Security Issues in Biometric Identification

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Outline

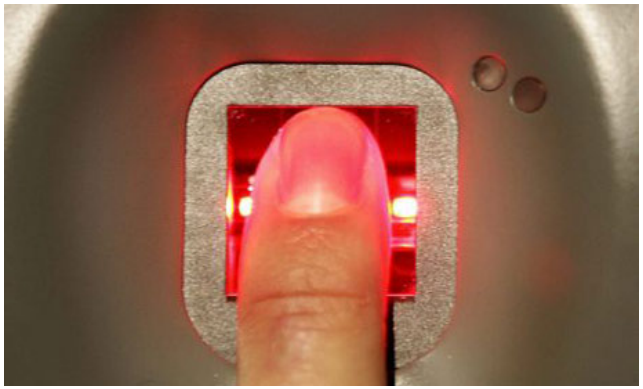
Introduction

- What are Biometrics?
- Benefits and Disadvantages
- Usage

What are biometrics?

Biometrics are traits inherent to an individuals body including:

- DNA
- Fingerprints
- Facial Scans
- Many more



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- Convenient: No need to carry or remember anything extra
- Stand-alone: No additional presence is needed.

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- Easily obtainable: It is easy to acquire someone's biometric information
- Limited supply: A person only has so many fingerprints
- Group size: Some biometrics perform poorly in large groups

Modern Use

Uses

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Biometrics are used for:

- Identification

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Process

Enrollment

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Authentication

Authentication is performed each subsequent time a user uses the system

Vulnerabilities

- Types of failures
- Types of attacks

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- False Negatives: When the system incorrectly denies access to an authorized person

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- Infrastructure attacks:
  An attack against the software

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These methods on their own are not sufficient

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A computer will estimate the time it takes to authenticate, and process random data to make up for the difference

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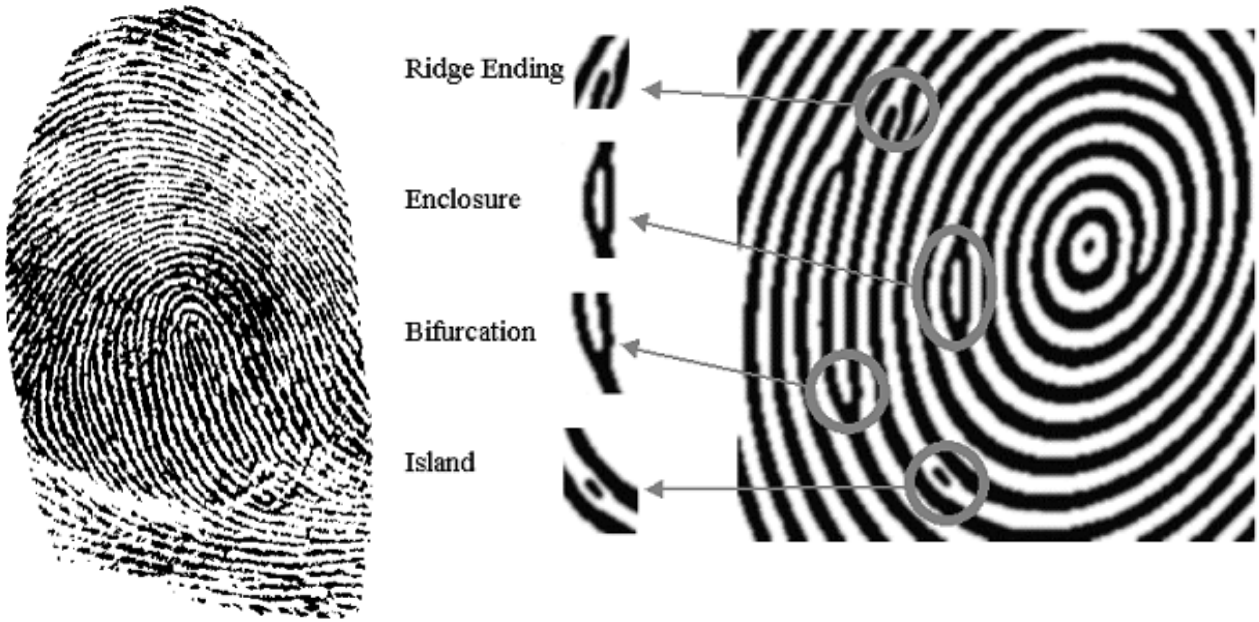
Yang and Verbauwhede used a method of hashing based on minutiae which proved effective
A minutia is a minor detail of the fingerprint, its location and details can be used to identify the fingerprint

Fingerprints

Fingerprint Minutiae



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- Used 10 fingerprints of 10 fingers to provide 100 fingerprint images
- Each minutia's neighborhood was determined by the six nearest neighbors
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- $<$ .01% false positives

Multimodal Systems

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- Allows for better watermarking and integrity verification systems

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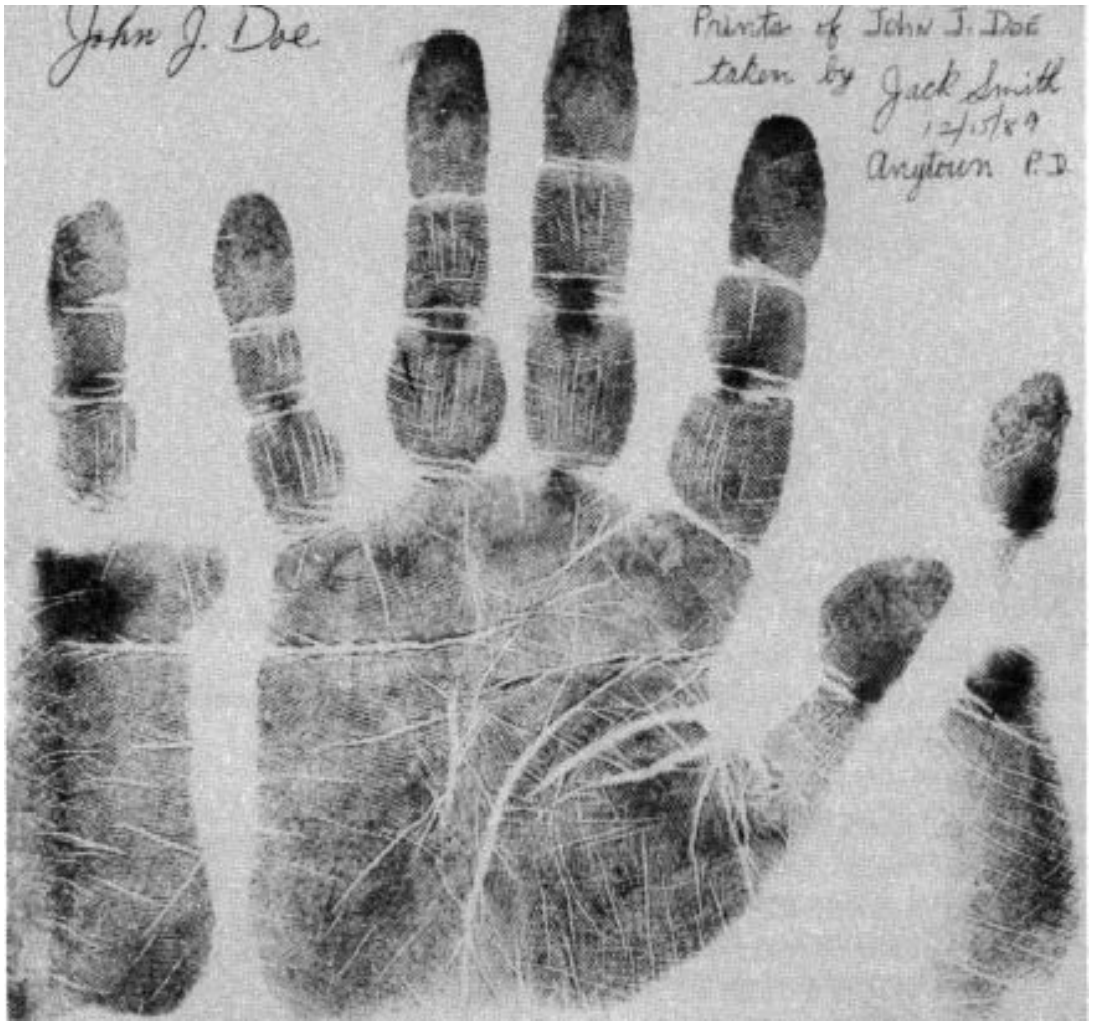
Sun et al. [2] designed a multimodal system which uses knuckleprints and palmprints

Palmprint


John J. Doe
Prints of John J. Doe
taken by Jack Smith
12/15/89
Anytown P.D.

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- After watermarking: 96.8% recognition on knuckleprints, 99.8% on palmprints
- No decrease in recognition, increase in security

Integrity Verification

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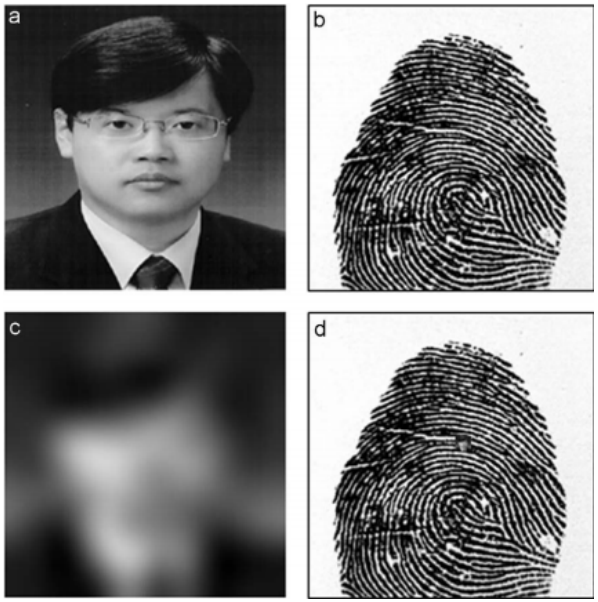
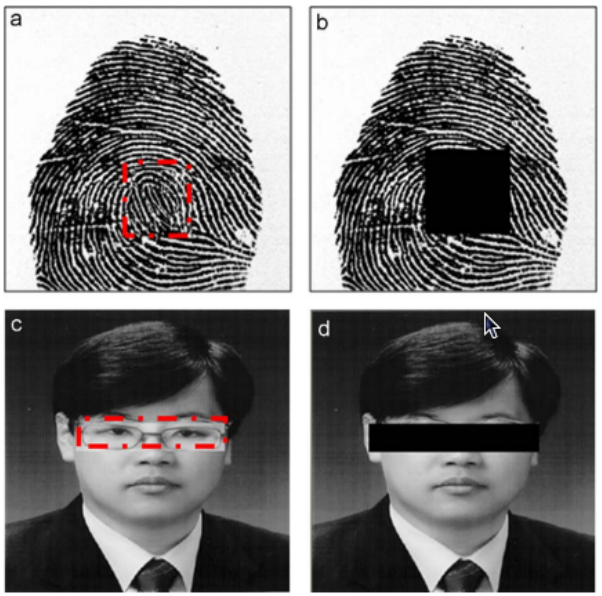
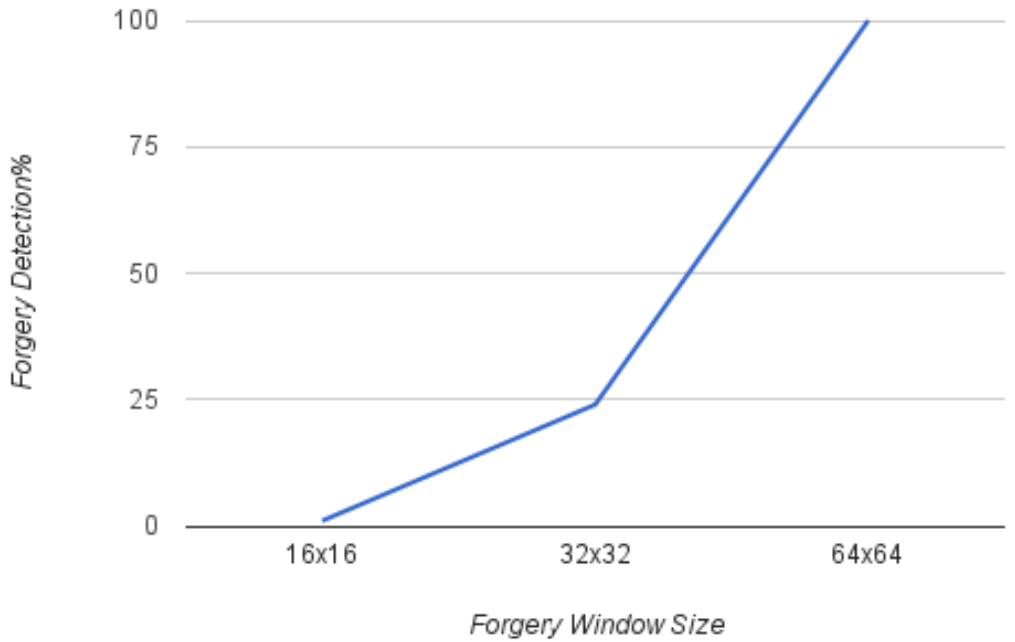
Won-gyum Kim and HeungKyu Lee designed a multimodal system which uses watermarking to verify the integrity of the input



Results

Forgery Detection Rate





Used 1000 forged fingerprint and face image pairs

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- There are difficulties in hashing fingerprints
- Hashing minutiae can get around this
- Yang and Verbauwhede achieved the standard of 1% false negatives and .01% false positives
- In the real world, fingerprints are used on groups far larger than 100, so scalability is unclear

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- Watermarking did not lower the effectiveness of the system

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- This system did not work well on small modifications
- It worked very well on larger modifications

Acknowledgements

Acknowledgements

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References

References

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2 Sun, Dongmei; Li, Qiang; Liu, Tong; He, Bing; and Qiu, Zhengding: A Secure Multimodal Biometric Verification Scheme, 2005

3 Kim, Won-gyum and Lee, HeungKyru: Multimodal Biometric Image Watermarking Using Two-stage Integrity Verification, 2009