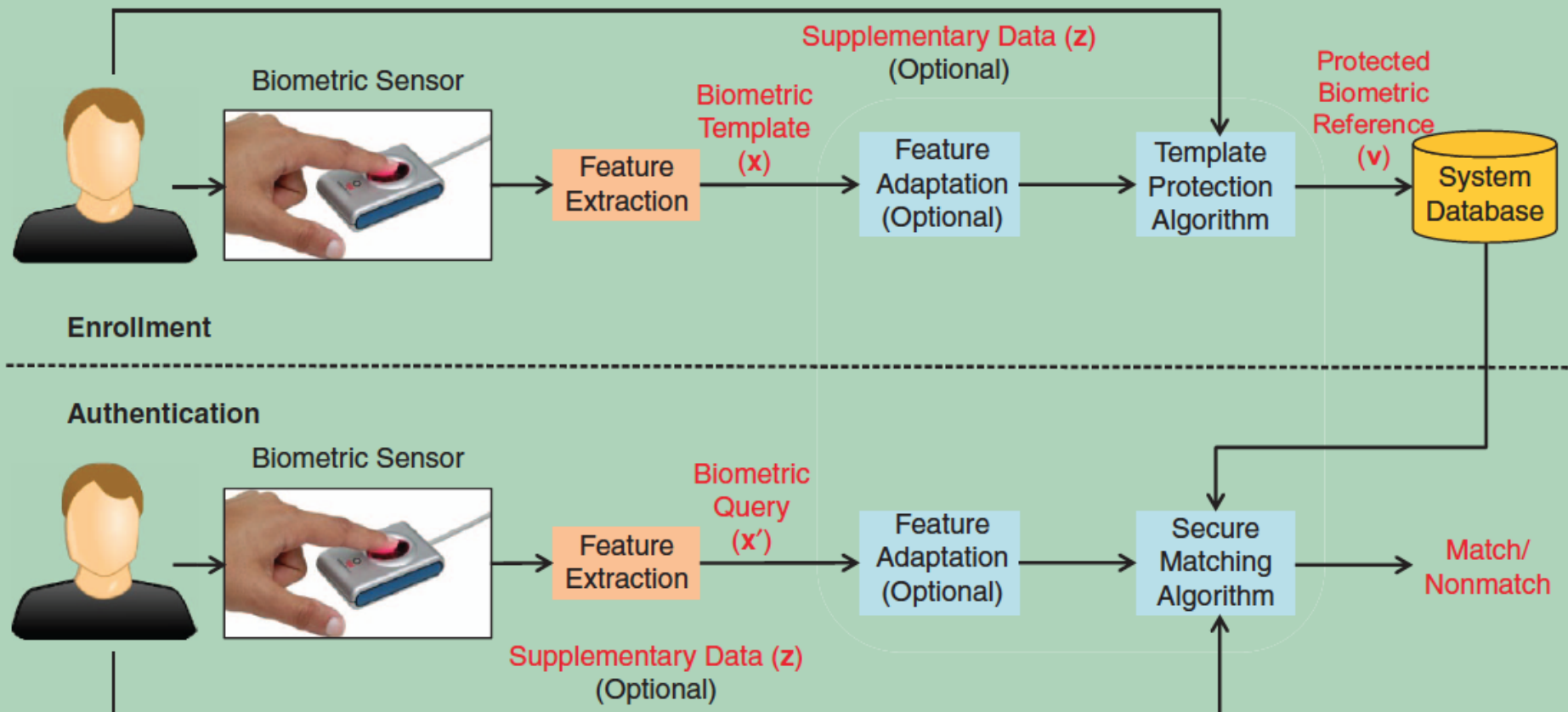
Biometric Template Protection

- Goals:

- Non-invertibility
- Revocability
- Nonlinkability

- Challenges:

- Scalability
- Key management infrastructure
- Metrics for quantifying privacy



Mitigating Presentation Attacks

- Biometrics susceptible to presentation attacks:
 - Spoofting
 - Replay attack
 - Altered biometrics
- Countermeasures:
 - Automatic liveness detection
 - Interactive capture protocol
 - Multifactor; Multi-modal biometrics
- Having common evaluation methodologies is important.
 - Benchmarking competitions are useful



(a)



(b)



Rapid DNA

From Benchtop to Booking

- Primarily for booking stations (buccal swabs as input).
- Low SNR of degraded samples limits forensic use of rapid DNA.
- Small amounts of DNA can be fused with fingerprints.
- Other molecular modalities are possible, including hand bacteria.



3+ hrs



45min – 1hr

<http://integenx.com/products/rapid-dna/>



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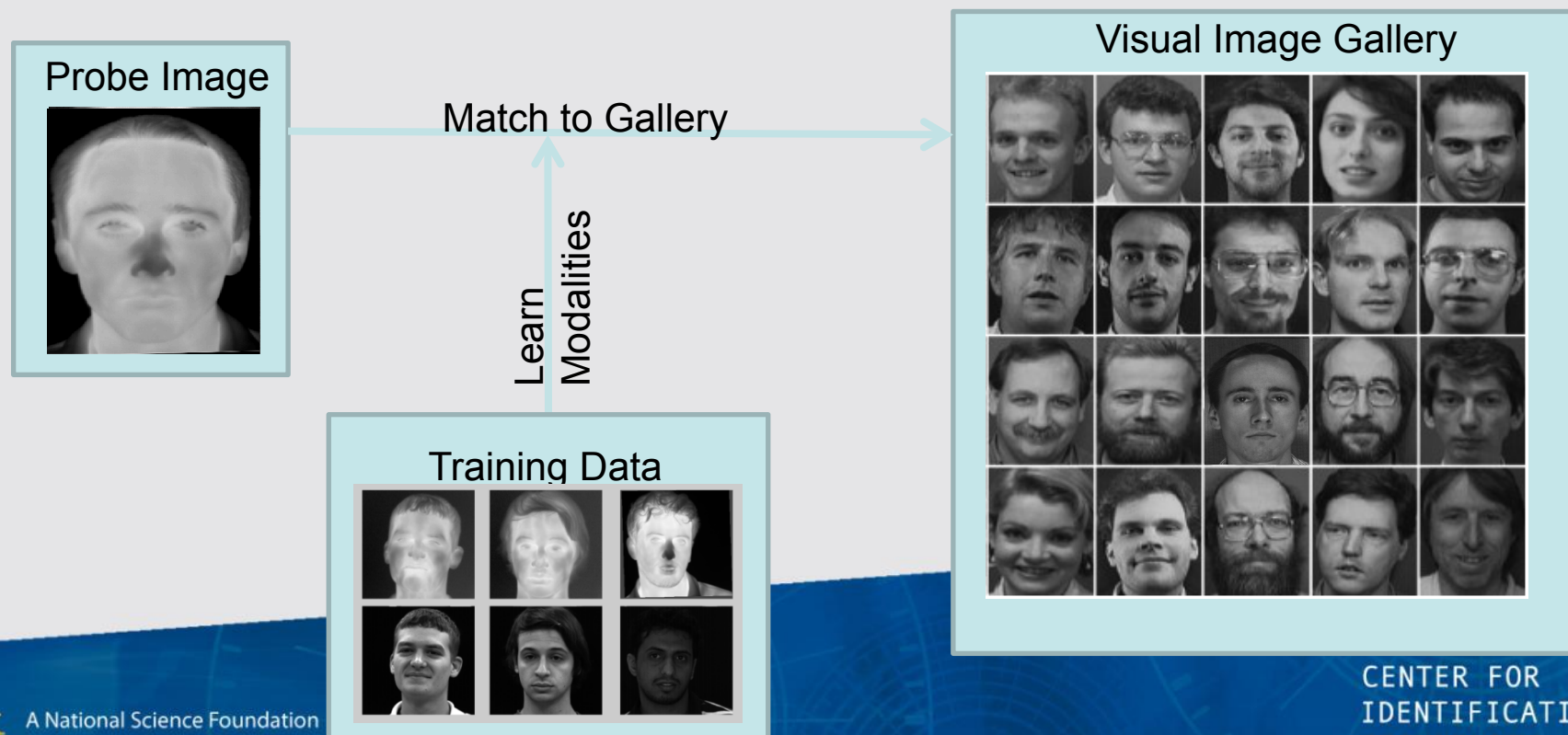
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Cross-Spectral Face Recognition

- Matching thermal probe image against a visible image gallery.
- A training set available of valid thermal-visible pairs.
- Goal is to learn a common latent feature subspace.
- Solution uses Coupled Dictionary Learning and Coupled Deep Neural Networks.



What is CITEr?



- **Multi-university research collaborative**
Sites: WVU, Clarkson, Arizona, and Buffalo.
Other Research Partners: Michigan State and Idiap (Switzerland)
- **Operates as an NSF Industry/University Research Center**
Industry and government partners join on a membership basis.
Research projects selected by members at semi-annual meetings.
NSF covers administrative costs, so no overhead for members.

RESEARCH AND EDUCATIONAL FOCUS

The importance of individual identity in a networked global society

SCOPE

Physiological, Behavioral, and Molecular Biometrics



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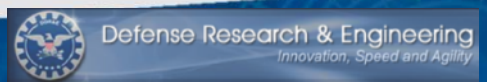
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CITeR Affiliates

- Aware
- Borders
- DoD—Defense Forensics and Biometrics Agency
- DoD—Defense Intelligence Agency
- DoD—Research & Engineering Enterprise
- DHS—Office of Biometric Identity Management (OBIM)
- DHS—Science & Technology
- Federal Bureau of Investigation

- Laurea Institute
- Morphotrak
- National Security Agency)
- NexID Biometrics, LLC
- Northrop Grumman
- Qualcomm
- Raytheon BBN Technologies
- SRC, Inc
- US Army ARDEC



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Research Datasets

Q-FIRE 2

Waiting in line (multiple subjects) & Passing items



Request data @ <http://clarkson.edu/citer/resources>



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Research Portfolio Snapshot



Fingerprint

- Level 3
- Liveness
- Anonymous biometrics
- Biometric cryptosystems
- Quality

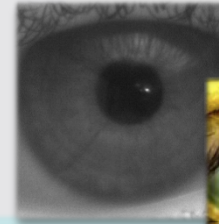


Palmprint

- Level 1,2,3
- Partial

Iris

- Non-ideal, off angle
- Unconstrained
- Iris at a distance
- Multispectral
- Quality

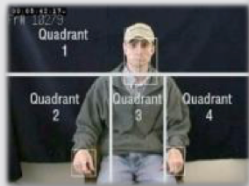


Multimodal - Cloud

- Fusion score/feature level, quality
 - Indexing
- System level design & evaluation
 - Privacy-Security
- Cloud computing, Multi-core
- Statistical performance evaluation

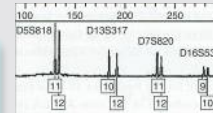
Credibility

- Kinesic
- Audio
- Linguistic



Molecular

- DNA
- VOC
- Bacterial



Multispectral

- Fusion
- Cross



Others

- Voice
- Conjunctival vascular
- Tattoo, body markings
- Soft biometrics
- Age progression
- Cardiorespiratory



Face

- Matching, quality
- Unconstrained
- 3D Face
- Face in a crowd
- Tinted glass
- Cosmetics



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