



ETHICAL CONSIDERATIONS

BIOMETRICS 21.12.2023

Emerging Applications



Amazon One (2020)



Personalization (2022)



Match on card (2022)



Consumer News

Amazon One Payment System Questioned By Senators Over Privacy Safety Of Users – Letter Sent To Amazon For Its Palm Biometric Payment System...

By Consider The Consumer on 08/25/2021

Senators Question Amazon One Collection of Biometric Data

On Friday, a trio of U.S. senators wrote to Amazon President and CEO Andy Jassy inquiring about his company's policy regarding the collection of biometric data from users as part of its new palm print payment system, Amazon One.

Amazon Rekognition

Deep learning-based image recognition service
Search, verify, and organize millions of images



Object and Scene
Detection



Facial
Analysis



Face
Comparison

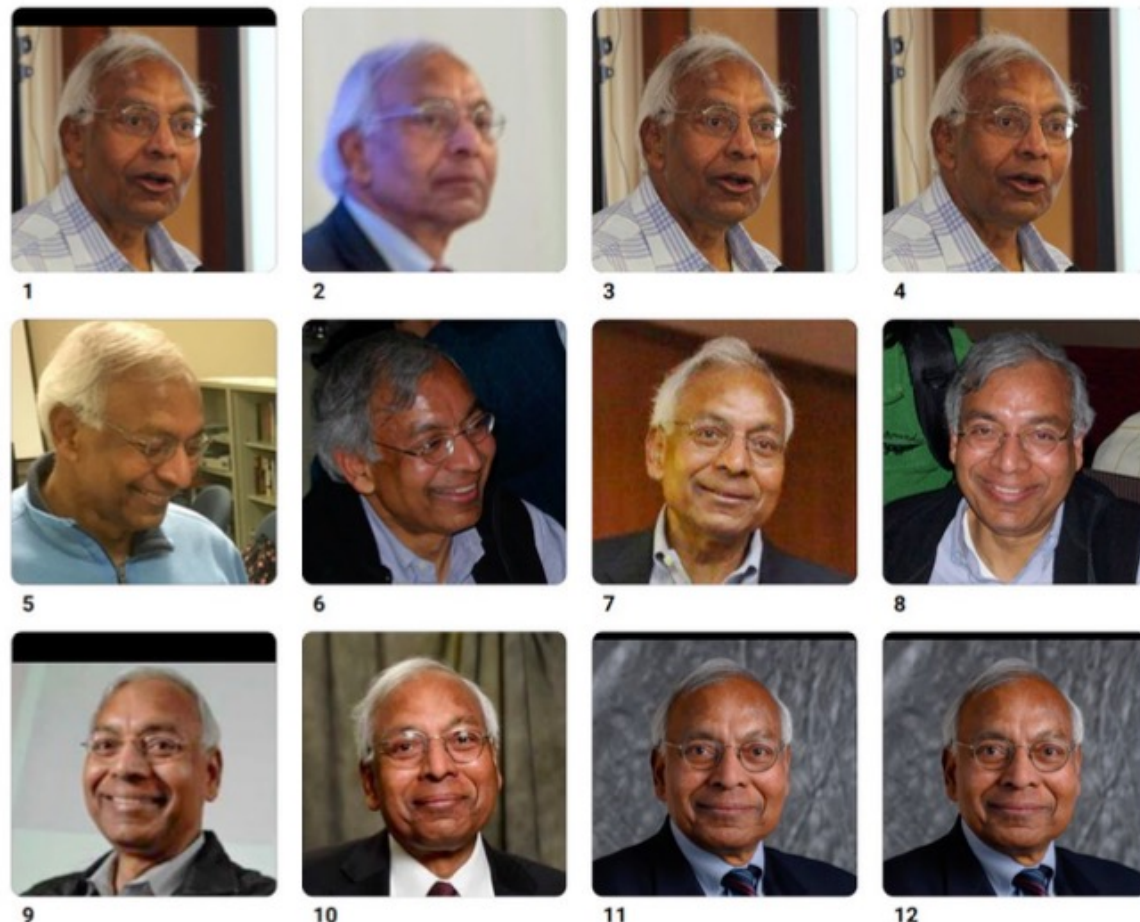


Facial
Recognition

Unconstrained Face Search



Query



Top 12 retrievals

20 billion face image database (Clearview.AI)

Clearview.AI Retrievals: Large Time Gap

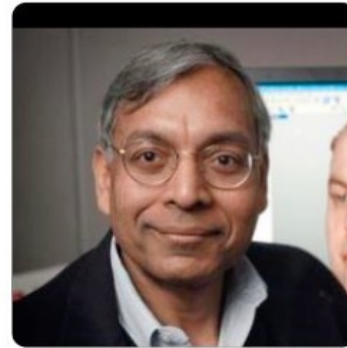
Original search image



**Probe
(1970)**



1



2

Image Index

1. Pioneering pattern recognition | College of Engineering. <https://www.egr.msu.edu/news/2018/12/04/pioneering-pattern-recognition> (MD5: b7cbc9670209d85fe488e155be883dc4)
2. Lynn F. Brumm Endowed Scholarship Honors Faculty Member | Giving to <https://givingto.msu.edu/stories/lynn-f-brumm-endowed-scholarship-honors-faculty-member> (MD5: f503dd0043d8bc2eac6ac9837214401e)

Top 2 retrievals

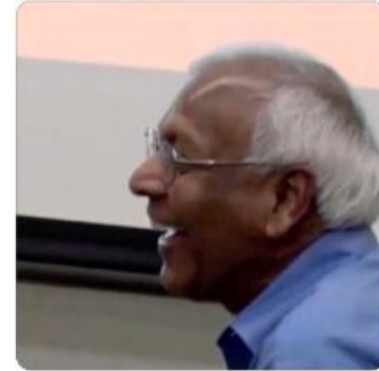
Gallery: 20 billion face images

Clearview.AI Retrievals: Occlusion

Original search image



5



7



11





12

Retrieved images

NTIA Initiative


- Major self-regulatory initiative intended to address privacy concerns associated with facial recognition technology.
 - Advocates and industry groups were attempting to develop a voluntary, enforceable code of conduct for the use of facial recognition technology and generally define the contours of transparency and informed consent.
- Stumbling block: nine consumer advocacy groups withdrew due to a lack of consensus on a minimum standard of consent re: commercial use of facial recognition technology.
- Self-regulatory guidelines were issued, but without any significant privacy requirements.

future  tense ASU | NEW AMERICA | SLATE

future  tense THE CITIZEN'S GUIDE TO THE FUTURE | JUNE 16 2015 7:04 PM

Frustrated Privacy Advocates Say Industry Has No Interest in Facial Recognition Safeguards

By Lily Hay Newman



Shoppers look for Black Friday deals at Somerset Collection mall on Nov. 29, 2013, in Troy, Michigan. Soon, you might not be just another face in the crowd when you go shopping.

Photo by Joshua Lott/Getty Images

The FBI has been developing a powerful and extensive facial recognition database for years now. Facebook has one, too. (For tagging! Right? Guys?) But if the technology seems a little creepy to you, you're not alone. Google even banned facial recognition apps on Glass in 2013. Now a Department of Commerce working group meant to reconcile these issues is struggling after all nine privacy advocates on the committee quit.

Facial recognition

The CNIL issues order to CLEARVIEW AI



THE SYSTEM

Clearview AI collects **photographs and videos** freely available on the Internet, including social media. Thanks to this collection, **the company markets access to its search engine** in which a person can be searched using a photograph. To do so, it establishes a **"biometric template"** without the consent of the persons concerned.



THE INVESTIGATIONS

Several complaints were sent to the CNIL, which was also warned by **Privacy International**. These complaints revealed the difficulties encountered by the complainants in exercising their rights with Clearview AI.



THE BREACHES

1. **Unlawful processing of personal data because the collection of the photographs and the use of biometric data are done without a legal basis.**
2. **Lack of satisfactory and effective consideration of the rights of individuals**, particularly of requests for access to their data.



THE DECISION

The Chair of the CNIL has decided to order **CLEARVIEW AI to cease this illegal processing and to delete the data within two months.**

Wrongfully Accused by an Algorithm





(a)

MICHIGAN STATE POLICE
INVESTIGATIVE LEAD REPORT
LAW ENFORCEMENT SENSITIVE

THIS DOCUMENT IS NOT A POSITIVE IDENTIFICATION. IT IS AN **INVESTIGATIVE LEAD ONLY** AND IS **NOT** PROBABLE CAUSE TO ARREST. FURTHER INVESTIGATION IS NEEDED TO DEVELOP PROBABLE CAUSE TO ARREST.

BID DIA Identifier: BID-39641-19	Requester: CA Yager, Rathe
Date Searched: 03/11/2019	Requesting Agency: Detroit Police Department
Digital Image Examiner: Jennifer Coulson	Case Number: 1810050167
	File Class/Crime Type: 3000

Probe Image	Investigative Lead
	

(b) Investigative Lead Report

FR system wrongfully identified (a) Robert William when the CCTV frame in (b) was searched against a 49M gallery; forensic experts did not conduct a manual examination of the candidate list

TinyFace Dataset



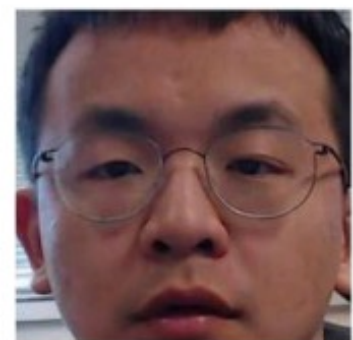
- Low resolution face images (average 20×16 pixels) of ~5K identities. (<https://qmul-tinyface.github.io/>)
- Rank-1 accuracy + **75.80%**

Chongqing: World's Most Heavily Surveilled City



2.58 m cameras for 15 m people (one camera/six residents); 1 billion worldwide by 2021
<https://www.theguardian.com/cities/2019/dec/02/big-brother-is-watching-chinese-city-with-26m-cameras-is-worlds-most-heavily-surveilled>

Face Spoofs



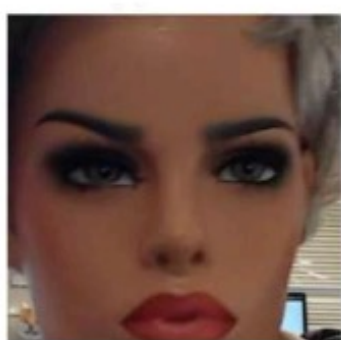
Live



Paper Mask



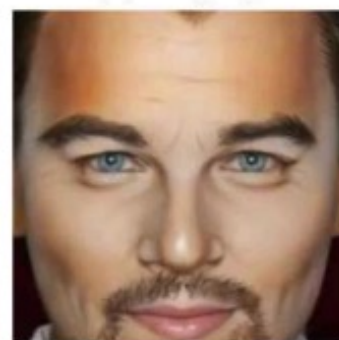
Half Mask



Mannequin



Paper Cut



Impersonation



Replay

TAR @ 2.0% FAR:

100%

96%

95%

95%

90%

72%



Silicone Mask

56%



Print

51%



Cosmetic

44%



Paper Glasses

43%



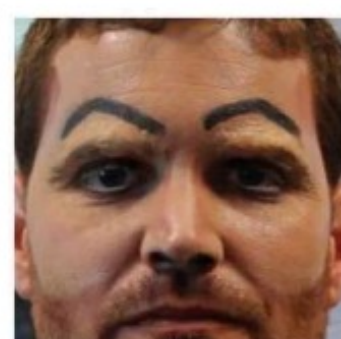
Transparent

39%



FunnyEye

33%

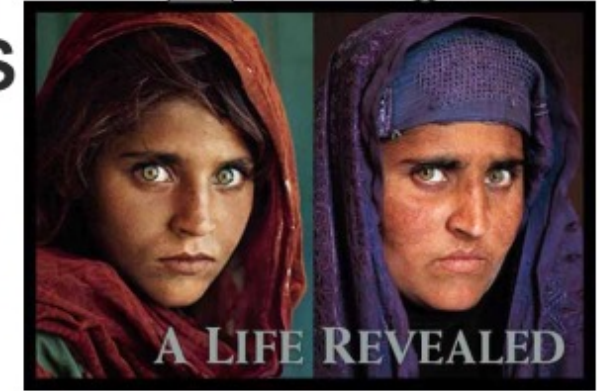


Obfuscation

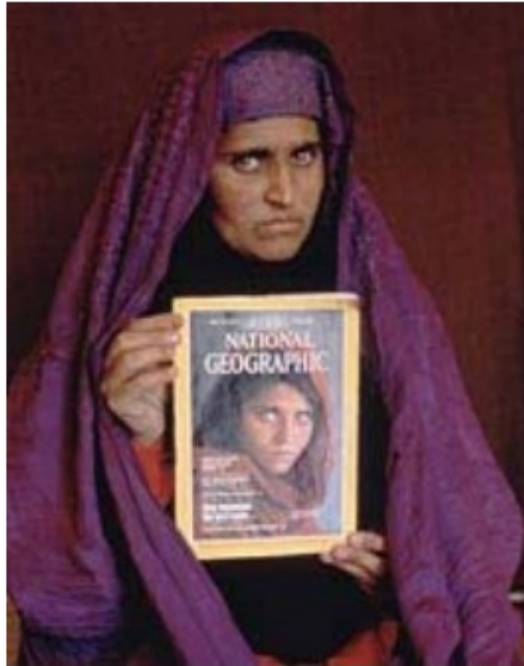
31%

All spoofs except Mannequin, Impersonation, Transparent, and Obfuscation belong to the same person in Live

Iris Biometric got really famous in the lost Afghan girl story..



Source: National Geographic Magazine



- In 1994 National Geographic photographer Steve McCurry took a picture of a little Afghan girl called Sharbat Gula in refugee camp in Pakistan.
- Her photo (she had amazing green eyes) made it to National Geographic 100 best Pictures!
- McCurry later tried to trace and find the girl, until finally 17 years later he located a girl with those same haunting green eyes.

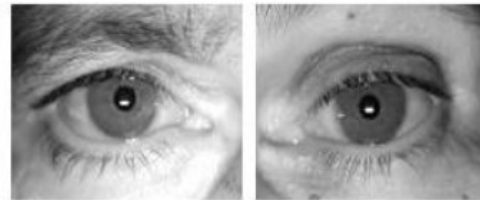
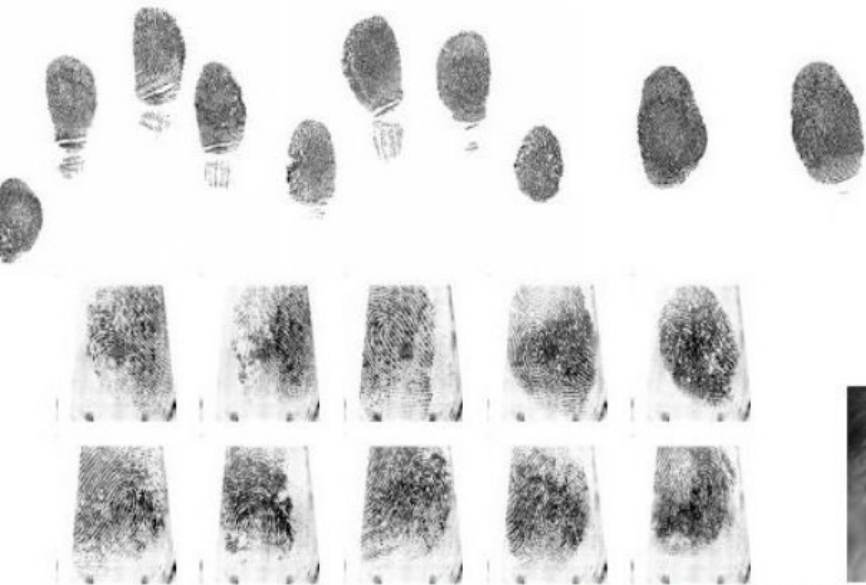
17 years passed...how to verify if this was the same girl?

- Hard-ship changed the girl's appearance. But she had those same haunting green eyes...
- The Explorer team got verification using U.S. FBI iris scanning technology. They used iris image from old taken photograph and compared to the new one.
- Iris code declared a 'match'!
- This was indeed the same girl! Iris biometric made it possible to verify this.

Aadhaar: World's Largest Biometric System



Fusion of 10 fingers, face & two irides for de-duplication



Gallery size: ~1.4 billion



~50 million authentications/day

<https://uidai.gov.in/>

Scalability

Current World Population

7,805,229,451

- **World population (2020) = 7.8 billion; #births/year = 130 million; projected to increase to 9.8 billion in 2050**
- **The United Nations Sustainable Development Goal (SDG) Target 16.9: “to provide legal identity for all, including birth registration” by 2030**

<https://www.worldometers.info/world-population/>

Biometrics in the Movies



2001: A Space Odyssey (1968)
Voice recognition



Blade Runner (1982)
Biometric scan for empathy



Star Trek II: The Wrath of Khan (1982)
Iris recognition



Judge Dredd (1995)
Biometric-authenticated weapon



Gattaca (1997)
DNA typing



Enemy of the State (1998)
Facial recognition; mass surveillance



Bourne Identity (2002)
Palm reader



Minority Report (2002)
Eye replacement for iris recognition



X-Men: Days of Future Past (2014)
Fingerprint scan spoofed

Facial Recognition for Pets Could Help Cities Save Furry Lives

Facial recognition is an emerging technology typically fraught with controversy, but most seem to agree that for animals, there's nothing but potential.

 Finding Rover

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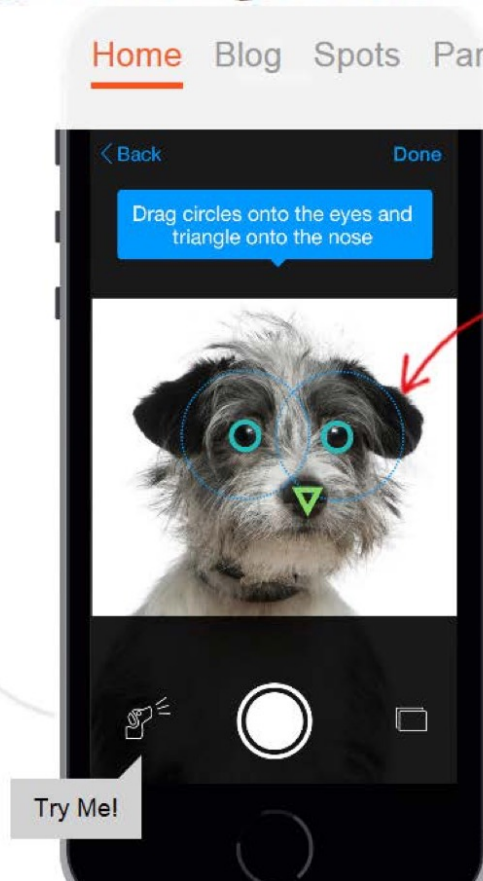


Technology
our core

Product
software & apps

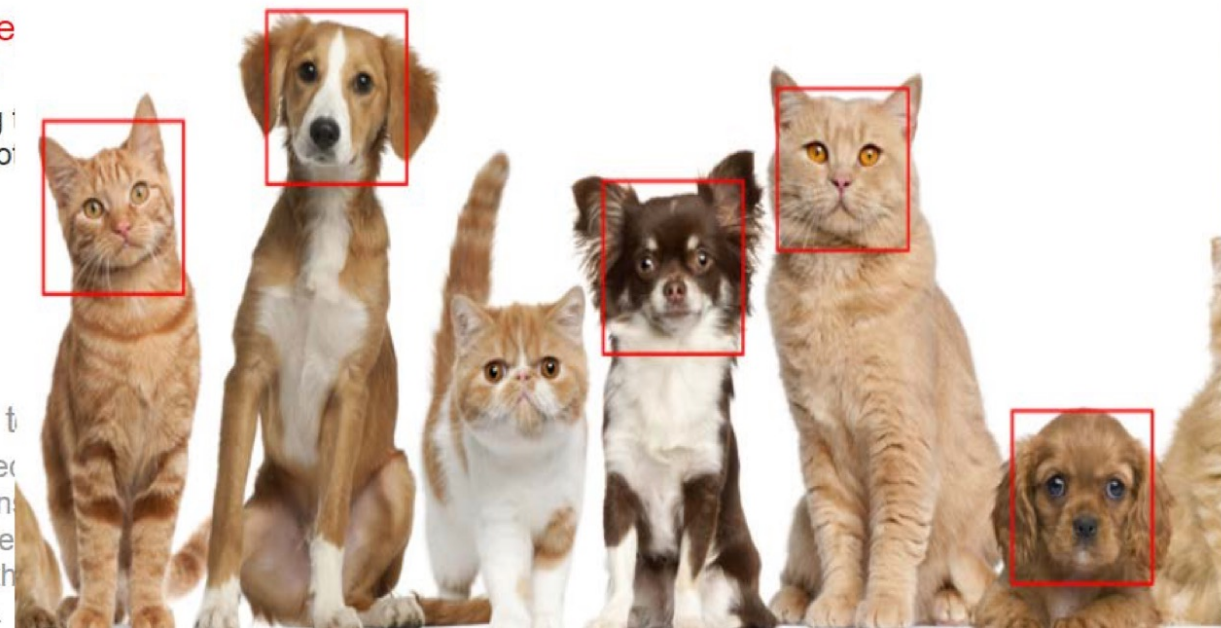
Corporate
who we are

- 1 Take a front-facing photo
A good picture is easy to take with our bark button.



- 2 Mark the eyes and nose
Simply drag circles onto the eyes and a triangle onto the nose.

- 3 We verify the photo
Our facial recognition system scans the dog's unique features and keeps the photo just in case.

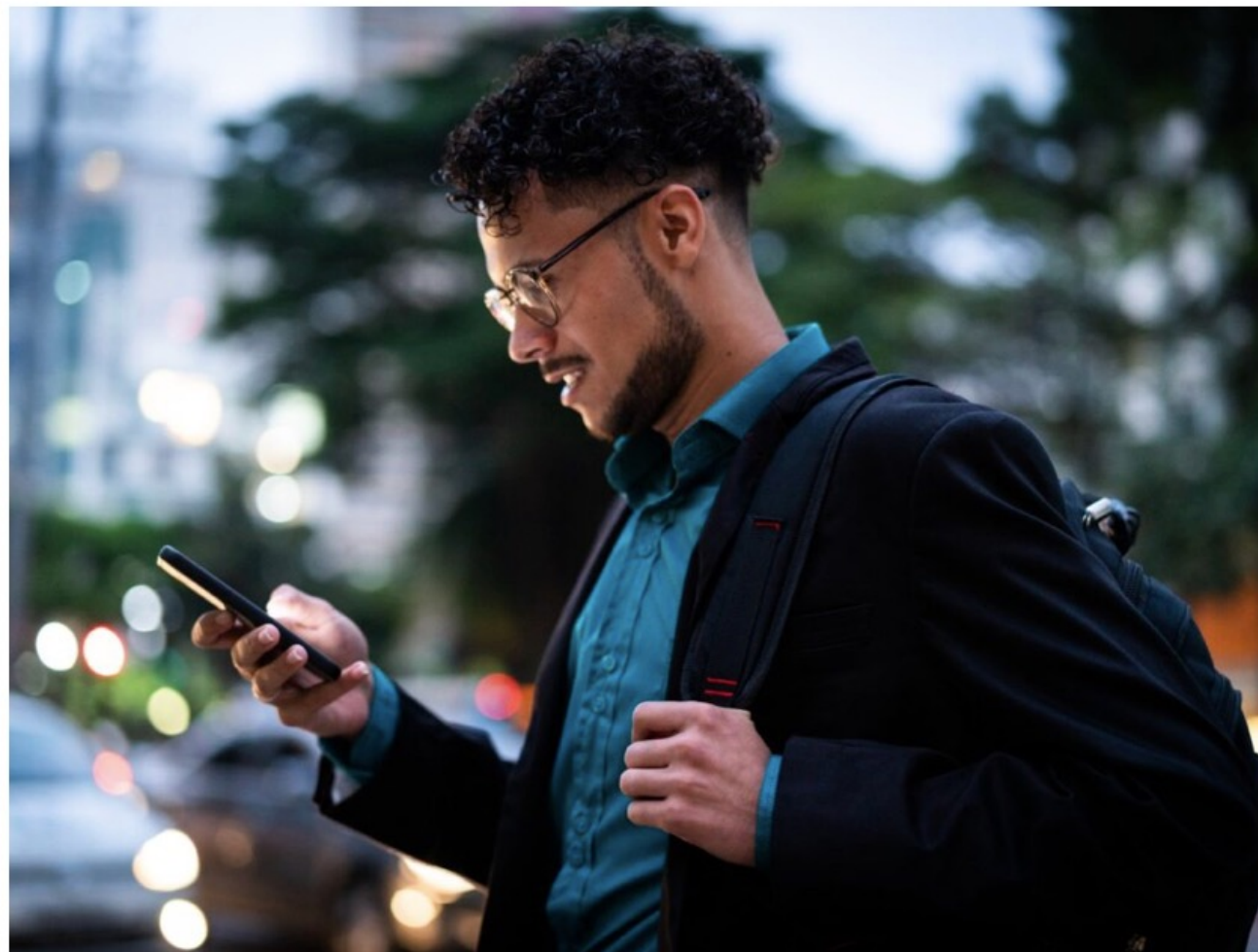


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NIST plans new biometrics test for presentation attack detection systems

Apr 5, 2022, 5:08 pm EDT | [Chris Burt](#)

CATEGORIES [Biometric R&D](#) | [Biometrics News](#) | [Liveness Detection](#)



The National Institute of Standards and Technology, the U.S. Commerce Department's body for setting the bar in biometrics and other advanced technologies, is launching a new version of its Face Recognition Vendor Test for technology to fight biometric spoof attacks.



IrisAccess®

MOST READ THIS WEEK

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[Worldcoin soon back to business in Kenya as co-founder eyes next growth phase](#)

[EU's biometric Entry/Exit System may have a launch date](#)

[Australia to rebrand myGovID following audit recommendation](#)

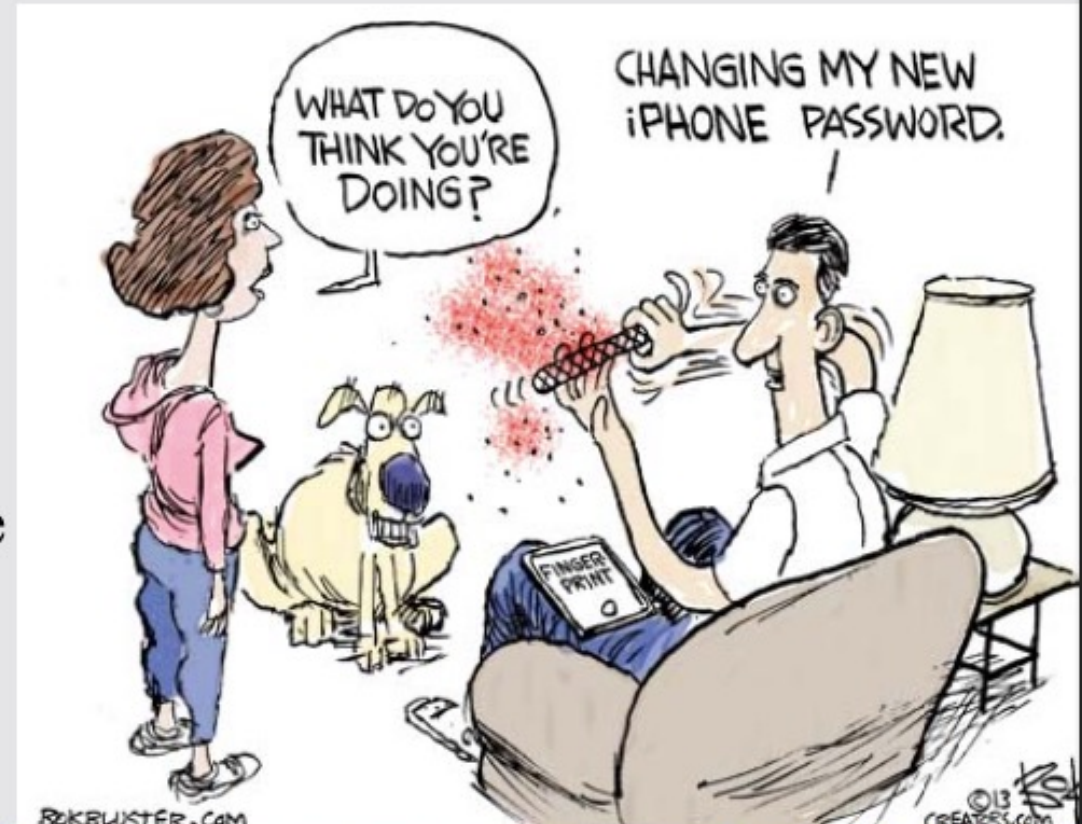
[Tag certified for biometric Mastercards, Zwipe and HID introduce recycled PVC cards](#)

[Canada makes another move towards age verification for porn sites](#)

[Biometrics launch for gumshoes and robot restaurants](#)

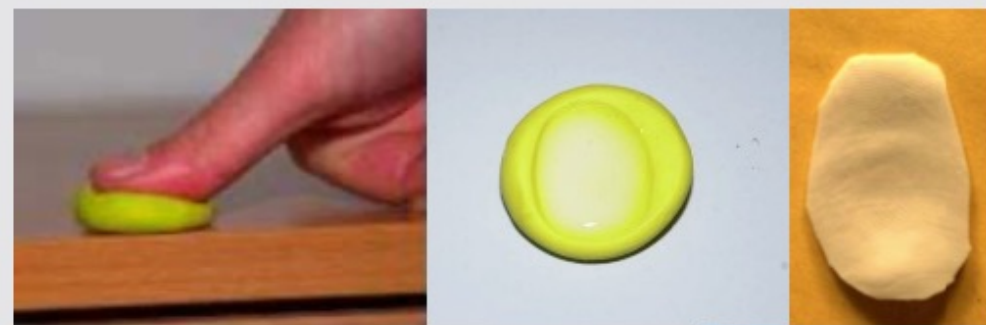
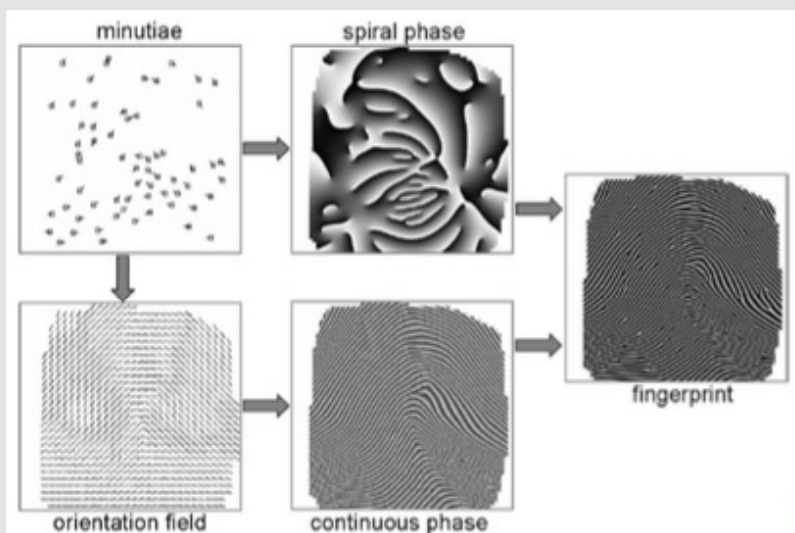
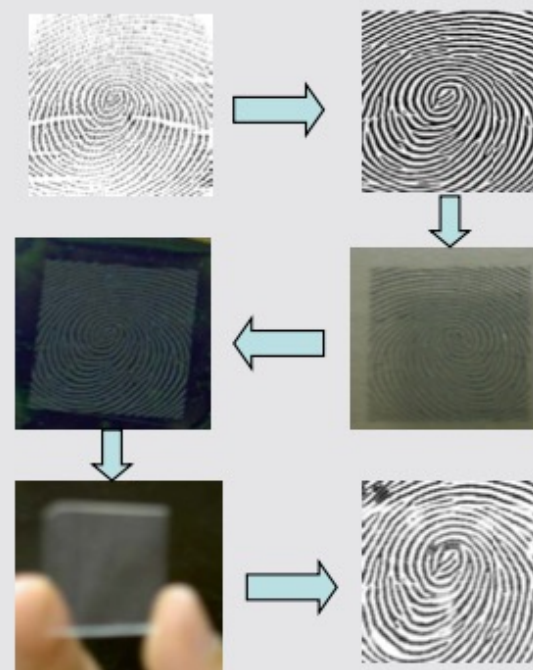
Presentation Attacks

- Spoofing is common term used most in past decade.
- ISO Standards underway:
 - **Presentation Attack** Definition: Presentation of an artefact or human characteristic to the biometric capture subsystem in a fashion **that could interfere** with the intended policy of the biometric system*
- Why?
 - Posing as another individual
 - Positive ID applications
 - Hiding your identity
 - Negative ID applications
 - May form 'new' identity for positive ID



Fingerprint Presentation Attacks

- **Cooperative**
Characteristic captured directly from individual with assistance (e.g. finger mold)
- **Latent**
Characteristic captured indirectly through lifting a latent sample
- **Synthetic**
Synthetic characteristic, not mapped to real person (e.g. synthetic fingerprint)



Coli, et al, 2006 [2].

Presentation Attack Testing on Conventional Systems

- Matsumoto et al., 2002 [3]
Testing acceptance rate of gelatin and silicone fingers (in terms of matching)
- Thalheim et al., 2002 [4]
Tested various techniques for spoofing biometric systems
Reactivating latent print and fingerprint on adhesive film
- Galbally et al., 2010 [5]
Optical and thermal sweeping sensors shown to be vulnerable to direct (presentation) attacks
- LivDet competitions 2009-13 [6]

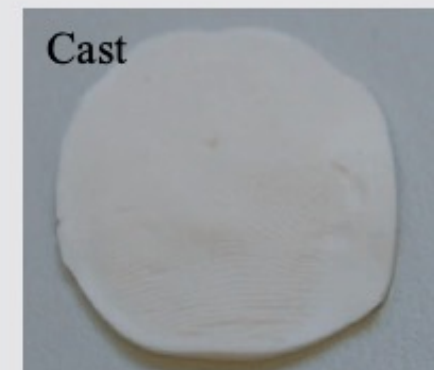


(a) Live Finger

(b) Gummy Finger



Mold

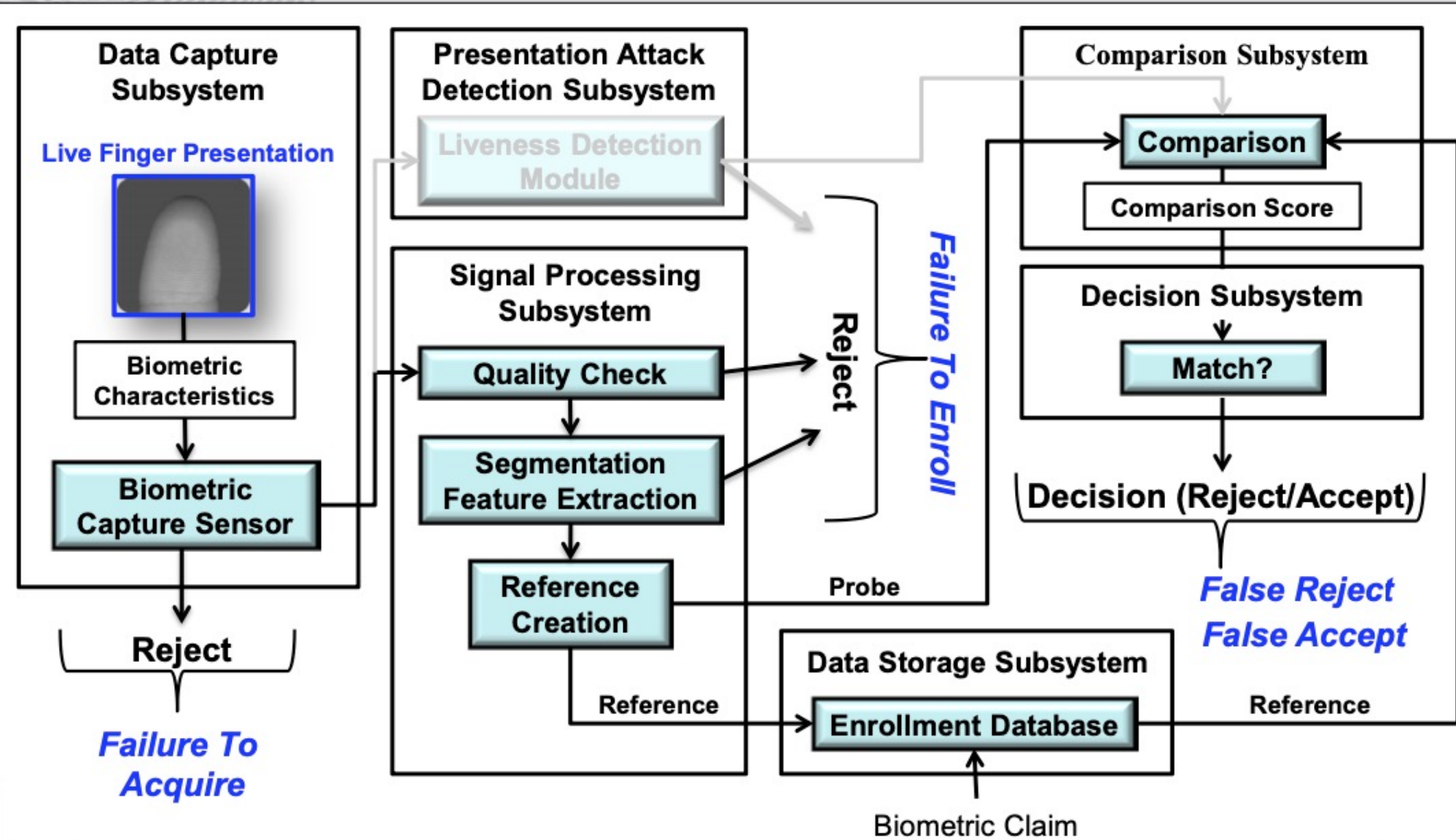


Cast

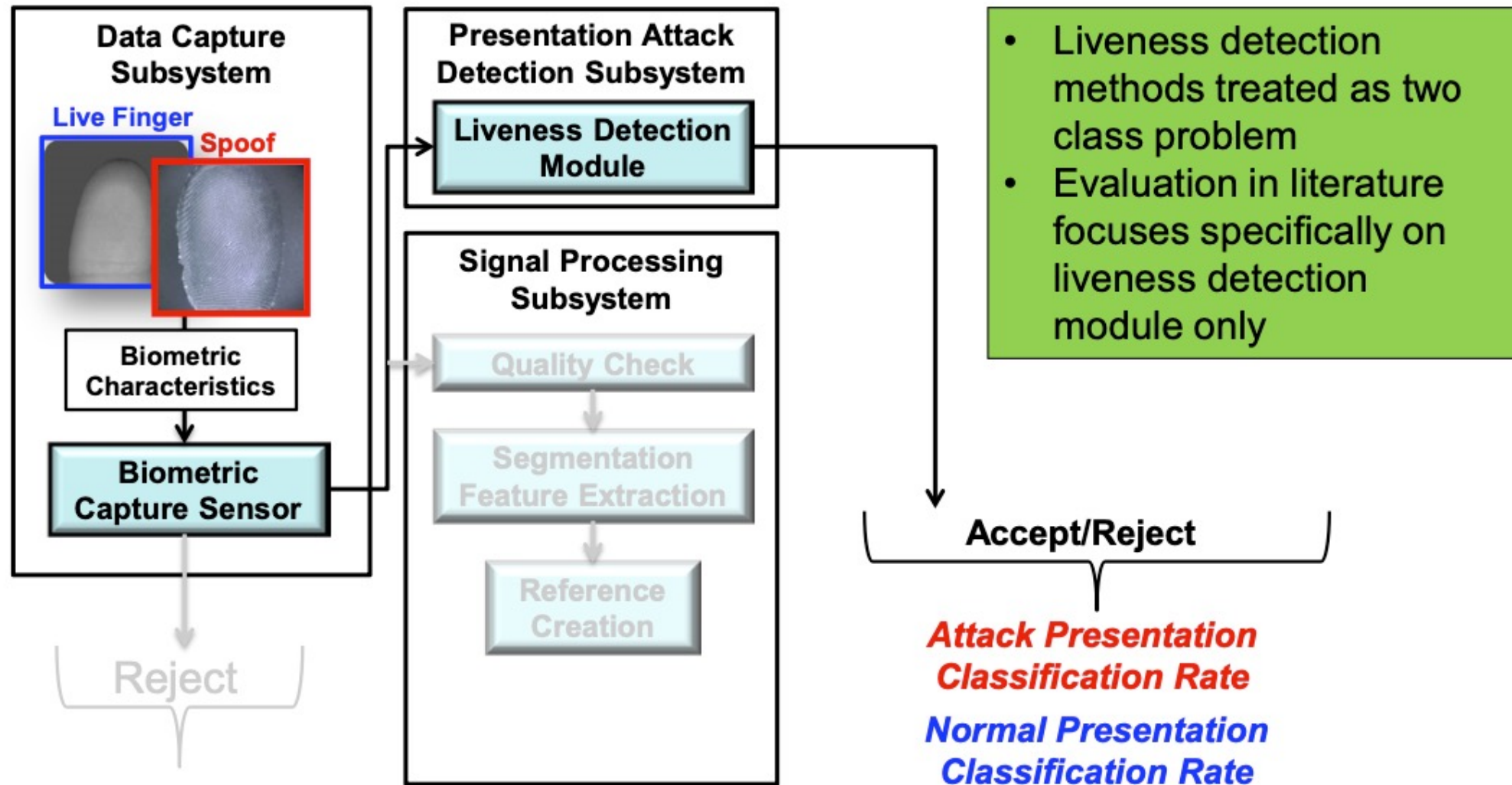
Presentation Attack Detection (PAD)

- Presentation Attack Detection (PAD) *
 - Automated determination of a presentation attack
- Examples of PAD
 - Liveness detection (failure)
 - Artefact detection
 - Altered biometric detection
 - Others terms that have been used: anti-spoofing, biometric fraud, spoof detection, authenticity detection, etc.

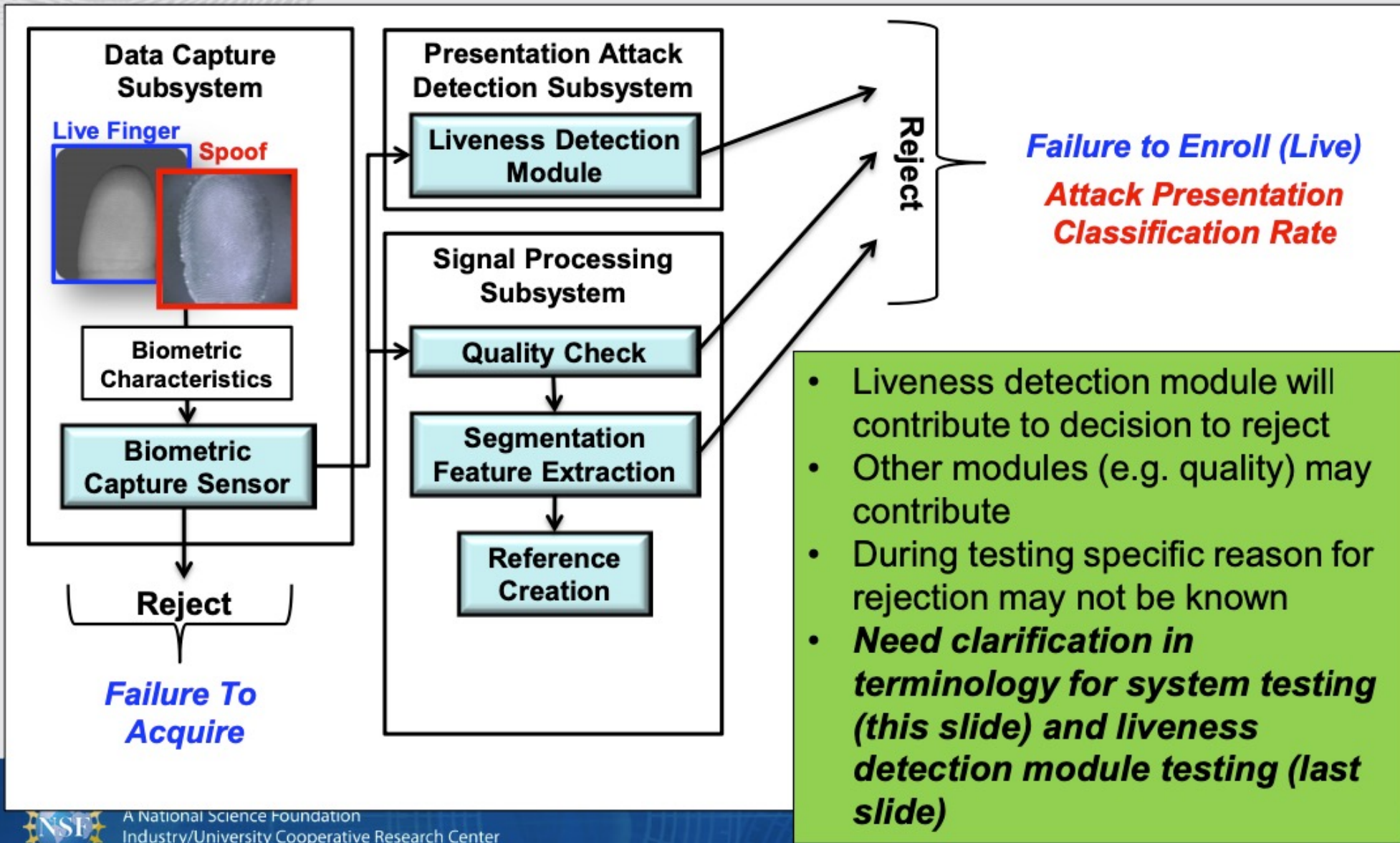
Traditional Metrics for Biometric Evaluation (Live Finger Input)



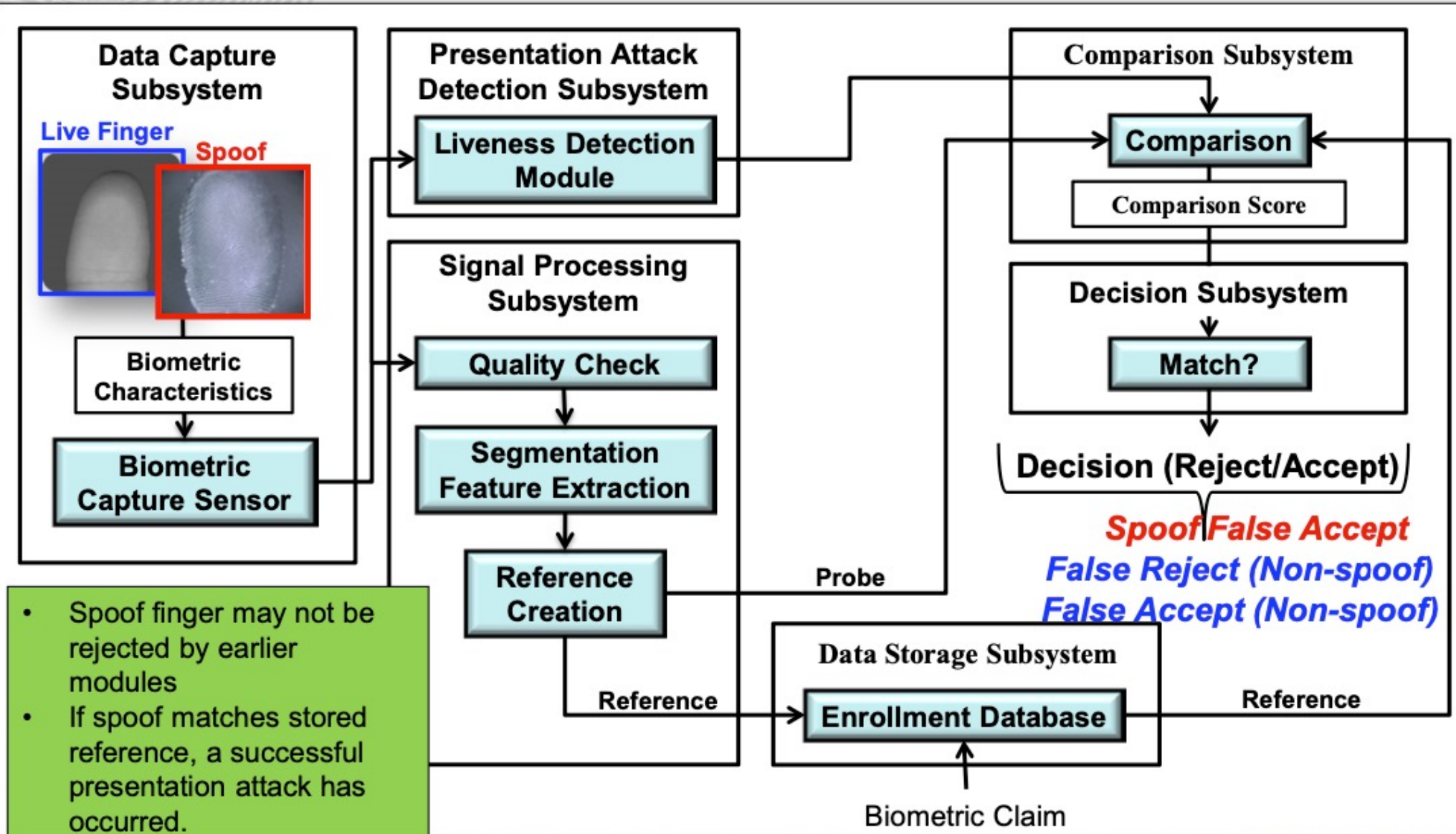
Additional Metrics (Spoof Input)



Additional Metrics (Spoof Input)



What about matching? (Spoof Input)



- Spoof finger may not be rejected by earlier modules
- If spoof matches stored reference, a successful presentation attack has occurred.

Summary

- Performance metrics for PAD system

Normal Presentation Classification Rate (NPCR): percentage normal presentations that are accepted as normal presentations

Attack Presentation Classification Rate (APCR): percentage of attack presentations correctly classified as attack presentations

- Performance metrics for combination of PAD subsystem and Comparison subsystem

False accept rate (FAR): Percentage of imposters accepted by the system

False reject rate (FRR): Percentage of genuine users rejected by the system

Spoof False Accept Rate (SFAR)--Percentage of spoof samples that are accepted by the system (i.e. by matching and PAD)