Face Recognition Grand Challenge
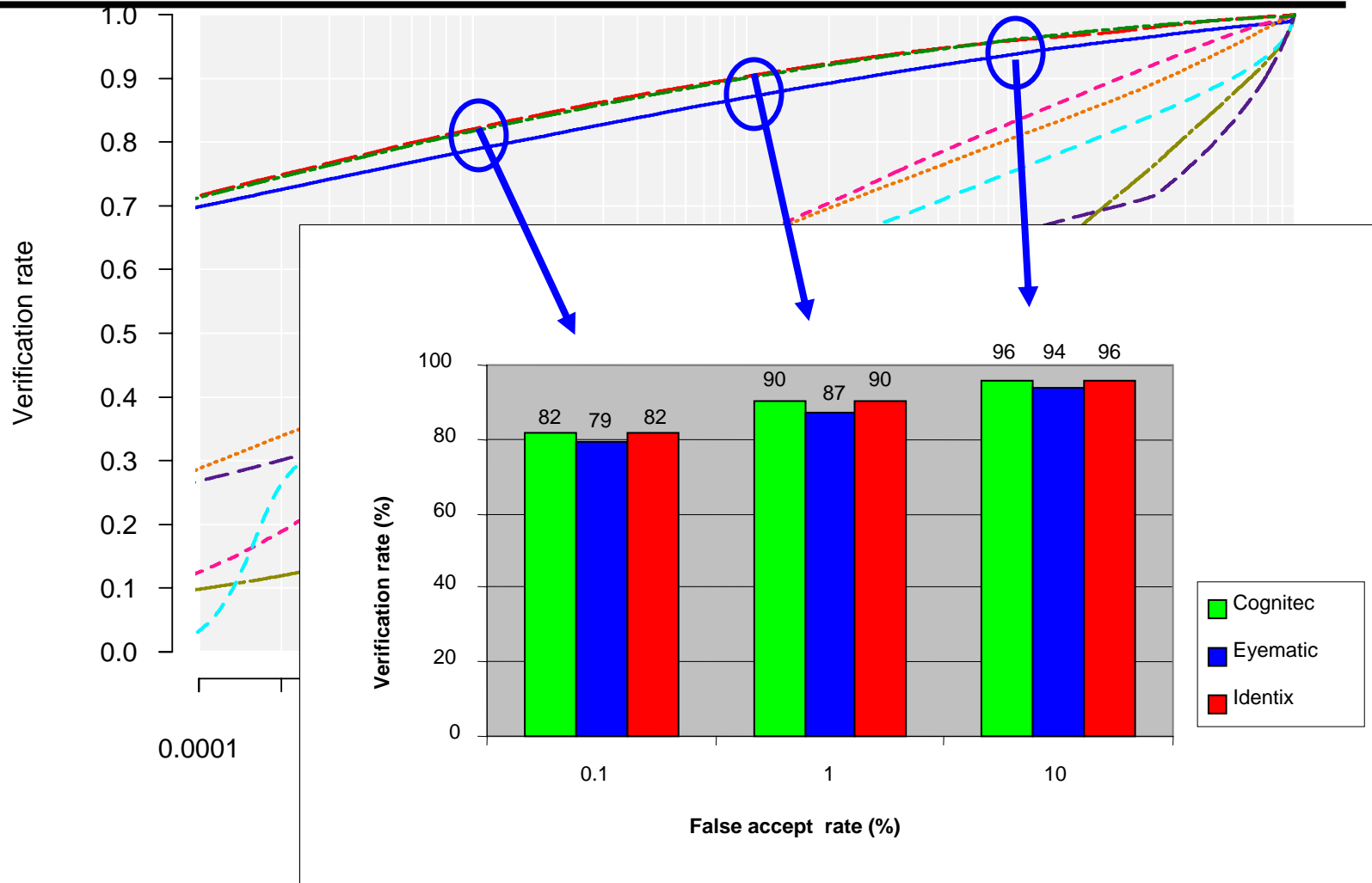
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NIST

March 2004

Face Recognition Grand Challenge

Systematically pursue two methods (2D and 3D) to reduce the error rate in face recognition by an order of magnitude.

Verification - HCInt

Select Point to Measure

- **Verification rate at :**
  - False accept rate = 0.1%

- **Current:**
  - 20% error rate (80% verification rate)

- **Goal:**
  - 2% error rate (98% verification rate)

Measuring Accuracy w/Error Rate of 2%

- **Non-match scores:**
  - Sufficient

- **Match scores:**
  - Need to design collection for sufficient number

1,000 match scores	=	~ 20 errors
10,000 match scores	=	~ 200 errors
50,000 match scores	=	~ 1,000 errors

- **Allows for error ellipses**
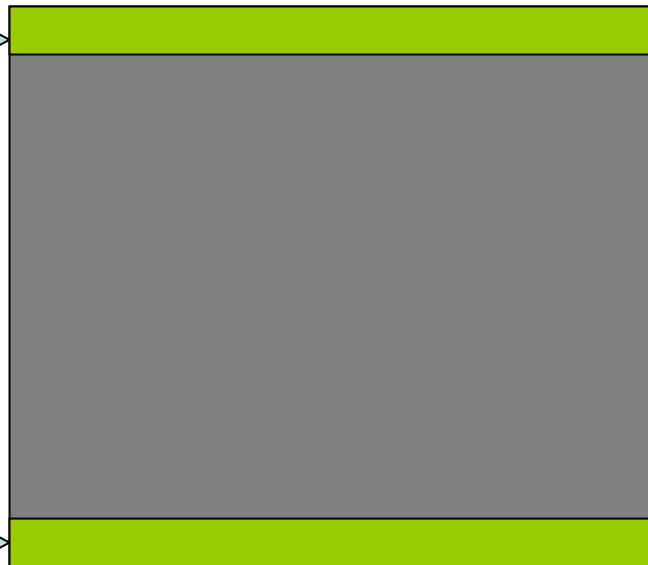- **Minimal demographic analysis**

Data Collection

Fall Semester	Spring Semester
(Gallery)	(Probes)
15 Weeks	15 Weeks
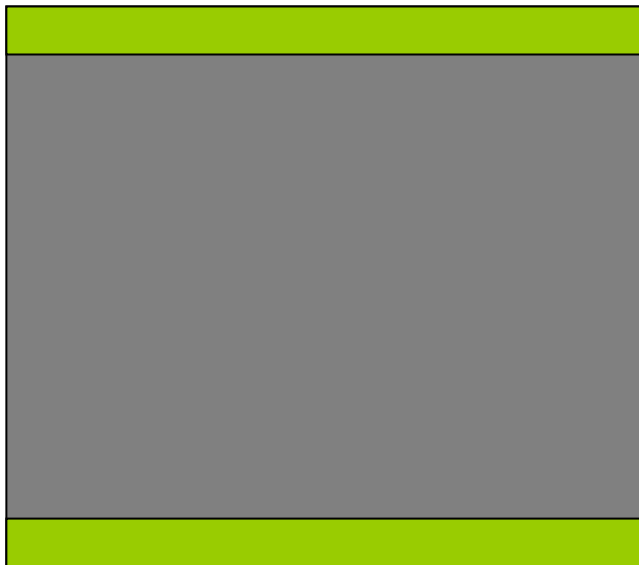
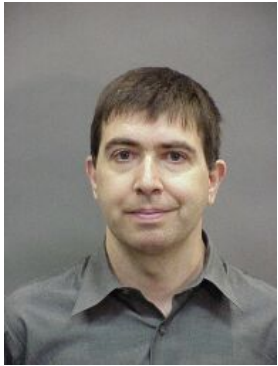**200 People**   **200 People**

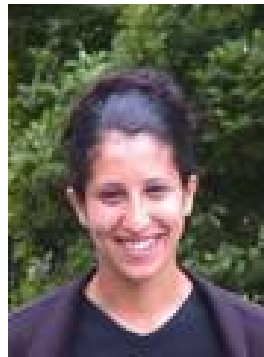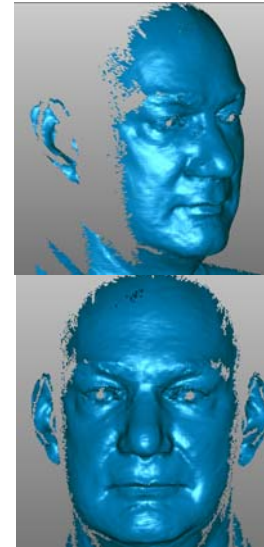**All match scores   ~ 50,000**

Modes Examined
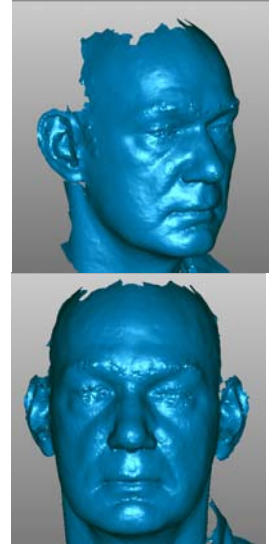

Single Still

Multiple Stills

Outdoor/ Uncontrolled

3D Single view

3D Full Face

Measure Progress on:

- Indoor cooperative face recognition
- Outdoor cooperative face recognition
- Comparison of still & 3D face recognition
- Effect of multiple images
- Effect of High Dynamic Range cameras on outdoor face recognition
- Comparison between human and machine performance

Programmatic

- **Series of Challenge Problems**
  - Facilitate development
  - Systematically measure progress

- **FR Challenge Grand Challenge Evaluation**
  - Independent measure

Experiment Design
FRVT 2002 versus Grand Challenge

FRVT 2002

- Flat design
- Process all data
- Blind data
- Black box
- Single mode
- Fixed design
- Central analysis

Grand Challenge

- Combinatorial design
- Process subset of data
- Transparent data
- Transparent box
- Multiple modes
- Adaptive design
- Distributed and central analysis

Grand Challenge Schedule

Date	Activity
Aug-Sep '05	Face Recognition Grand Challenge Evaluation
Sep '04	Release challenge problem v2.0
Aug-Sep '04	Baseline performance determination for v2.0
April '04	Release challenge problem v1.0
April '04	First challenge problem workshop • Explain challenge problem in detail

Challenge Problem Infrastructure
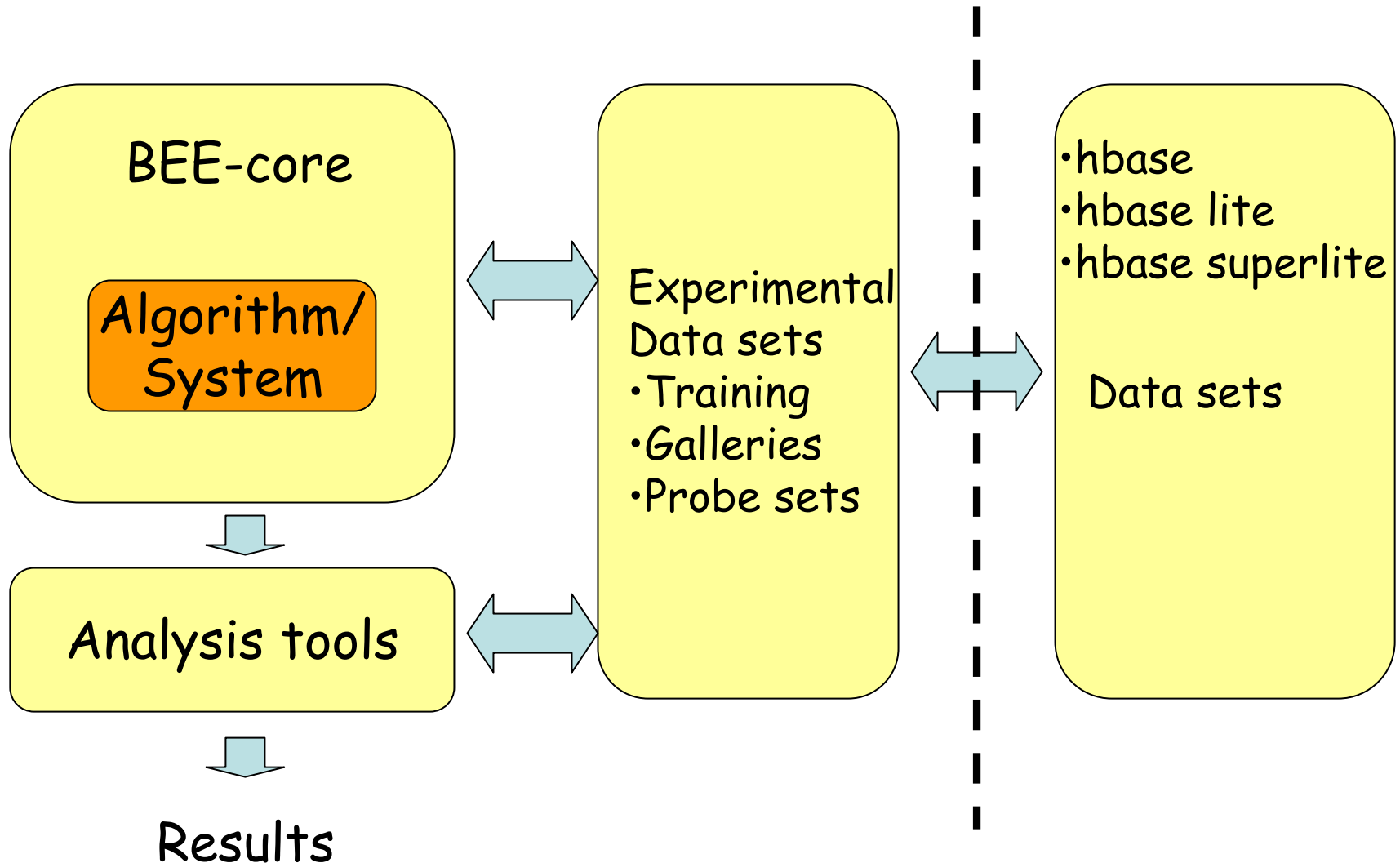
- **Based on HumanID gait challenge problem**
  - Design set of experiments
  - Baseline algorithms
  - **Infrastructure for running experiments**

- **Documented progress**
  - Forced researchers to concentrate on a problem

BEE Architecture

BEE: Biometric Experimentation Environment

- **Flexible Framework for Biometric Algorithms**
  - Plug & play algorithms
  - Mix & match modular components
- **Provides Universal XML-Based Interfaces**
- **Facilitates Biometric Evaluations**
- **Uses a Non-Proprietary Open Source Design**

Experiments

- **Evaluate single system using multiple datasets**
- **Evaluate multiple systems with uniform data**
- **Complete audit trail**
- **Audit trails are portable and can be used as inputs to subsequent runs**
- **Similarity matrices offer a portable representation of raw results**
- **Rerun trial using intermediate results**
- **View graphs/reports on experiments performance**
- **Supports independent advanced post analysis**

Experiment Definition

BEE

Data Sets
(Signature Sets)

Algorithm/ System

Raw Results
(Similarity File)

Analysis
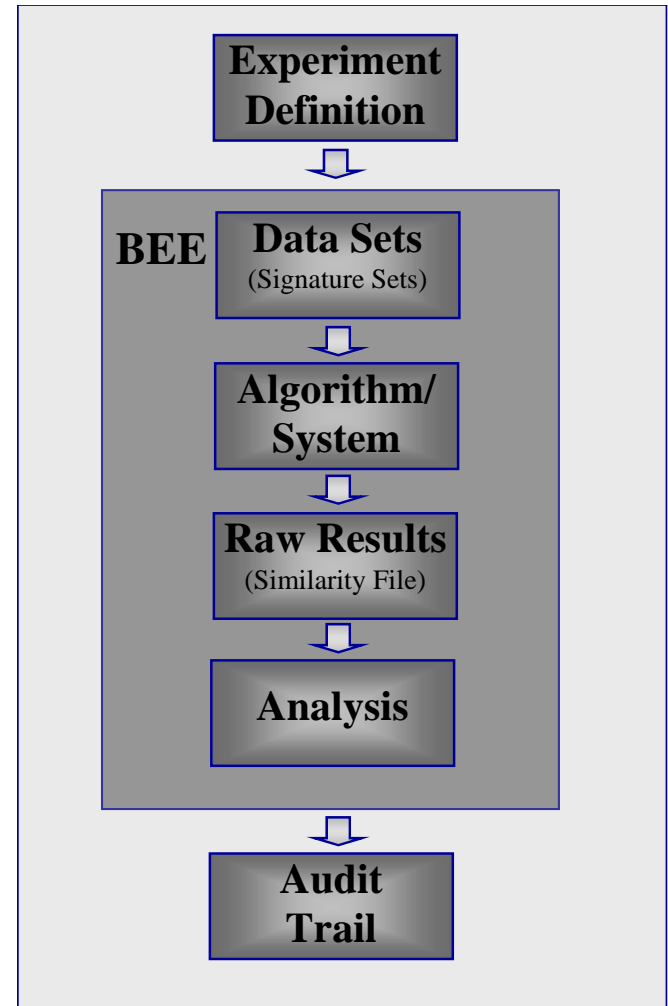
Audit Trail

Reproducibility via XML

Datasets (inputs)

Similarity Matrix (raw results)

Audit Trail (output)

```
<Signature>
  <Subject id="hgfR00001" />
  <Image file="img.jpg" />
  <Recording id="hgfR00001"/>
</Signature>
```

```
<Audit>
  <Target file = "DataSet1.xml" />
  <Query file="DataSet2.xml" />
  <BioBox module="hFace 1.2"/>
</Audit>
```

```
<Audit>
  <Similarity file="Similarity.xml" />
  <Target file = "DataSet1.xml" />
  <Query file="DataSet2.xml" />
  <BioBox module="hFace 1.2" />
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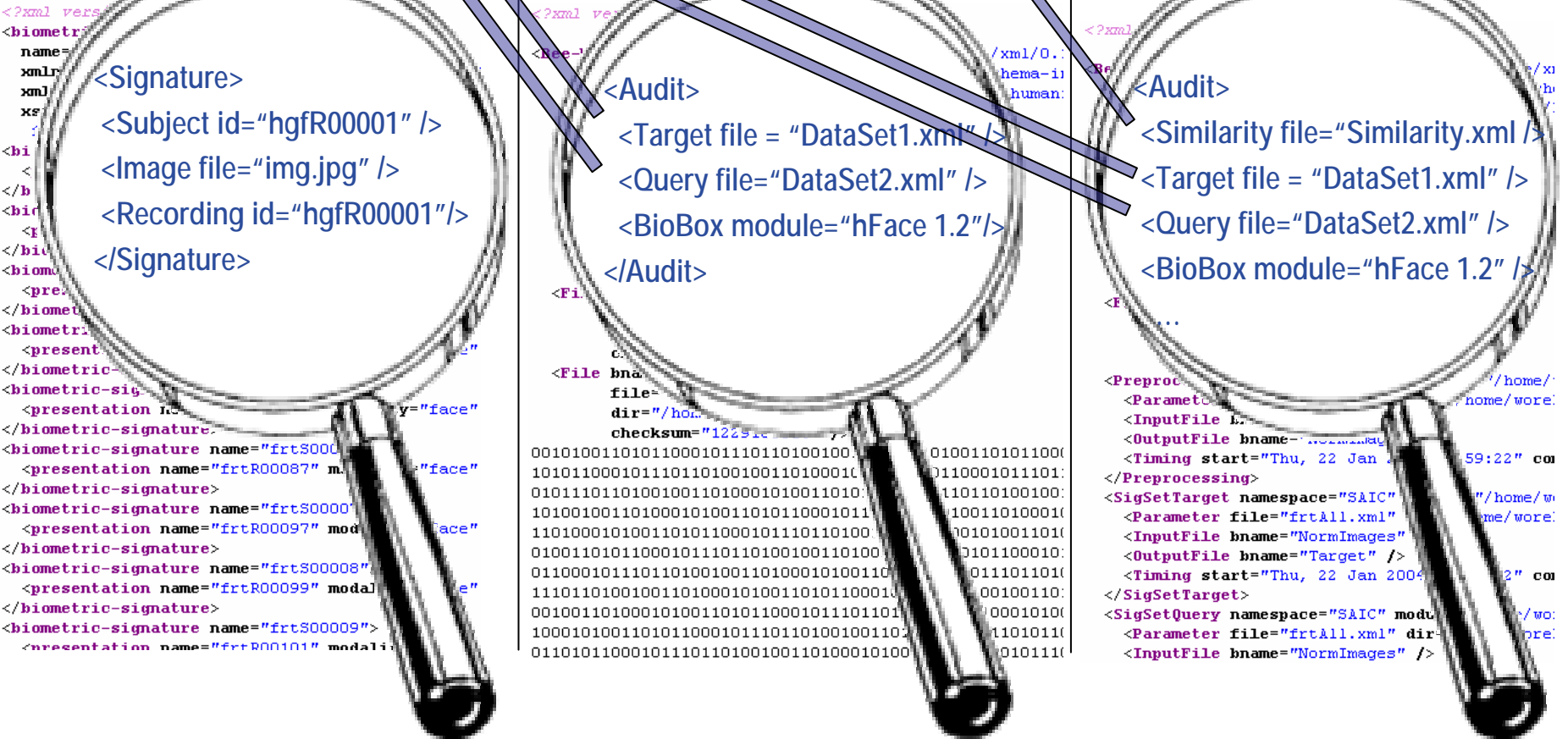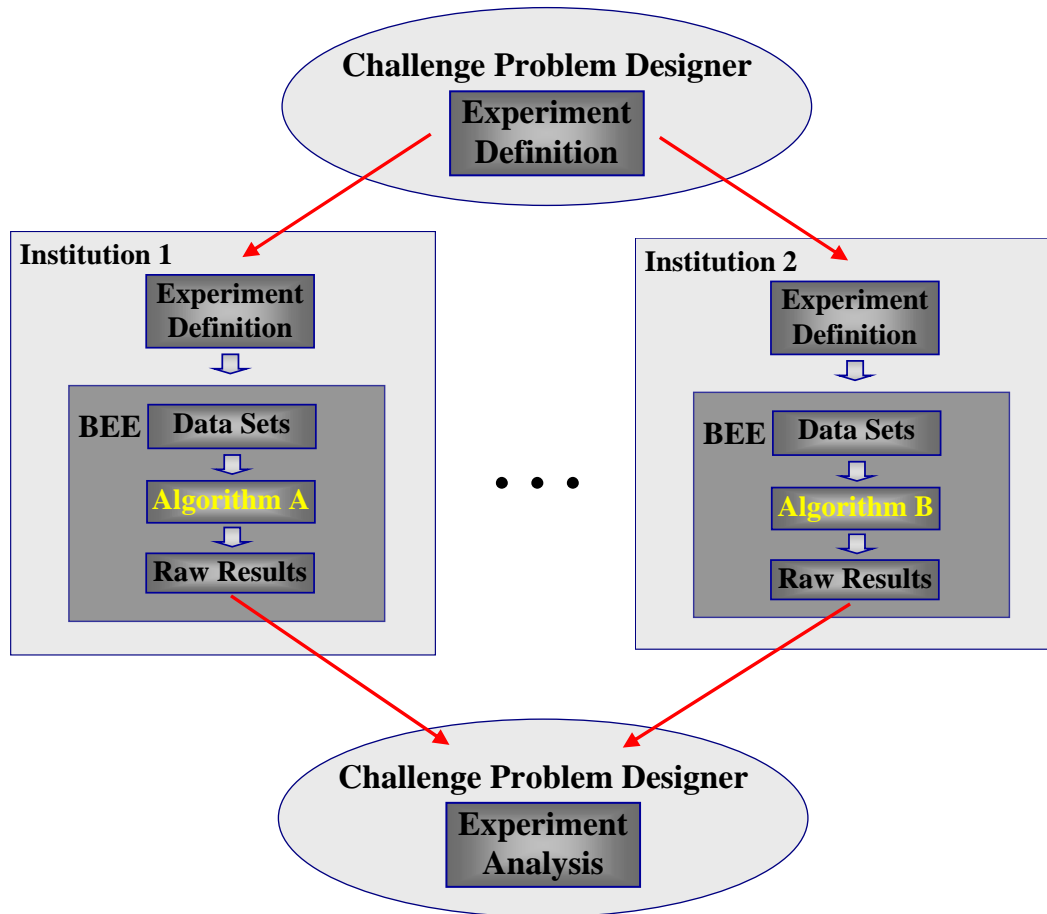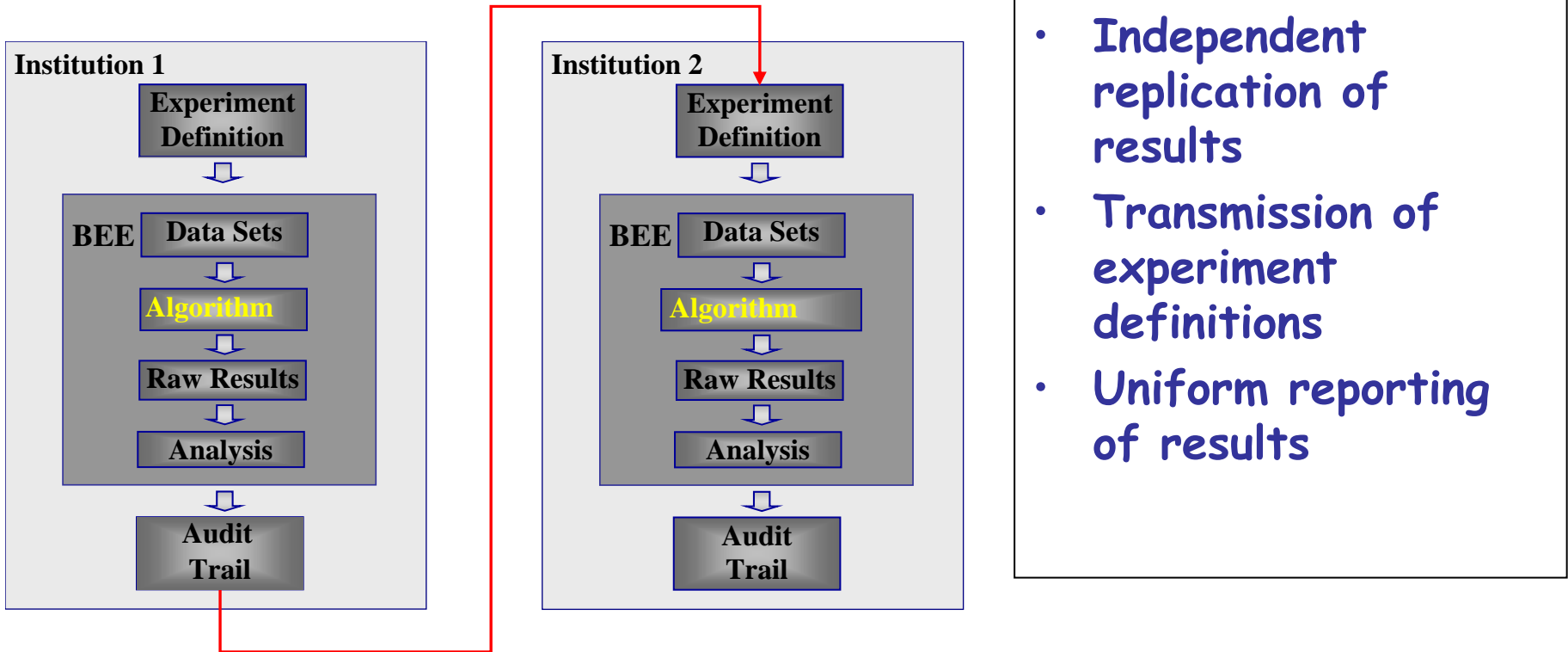
Cross Institution Experimentation

- **Execution of multiple algorithms at multiple institutions with a common experiment definition**
- **Transmission of raw results**
- **Uniform reporting of results**
- **Cross institutional analysis**

Cross Institutional Experiment Replication

- **Independent replication of results**
- **Transmission of experiment definitions**
- **Uniform reporting of results**

Grand Challenge Evaluation Team

- **Jonathon Phillips—NIST**
  - Director Face Recognition Grand Challenge
- **Notre Dame (Prof. Kevin Bowyer and Prof. Patrick Flynn)**
  - Data collections
  - Baseline algorithms
- **SAIC (Dr. Todd Scruggs)**
  - Design and implement BEE
  - Maintain hBase
- **Mitre (Joe Marques)**
  - Analysis
  - Assist with Grand Challenge
- **University of Texas at Dallas (Prof. Alice O'Toole)**
  - Human performance

Conclusion

- **Face Recognition Grand Challenge**
  - Order of magnitude increase in performance
  - Systematically investigate still and 3D
  - Formulate series of challenge problems
  - Final Grand Challenge evaluation

- **Biometric Experimentation Environment (BEE)**
  - Infrastructure for Grand Challenge
  - Uniform structure for challenge problem