

# MBE Still Face Track

Large scale evaluation of 2D Face  
Recognition Technology

George W. Quinn

[gw@nist.gov](mailto:gw@nist.gov)

9/23/2010

# MBE Sponsors

## Executing Agency



## Sponsoring Agencies



# Why Face?

## Advantages

---

- Large corpus of imagery available.
- In many cases it's the only biometric available (e.g. CCTV)
- Usability (can be run in 'passive' mode).
- Fewer privacy concerns
- Multi-model
- Method of capture is cheap and widely available.



QuickTime™ and a  
decompressor  
are needed to see this picture.

# Purpose of MBE Still

## WHAT

---

- Determine latest state-of-the-art of face recognition. The last NIST conducted FR evaluation was the FRVT 2006.
- To report parameters important to procurers. These include
  - Matching accuracy
  - Timing statistics
  - Speed/accuracy trade-off
  - Scalability
  - Template size
  - Computational requirements

## WHY

---

- To provide quantitative support to government and industry in an expanding biometric market, specifically via contributions to
  - Testing, measurement, research, calibration
  - Standards (ISO/IEC 19794-5, ANSI/NIST ITL 1-2007)
  - Recommendations, guidelines

# Applications

## Identification

- Duplicate detection (e.g. DMV)
- Forward criminal search
- Watch-list, covert surveillance
- Access-control without presentation of a credential or PIN.
- Disaster post-mortem
- Rapid subject identification

## Verification

- Access Control (e.g. E-Passport, US-VISIT, smart cards)

Access Control



# Datasets Overview

## Dept. of State (DOS):

- 5.7 million people.
- Highly controlled. Low resolution.
- Legacy (~10 years old)
- Provides a direct method of tracking the progress of FR technology over time.



## Law Enforcement (LEO):

- 1.8 million people.
- Controlled. Some pose / lighting variation.
- Contemporary.
- Operational (currently used by FBI).



Sample LEO images available as NIST Special Database 32 (a.k.a MEDS-I):

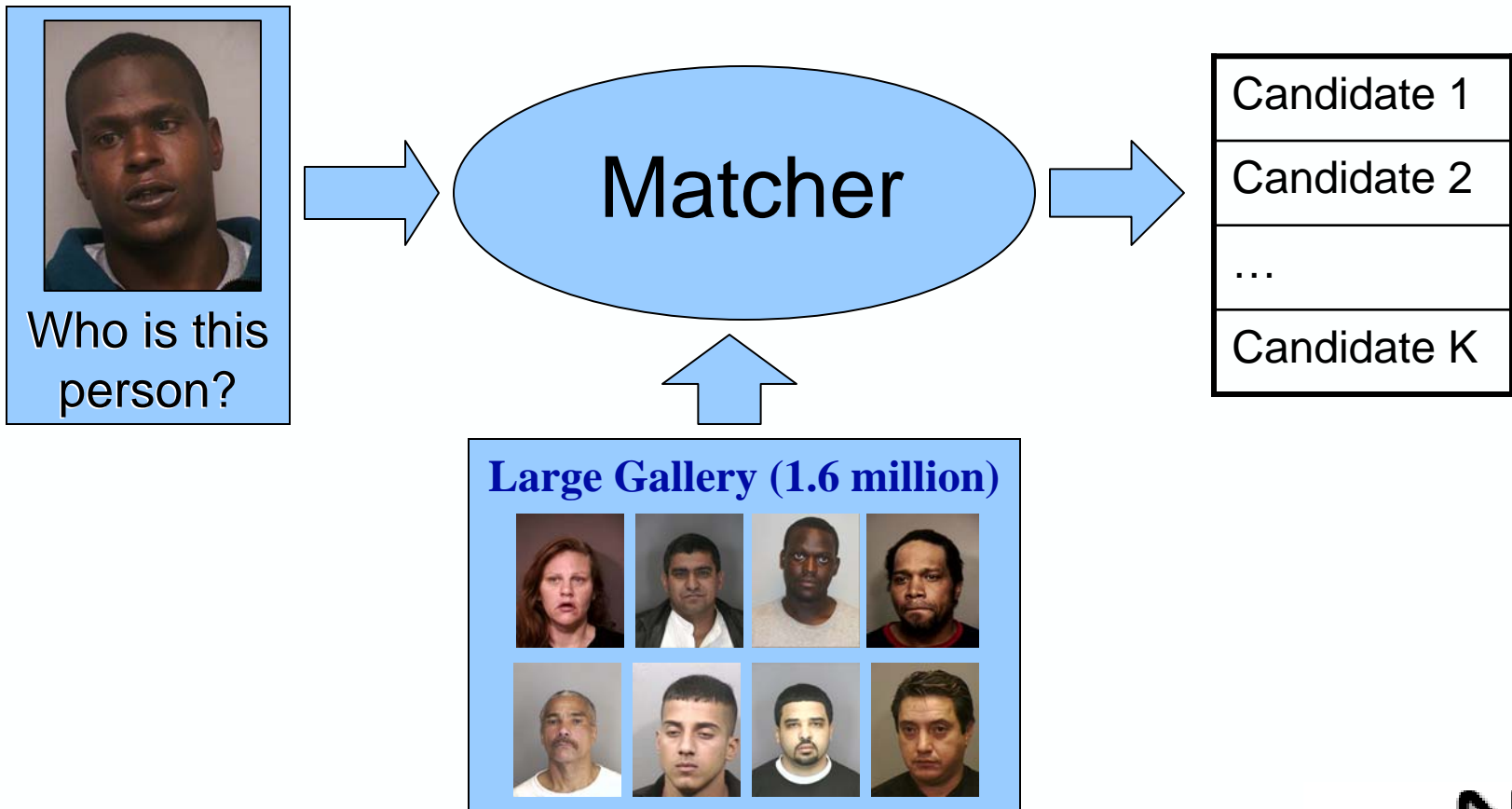
<http://biometrics.nist.gov/>

# MBE Still Face Track Participation

- Cognitec (DE)
- L1 Identity (US)
- Morpho / Sagem (FR)
- NEC (JP)
- Pittsburg Pattern Recognition (US)
- Neurotechnology (LI)
- Toshiba (JP)
- University of Surrey (UK)
- Dalian Tech. Uni. (CN)
- Tsinghua Uni. (CN)

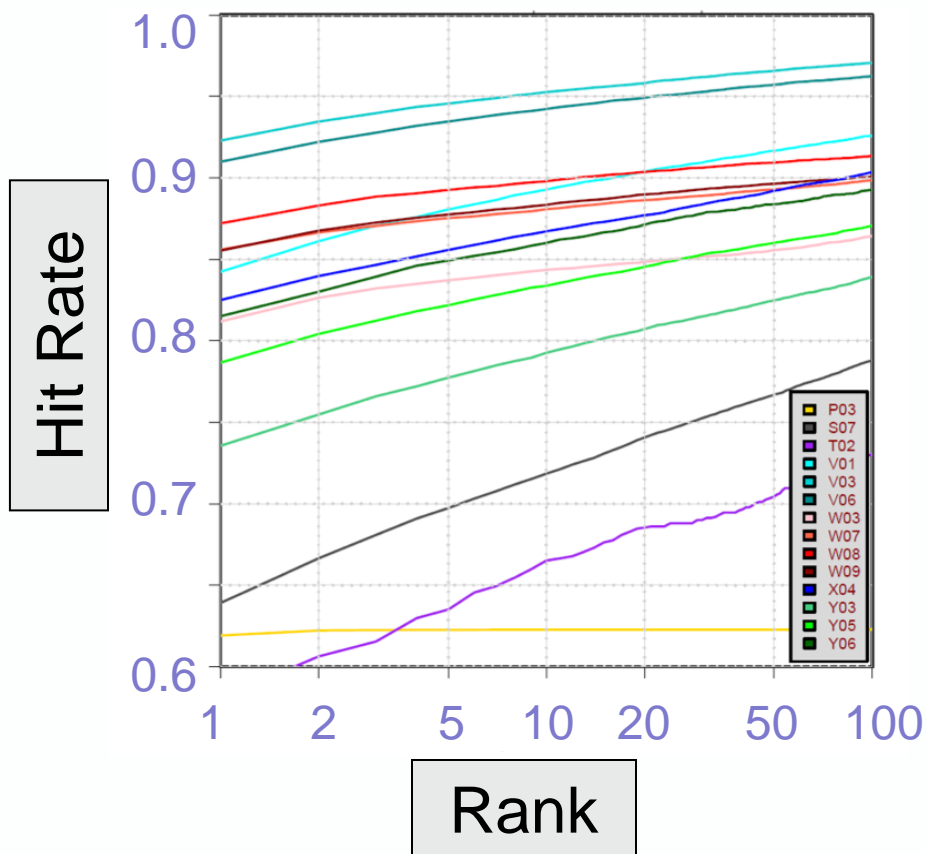
# Rank-based Identification

A **rank-based** identification systems returns the top K candidates for each search.





# CMC Curve (Rank-based Performance)



➤ Rank 1 Hit Rate: 0.92

➤ Rank 5 Hit Rate: 0.95

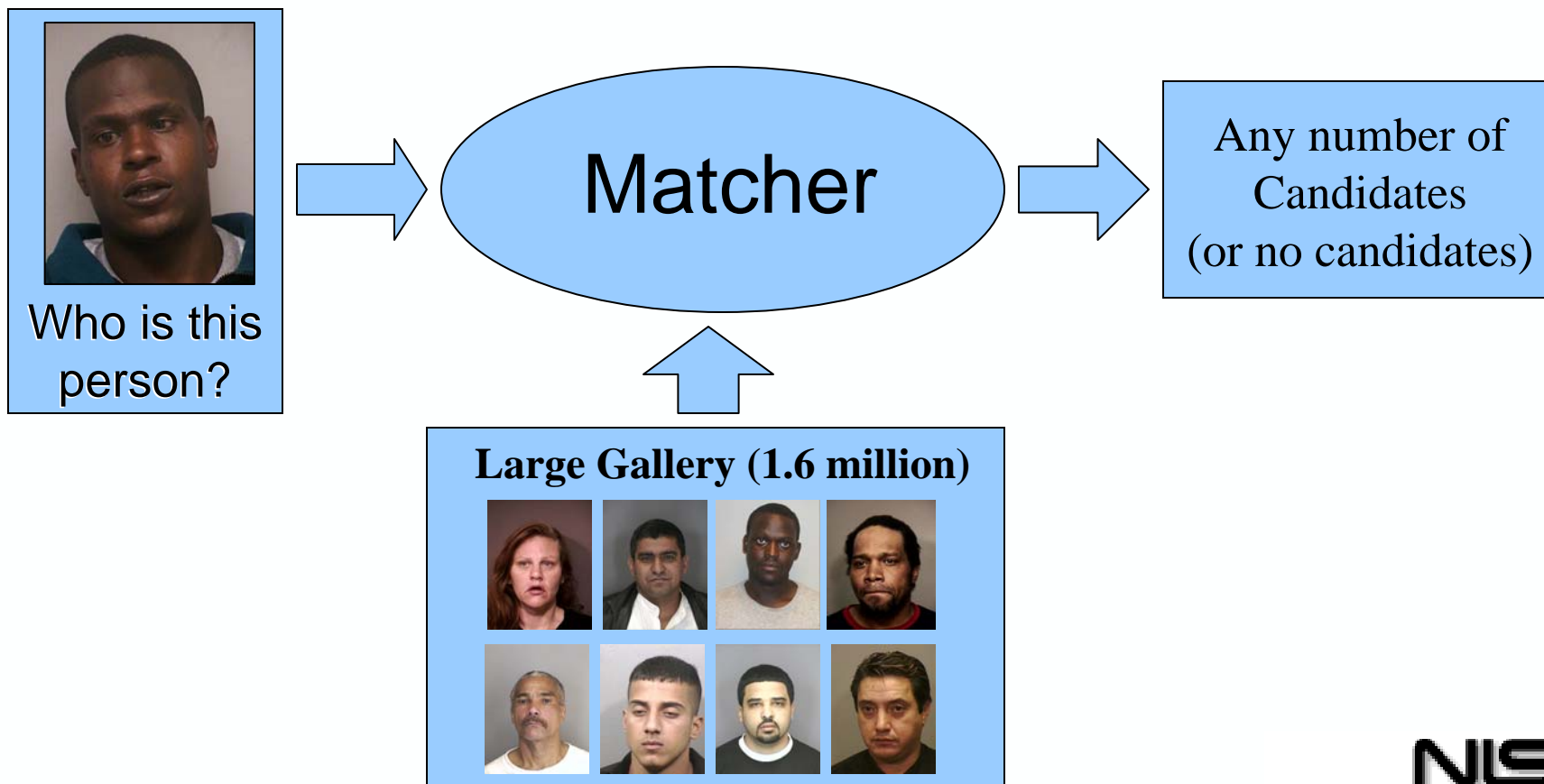
➤ Diminishing returns as rank increases.

Gallery: 1.6 million

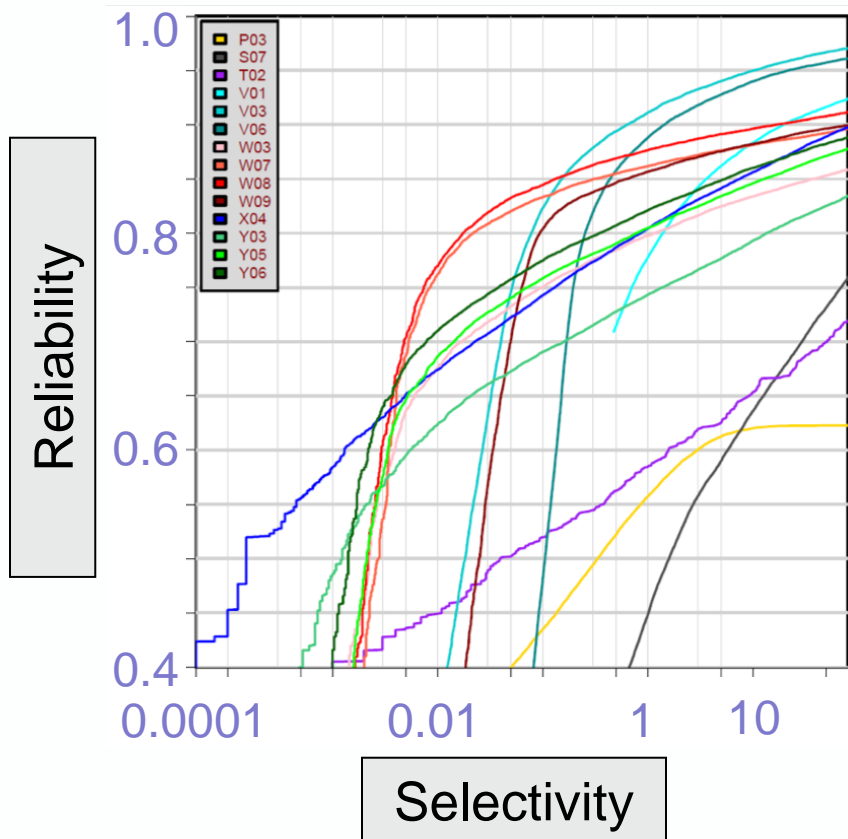
LEO images

# Score-based Identification

A **score-based** identification systems returns only those candidates with a score above some threshold. The result is a variable sized candidate list.



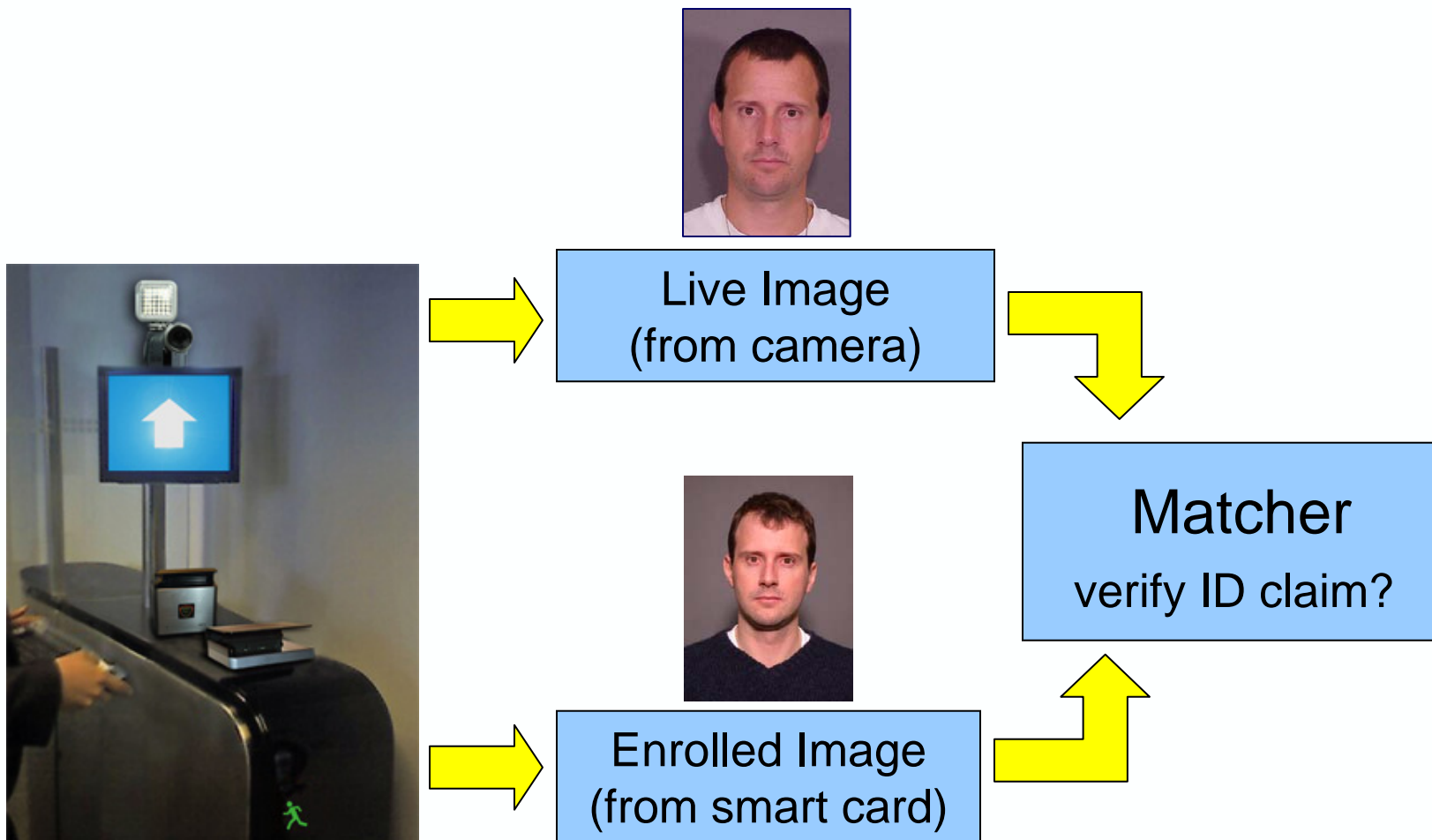
# Identification Performance (score-based)



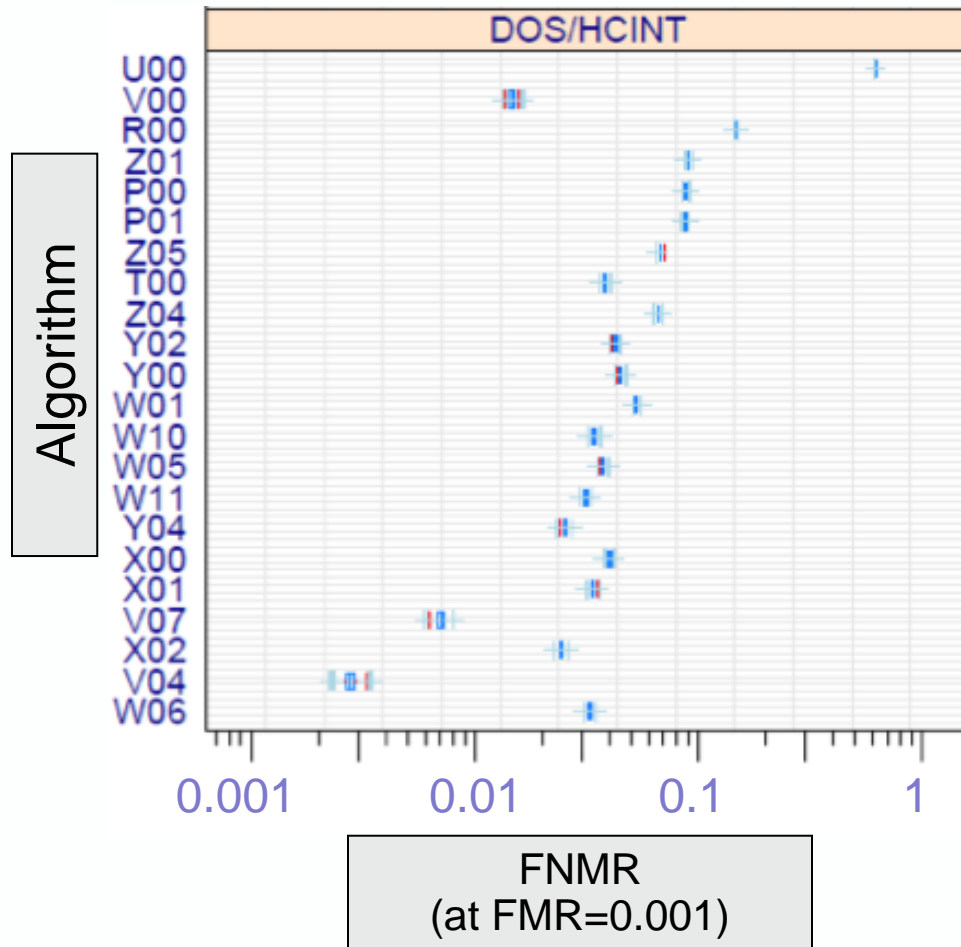
➤ Best algorithm depends on desired selectivity.

Gallery: 1.6 million LEO images.

# Verification



# Verification Performance



Best algorithm:

FNMR < 0.003 (at FMR = 0.001)

FRVT 2006 best algorithm:

FNMR = 0.026 (at FMR = 0.001)

FRVT 2002 best algorithm:

FNMR = 0.20 (at FMR = 0.001)

# Sources of Error

---



Non-frontal  
pose



Non-neutral  
expression

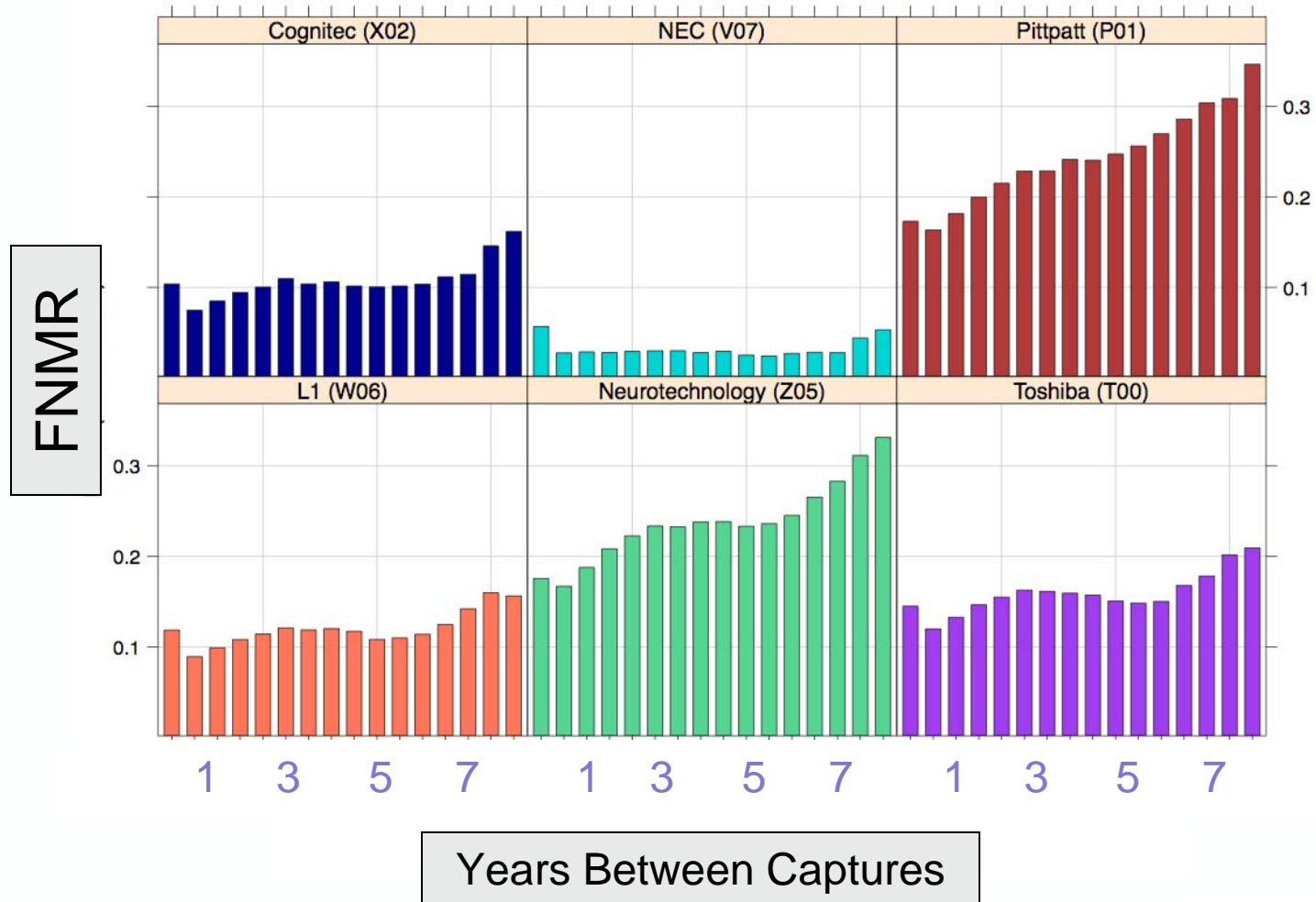


Bad  
lighting



“Fish Eye”  
effect

# Face Aging



# Upcoming in the MBE Still Track

- Revision to Report (NIST IR 7709) will include
  - New algorithms
  - Pose effect (class D)
  - Memory Usage
- Follow-up compression study
  - Relevant to situations where face images are stored on space limited devices such as smart cards (e.g. E-Passports, gov't PIV cards).
  - Transferring images over limited bandwidth networks.
  - Guidelines for compressing face images.
  - Handling compressed video.



# Thanks for your Attention

<http://face.nist.gov/mbe>

[gw@nist.gov](mailto:gw@nist.gov)

[patrick.grother@nist.gov](mailto:patrick.grother@nist.gov)

[jonathon.phillips@nist.gov](mailto:jonathon.phillips@nist.gov)