Research on HID

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at TAPAC

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Biometrics

- *Biometrics 'pre-history'*
  - Signature – confirm an agreement
  - Latent fingerprints –Ties a person to a scene
  - 10 print fingerprint – Uniquely identifies a person

- *Recently, biometrics have been used for:*
  - Access Control
  - Cooperative Subjects
  - Single-mode biometrics combined with human interaction (e.g. login, badge presentation, etc.)
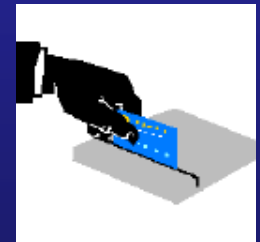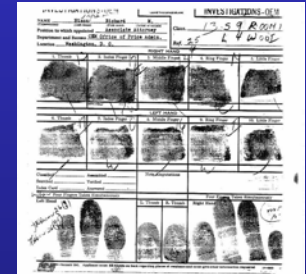
- *HID tries to extend the technology to distance and non-cooperative subjects*

HID Project

Detect, track, and identify people, including non-cooperative subjects, in distance (up to 500ft) by using multiple modality

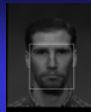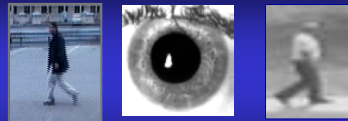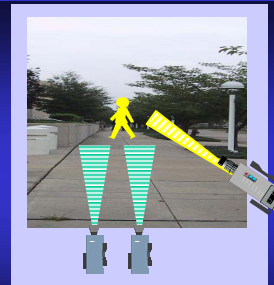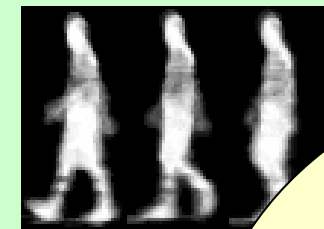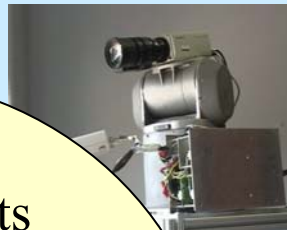| <10 Feet	<150 Feet	500 Feet
Cooperative Subjects (indoors)	Cooperative Subjects (outdoors)	Non-cooperative Subjects
Limited Signatures	Multiple Signatures	Multi-Modal
Traditional Biometrics	Active Systems	Integrated Systems

CMU HumanID Project

Body/Gait

Shape based recognition
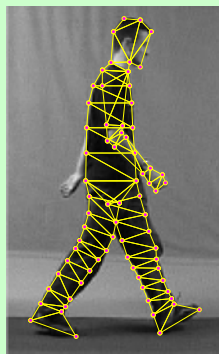
2D body model fitting

Distance HID
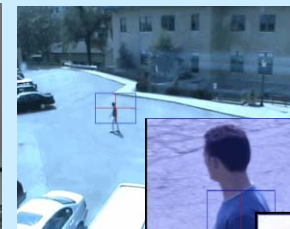
Master/slave active image acquisition

Datasets

MoBo

Cohn-Kanade

K-Act

PIE

Face/Expression

Non-rigid feature detect/track

AAMs

Asymmetry analysis

Activity

shape/color/motion

time

sort
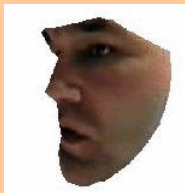
Motion segmentation
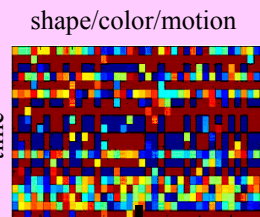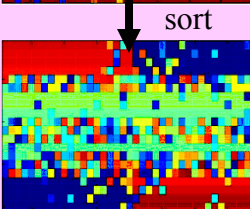
activity clustering

Putting "D" in HID

Master camera

detect/track

servo control

pan/tilt

Slave camera
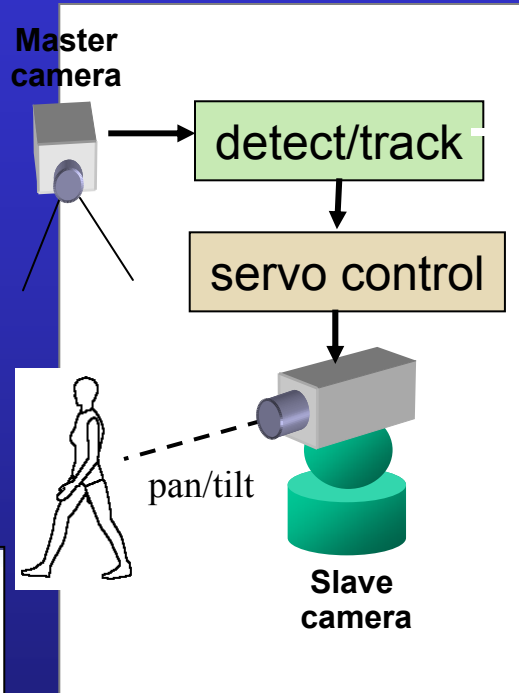
Detect/Track
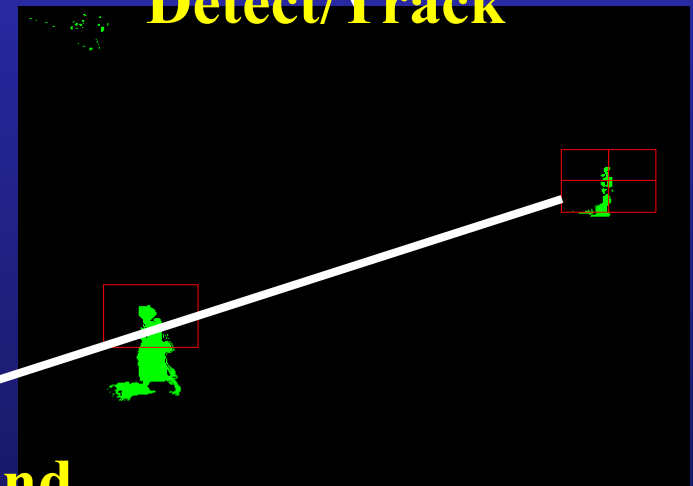
Zoom and Track

Face/Gait recognition

State of the art of Face Recognition:

"Verification" Task
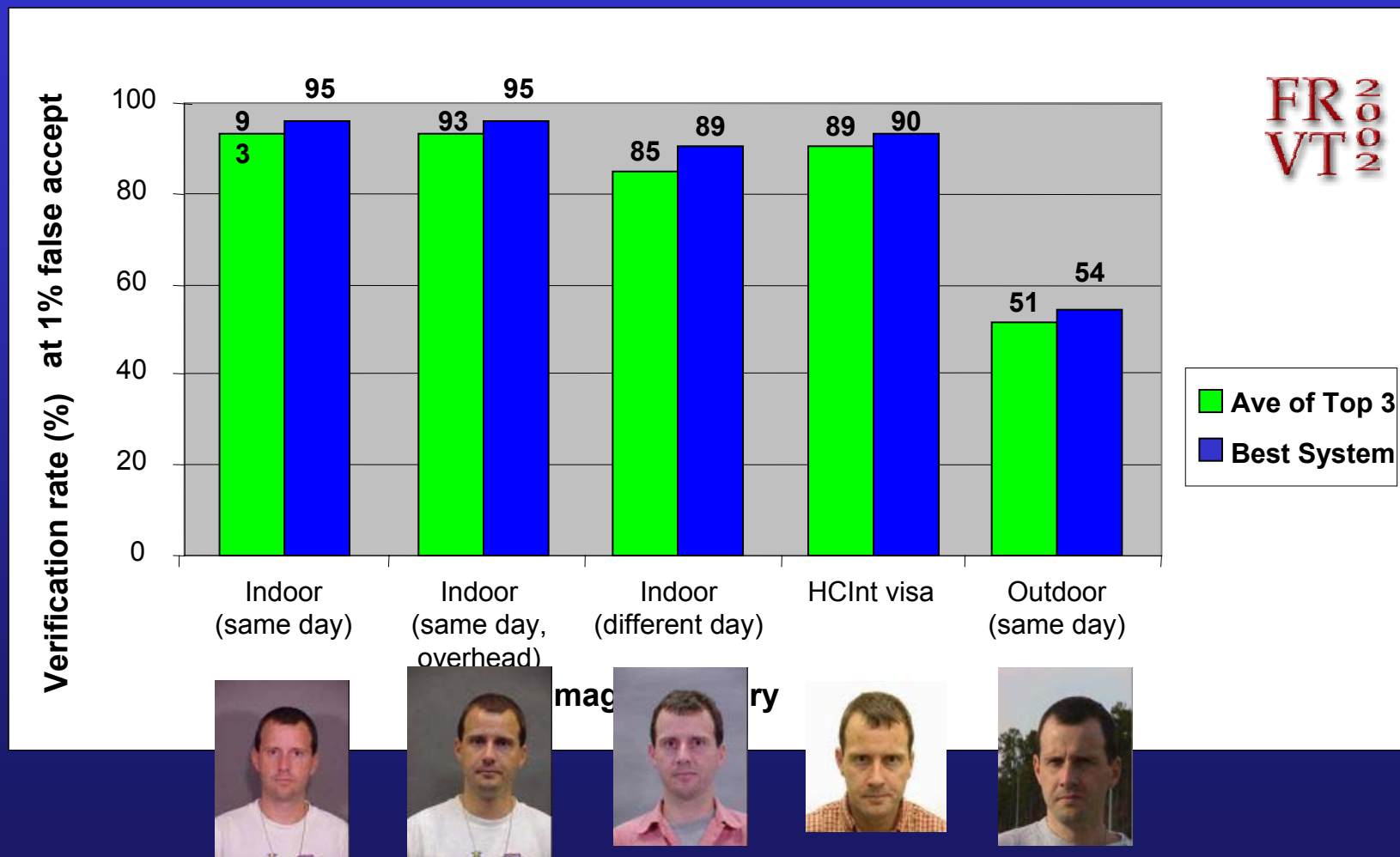
Verification = Accept or reject of the claimed identity

State of the art application

SmartGate
Passport Australia

5 photo enrollment process

Registration

SmartGate

- **Sydney Airport**
- **Place passport on reader**
- **Checks person is enrolled**

- **~4,000 crew enrolled**
- **> 50,000 transactions**
- **Most referrals not related to Face Recog.**

Qantas Crew Survey Results

- **Conducted by AC Nielsen**
- **530 crew surveyed**
- **70% of all Sydney based aircrew enrolled**
- **SmartGate preferred method of border clearance for 98% of aircrew**
- **85% of aircrew prefer SmartGate to other automated systems**
- **96% of aircrew have no privacy concerns**

Face Recognition works, and people like it.
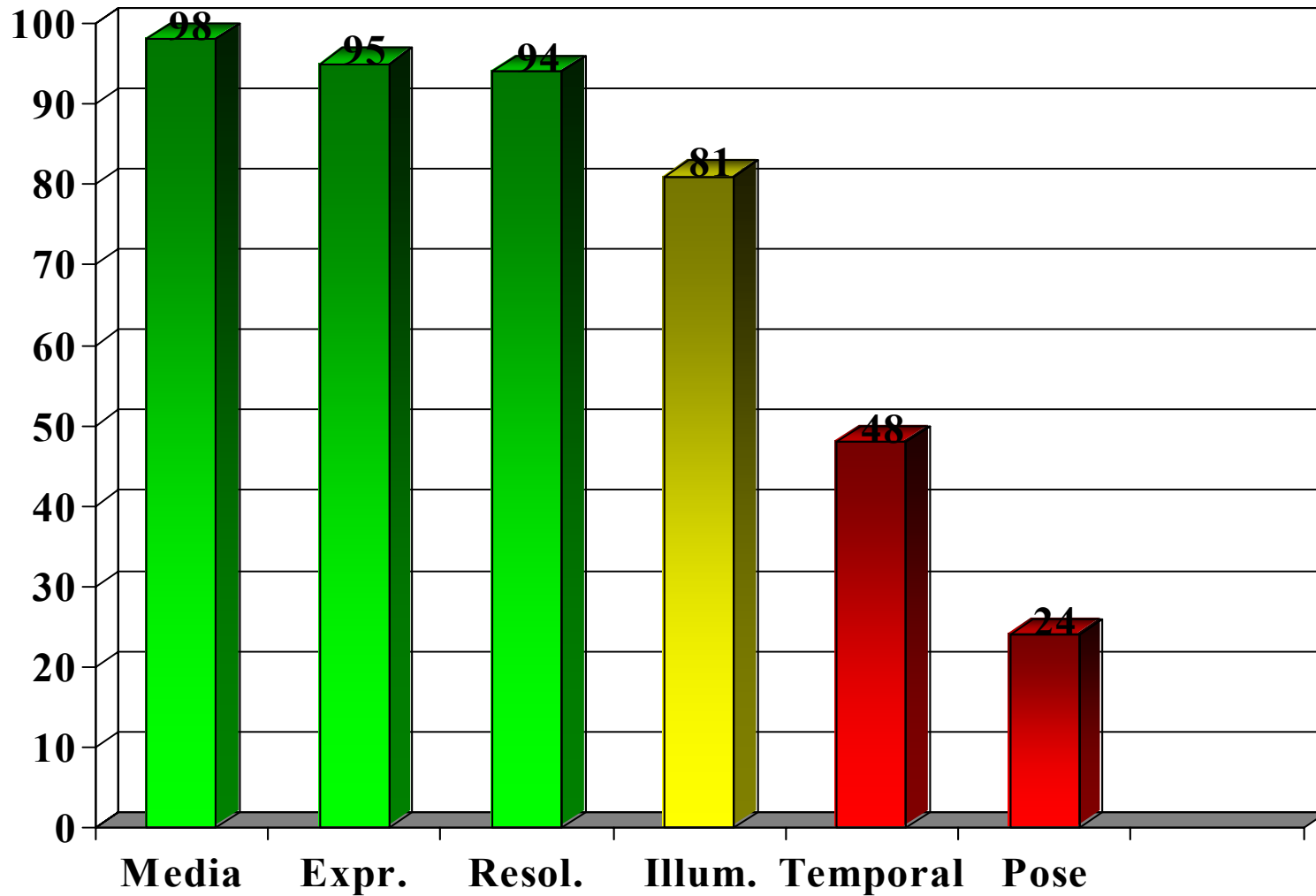
Face identification is far more difficult with non-cooperative subjects

Variations!

- Pose

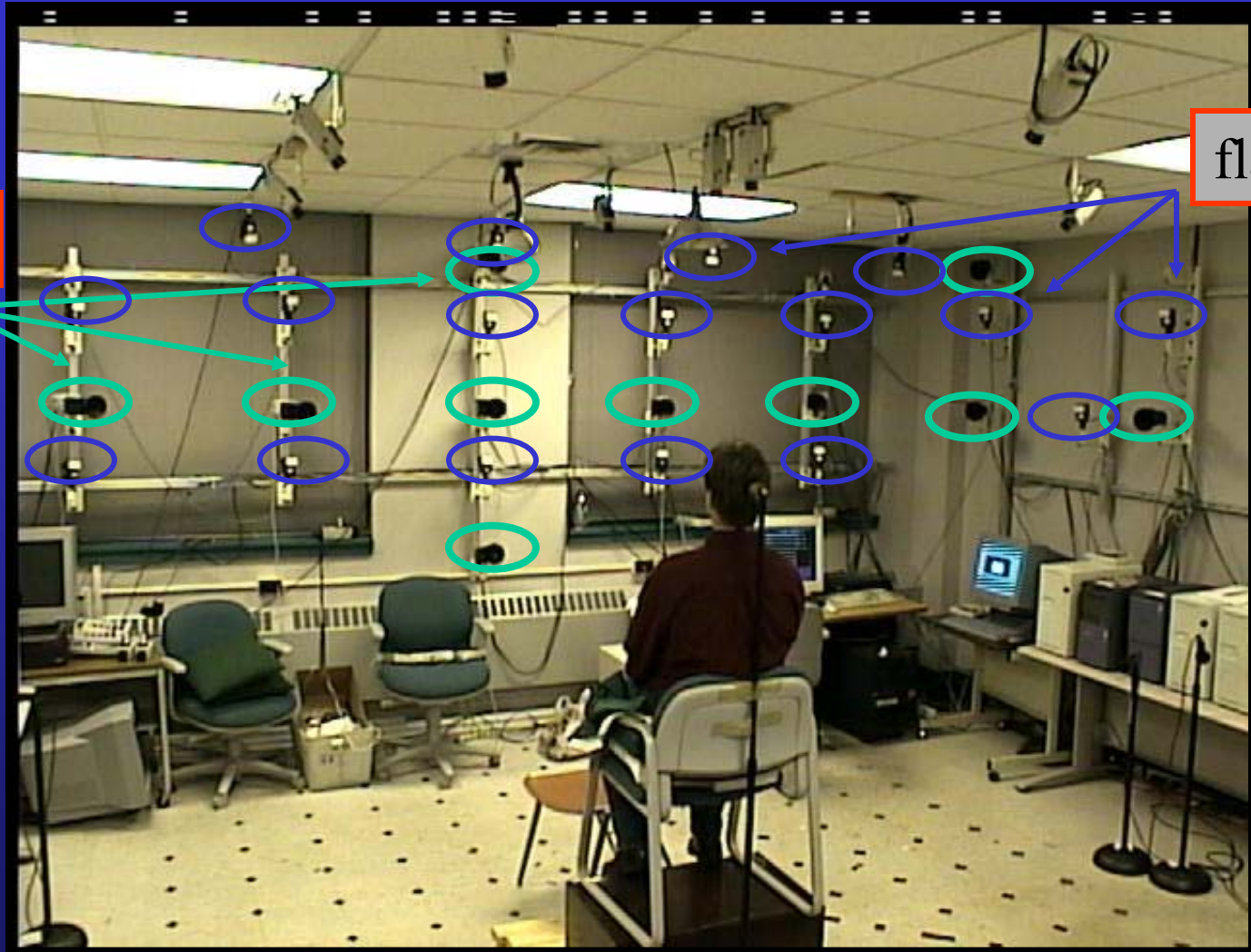- Illumination

- Expression

- Resolution

- Occlusion

- Time lapse
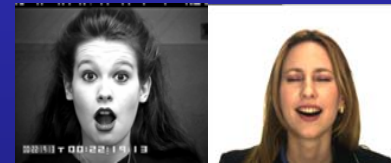
Face Recognition Vendor Test 2000
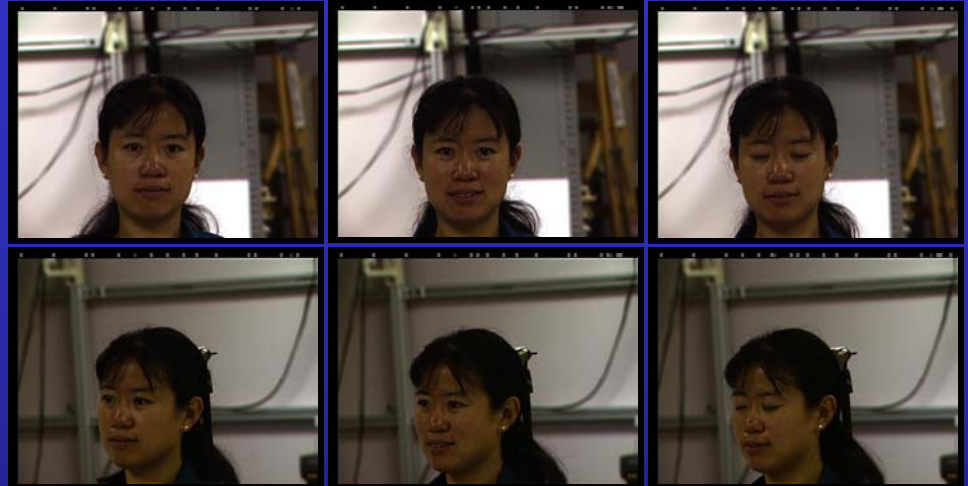
CMU "PIE" Capture Setup

CMU PIE (Pose, Illum. Expression) Database
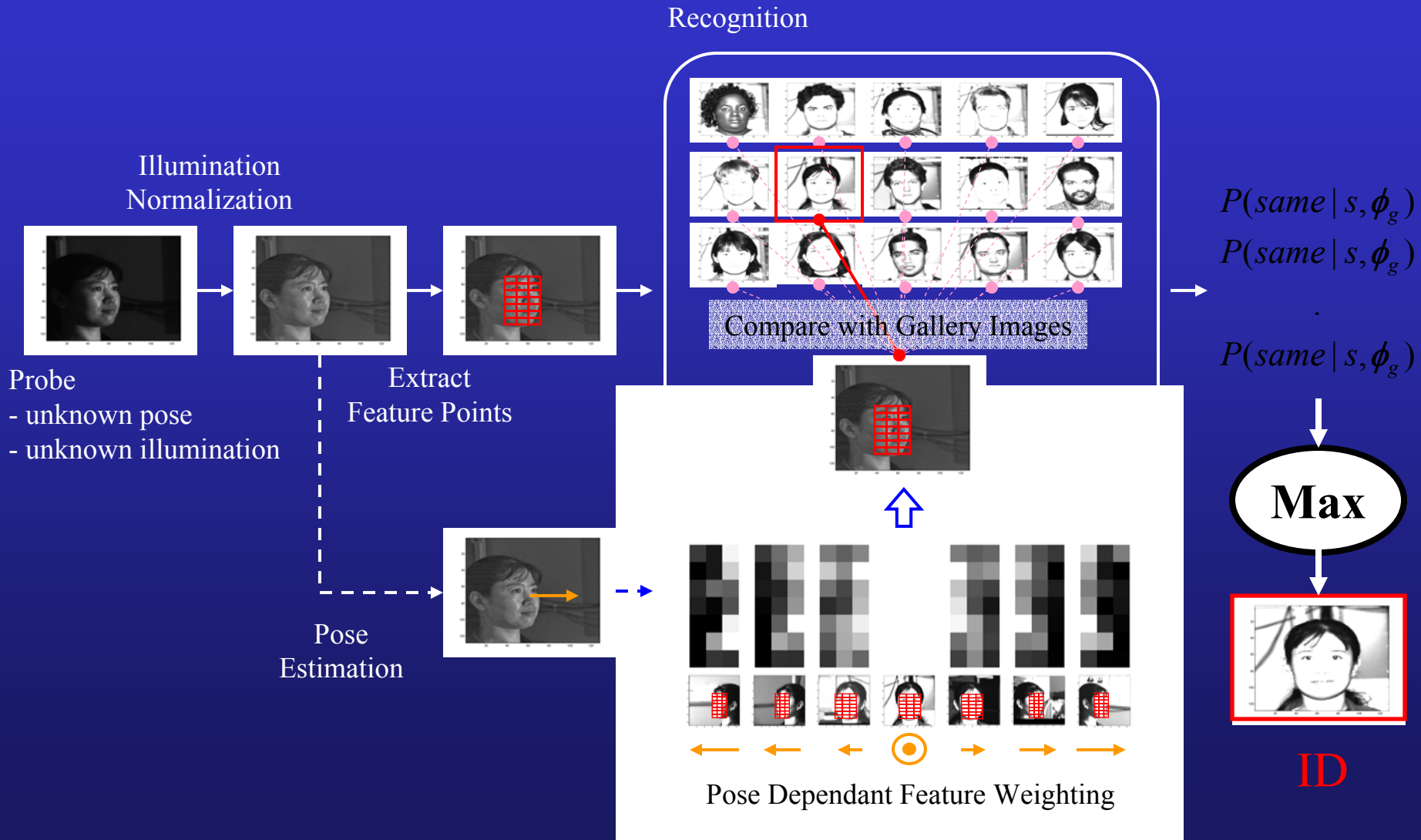
21 Illuminations

Expression

Neutral   Smile   Blinking

13 Poses

c25   c09   c31
c22   c02   c37   c05   c27   c29   c11   c14   c34
c07

68 peoples

Pose Invariant Face Recognition

Recognition

Illumination
Normalization

Probe
- unknown pose
- unknown illumination

Extract
Feature Points

Pose
Estimation

Compare with Gallery Images

Pose Dependant Feature Weighting

$P(same \mid s, \phi_g)$
$P(same \mid s, \phi_g)$
.
$P(same \mid s, \phi_g)$

Max

ID

Performance for Pose Variance with PIE Database
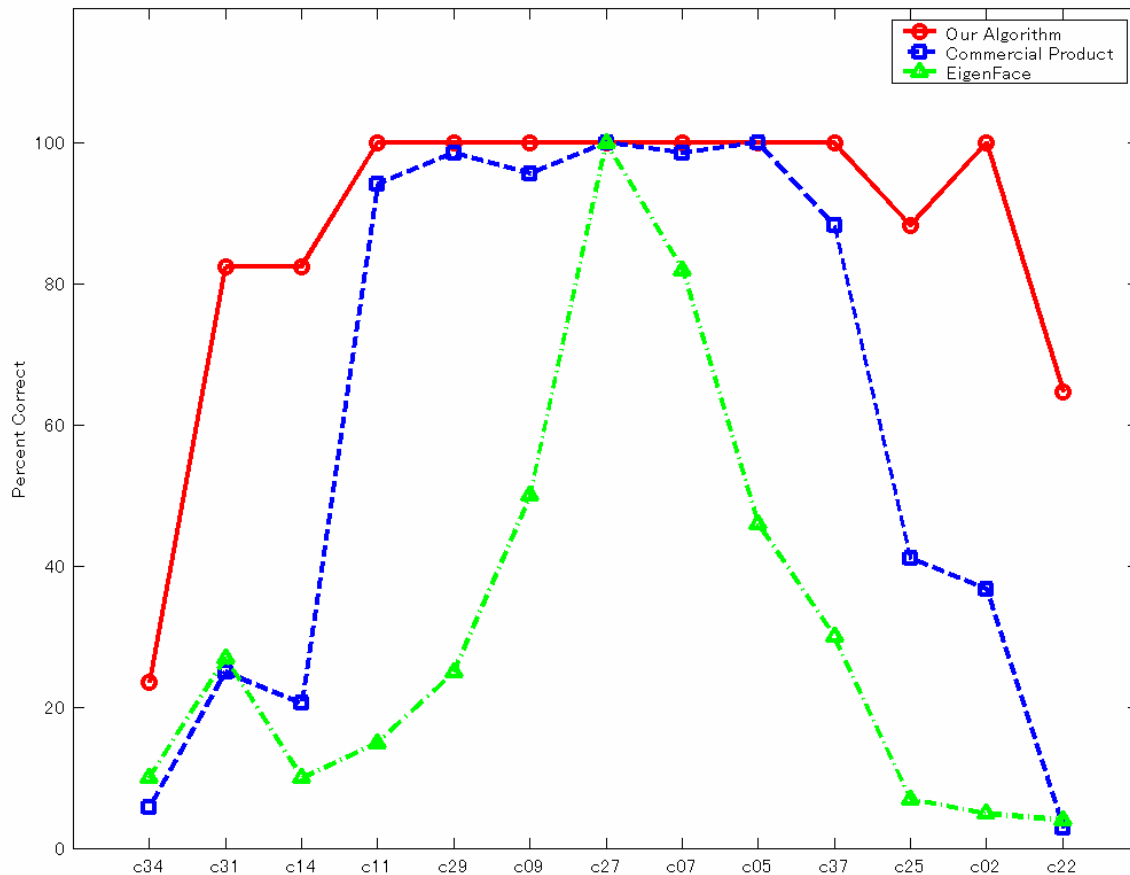
Pose Variance of Probe

Human Identification Technology

- Research performed under IRB-approved process
- Important technology with many critical and useful applications, such as access control, crime prevention, security, and force protection
- Still progressing and requires progress before massive and naïve applications
- Intensively studied and applied by other countries