

STANDARDS RELEVANT TO BORDER CONTROL AND IMMIGRATION

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AGENDA

- MORPH DETECTION
- FACE STANDARDS
 - QUALITY
 - QR CODES
- TESTING STANDARDS
 - INJECTION ATTACK
 - DEEP FAKE TESTS
 - DEMOGRAPHIC
 - OPERATIONAL
- NEW NIST FRTE 1:N TESTS
- SUMMARY

NIST Interagency Report
NISTIR 8584

Face Analysis Technology Evaluation (FATE) MORPH

*Part 4B: Considerations for Implementing Morph Detection in
Operations*

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This publication is available free of charge from:
<https://doi.org/10.6028/NIST.8584>

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U.S. Department of Commerce
Howard Lutnick, Secretary
National Institute of Standards and Technology
Secretary of Commerce for Standards and Technology and Acting NIST Director



ISO/IEC AW1 29794-5(en)

Second edition

Date: 2026-03-04

Information technology — Biometric sample quality —

Part 5: Face image data

Technologies de l'information — Qualité d'échantillon biométrique —

Partie 5: Données d'image de face

MORPH DETECTION TODAY



Morph of US Presidents 43+44



- **PROBLEM:**
 - Two people on one passport
 - Both people can authenticate
- **GOLD STANDARD SOLUTION: Trusted Capture**
- **WEAKER SOLUTION #1:**
 - Detect during passport application / re-apply
 - **S-MAD:** Single image morph attack detection
 - Works on known morph species
 - Fails on different / unseen morphing species
- **WEAKER SOLUTION #2:**
 - Detect during border crossing
 - Two images: passport + the trusted live image
 - **D-MAD:** Differential morph attack detection
 - Fails when confederates look similar
 - Gives false alarms with ageing
- **SET FALSE ALARM RATE TO 1% OR SOME LOWER VALUE**
- **WHEN MORPH IS DETECTED**
 - Investigate!
 - Use D-MAD and S-MAD in combination
 - One-to-many
 - Recapture perfect images
 - See NIST IR 8584

BIGGER PICTURE

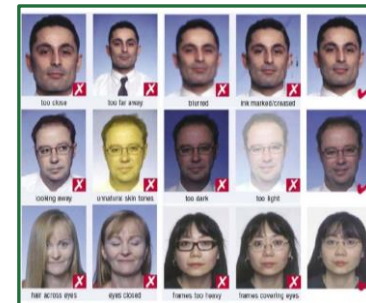
- Morphs exist
- Prevalence unknown
 - Surveillance, use detectors quietly to estimate prevalence
- Funding
 - EU iMARS ...
 - DHS, USG 🙌 🙏
 - Developers
- NIST encourages
 - FR Developers → D-MAD
 - International data sharing
 - **Pilots** (offline / online)
 - Research
 - GUI tools
 - Subtract X from suspect morph $MORPH(Y, X)$ to aid human inspection

ISO/IEC FACE STANDARDS

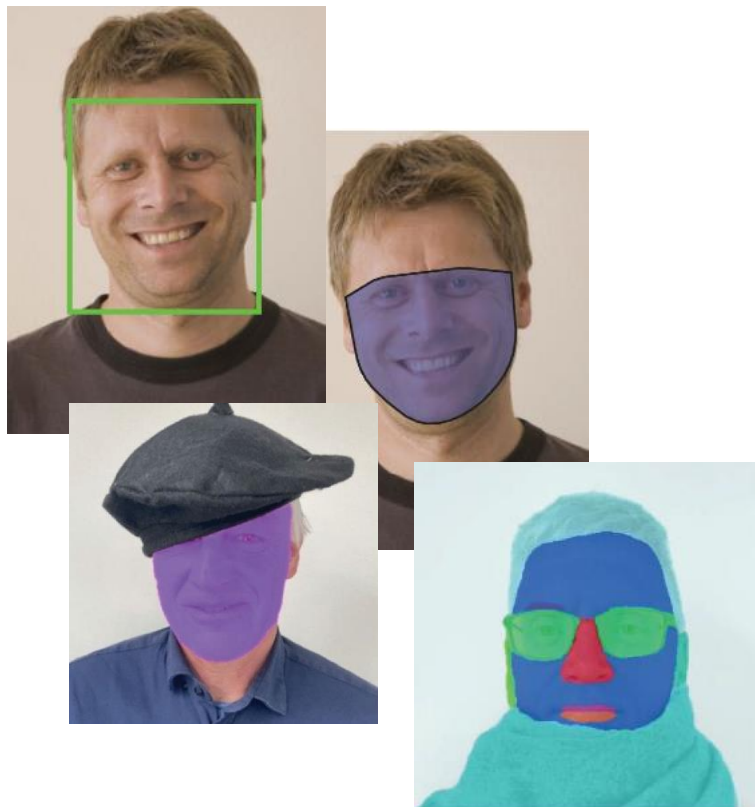
- 1 ISO/IEC 19794-5:2005 Original e-Passport
- 2 ISO/IEC 29794-5:2024 Software quality assessment of face photos
- 3 ISO/IEC 39794-5:2019 Next generation e-Passport
- 4 ISO/IEC 49794-5:2022 e-Passport transition guidance
- 5 ISO/IEC 59794-5:2028 Compact signed faces for 2D barcodes

- 6 ISO/IEC 25447:2027 Less constrained face image capture

1. Interchange format
2. Photography + imaging guides



ISO/IEC 29794-5 FACE IMAGE QUALITY



- **STANDARD PUBLISHED 2024**
 - OPEN SOURCE REFERENCE CODE: OFIQ

- **STANDARD UNDER REVISION**
 - OFIQ v1 → OFIQ v2 est 2027.

- **OVERALL QUALITY SCORE**



- **ALSO IMAGE DIAGNOSTICS**
 - HEAD ORIENTATION: ROLL, PITCH, YAW
 - OVER- AND UNDER-ILLUMINATION
 - MIS FOCUS
 - RESOLUTION
 - OCCLUSION
 - CROPPING
 - ...

ISO/IEC 29794-5 – IMAGE ANALYSIS

TEST SOFTWARE ABILITY TO
DETECT SPECIFIC QUALITY
PROBLEMS



1. Subject Behavior

- Num faces
- Eyes visible
- Eyes-open
- Mouth occlusion
- Mouth open
- Face occlusion
- Intereye Distance
- Head size
- Cropping
- Pose
- Shoulders
- Expression
- Head covering

2. Camera + Environment

- Background uniformity
- Illumination uniformity
- Greyscale moments
- Exposure
- Dynamic range
- Sharpness
- Motion blur
- Compression
- Natural color

ISO/IEC 59794-4 FACE ON 2D BARCODE

INTEROPERABLE FACES ON 2D BAR CODES RECOGNITION ACCURACY OF VDS-STORED FACES



- [ISO/IEC 18004:2024](#) QR code
- [ISO/IEC 16022:2024](#) Data Matrix
- [ISO/IEC 24778:2024](#) Aztec code
- [ISO/IEC 15438:2015](#) PDF417
- [ISO/IEC 16023:2000](#) Maxicode

PDF 417 BARCODE SUITABLE FOR
DRIVER'S LICENSE, 800 BYTES, WEBP.



ISO/IEC ATTACK STANDARDS

1 ISO/IEC 30107:2021 Presentation Attack Detection

2 ISO/IEC 26655:NEW Deepfake Detection

3 ISO/IEC 25456:2027 Injection Attack Detection

ISO/IEC 30107 PRESENTATION ATTACK DETECTION

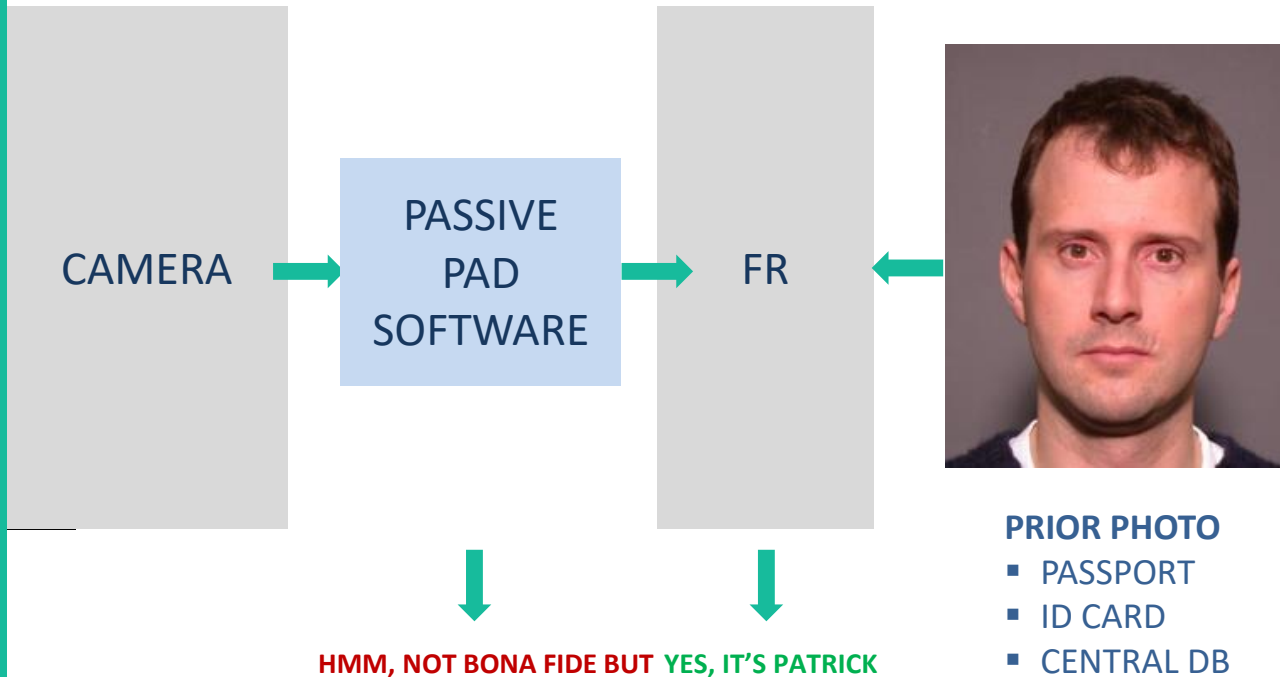
ANALOG ANATOMY



ATTACK PHOTO

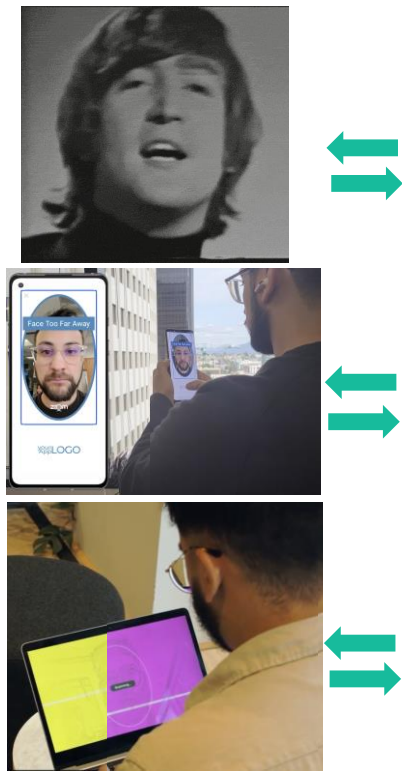
- REPLAY
- MASKS
- ...

DIGITAL REPRESENTATION

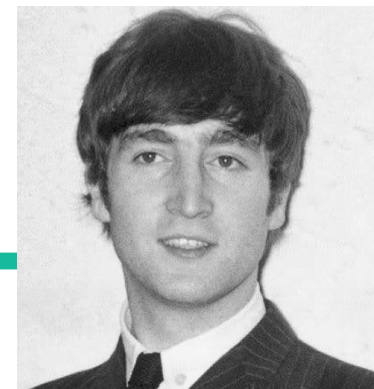
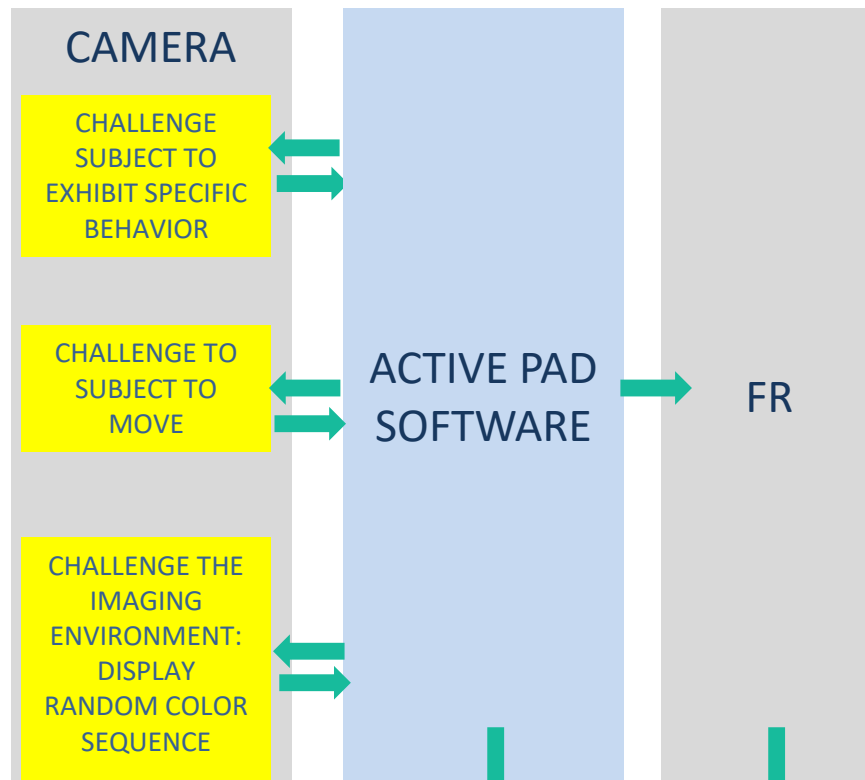


PAD ACTIVE DETECTION APPROACHES

ANALOG ANATOMY



DIGITAL REPRESENTATION



PRIOR PHOTO

- PASSPORT
- ID CARD
- CENTRAL DB

YES, IT'S BONA FIDE AND ... YES, IT MATCHES

ISO/IEC 25456 INJECTION ATTACK DETECTION

DIGITAL REPRESENTATION

THERE IS NO CAMERA
(!!)

HIJACKED
CAMERA

VIRTUAL
CAMERA

FR



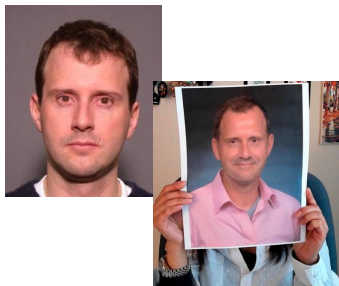
PRIOR PHOTO

- PASSPORT
- ID CARD
- CENTRAL DB

YES, IT'S PATRICK

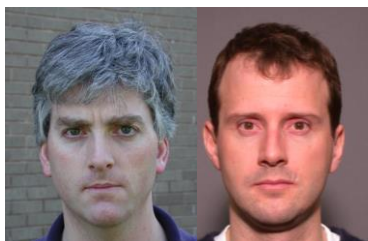
Source: gemini.google.com

LEGITIMATE OR NOT: FOUR TYPES

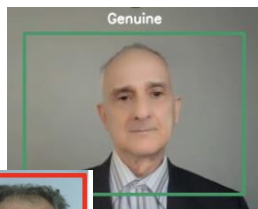


LEGITIMATE BIOMETRIC, FAKE BIOGRAPHIC

ATTACK BIOMETRIC, LEGITIMATE BIOGRAPHIC



MORPH



FACE SWAP



DEEP FAKE
FULLY SYNTHETIC



ID DOCUMENTS

- PASSPORT
- DRIVERS LICENSE



CENTRAL DB

- LINKED-IN
- CLEARVIEW

FRTE

FACE RECOGNITION TECHNOLOGY EVALUATION

RECOGNITION: **WHO** IS IN AN IMAGE

1:1 VERIFICATION

1:N SEARCH

FACE IN VIDEO 2024

TWINS DISAMBIGUATION

SAME PERSON OR NOT?

WHO? WHERE? WHEN?

1:N ON NON-COOP PEOPLE

SAME PERSON, OR TWIN?

FATE

FACE ANALYSIS TECHNOLOGY EVALUATION

ANALYSIS: **WHAT** ABOUT AN IMAGE

MORPH DETECTION

QUALITY + DIAGNOSTICS

PAD

AGE ESTIMATION

TWO PEOPLE IN ONE FACE?

HOW BAD IS THIS PHOTO

SUBVERSIVE PHOTO?

HOW OLD? OLD ENOUGH?

Benchmarks are:

- Independent + public
- Free + Regular + Fast
- Repeatable + Fair
- Black box
- Large-scale
- Sequestered datasets
- Statistically robust
- Transparent + extensible
- **ABSOLUTE PERFORM.**
- **RELATIVE PERFORM.**
- **! Certification**
- **! Procurement**

IREX

IRIS EXCHANGE (INTEROP) TECHNOLOGY EVALUATION

1:N IRIS + NEW DATASET

FRIF

FINGERPRINT TECHNOLOGY EVALUATION

1:N FINGERPRINT

TATT

TATTOO TECHNOLOGY EVALUATION

1:N TATTOO

SRE

SPEAKER RECOGNITION TECHNOLOGY EVALUATION

1:1 VOICE



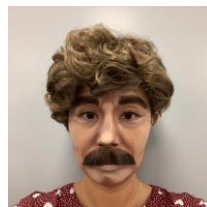
Patrick
Grother



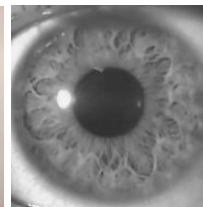
Kayee Hanaoka
(+ Mei Ngan)



Austin
Hom



(not)
Mei Ngan



Jim
Matey

THANK YOU!

PATRICK.GROTHER@NIST.GOV

