



# Visualization of Operational Performance in Biometric Systems

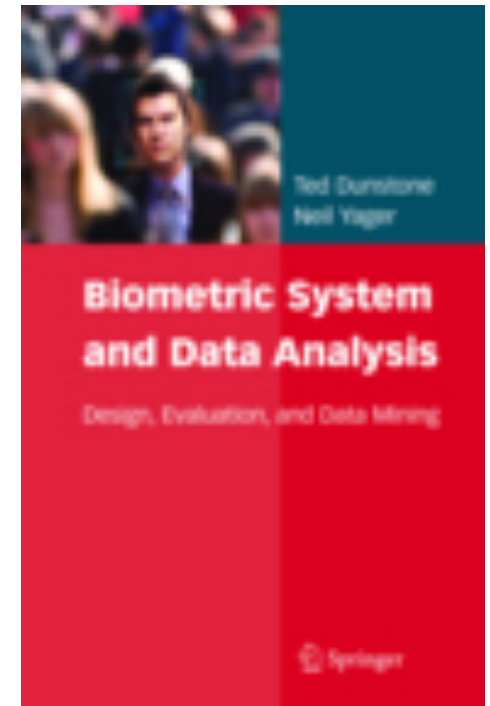
## The Zoo and Beyond

NIST Biometric Performance Conference

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Biometix



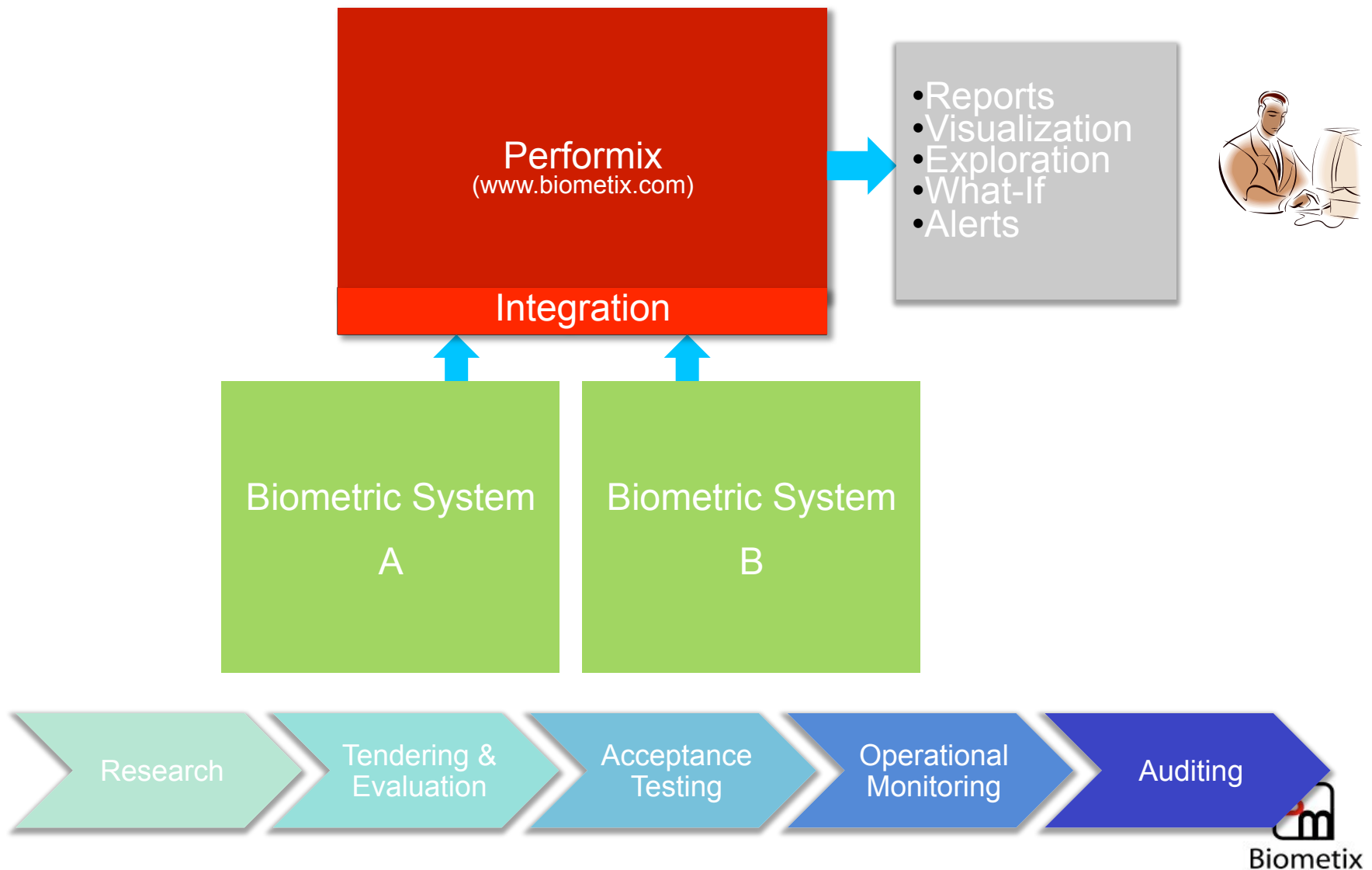
- Setting up and monitoring complex large scale biometric systems is costly, difficult and time consuming.
- What is needed in a testing/monitoring tool to automate the process & reduce cost
  - Accurate
  - Vendor Neutral
  - Uni/Multi-Modal
  - No Data Size Limit
  - Extensible
- We have built a tool where we have developed several new testing and visualization techniques, including zoo analysis.



<http://www.springer.com/computer/image+processing/book/978-0-387-77625-5>

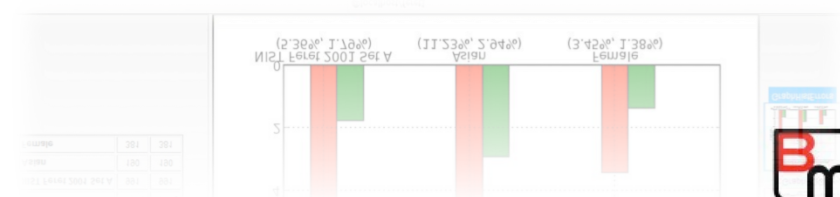
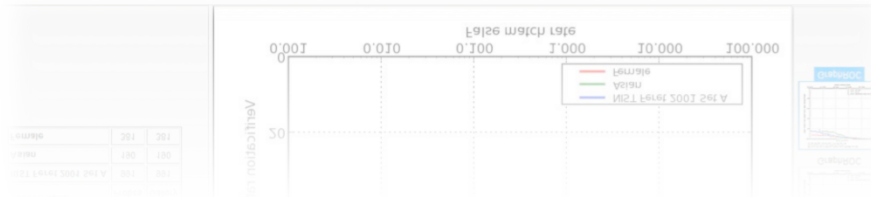
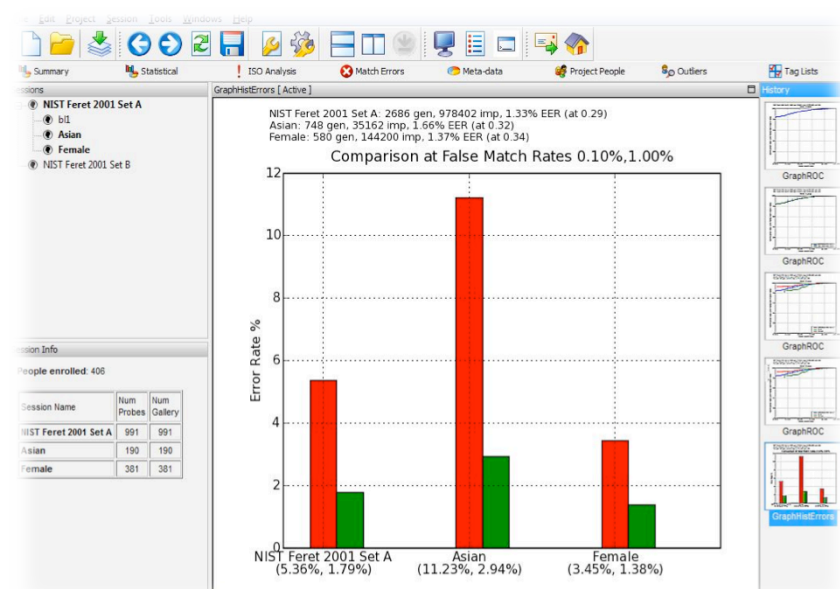
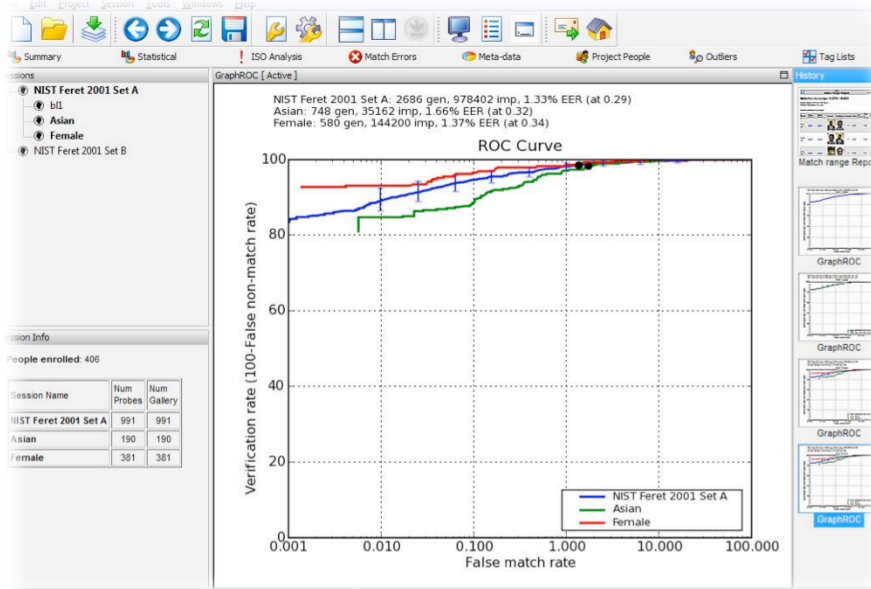


# Testing & Monitoring Framework





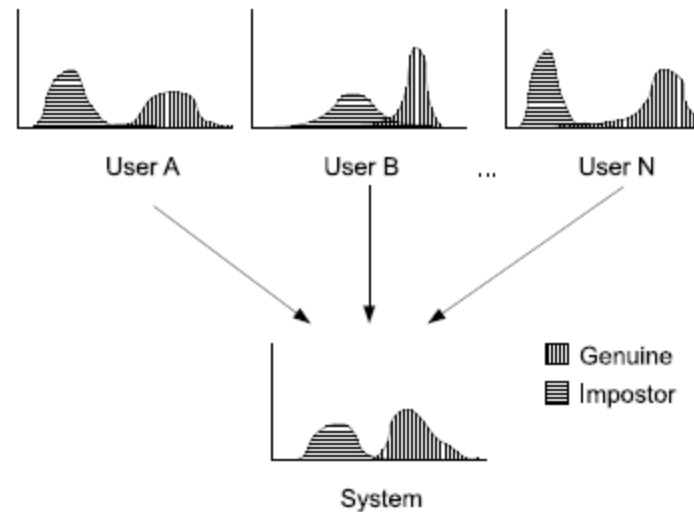
# Standard Group Statistics







# Zoo Analysis: Individual Analysis



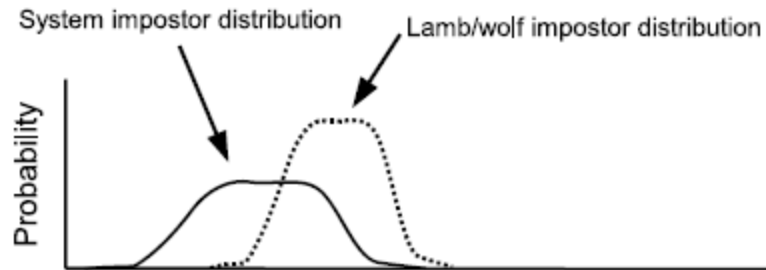
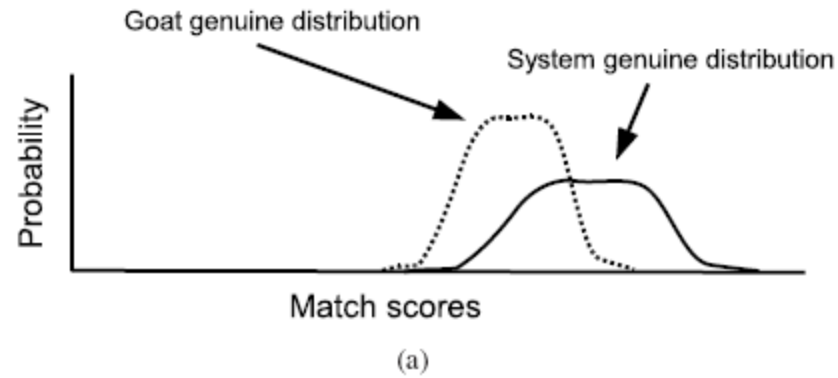
Physiology, Data Capture, Behaviour

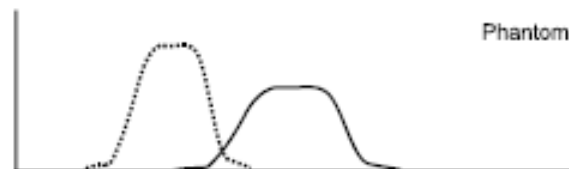
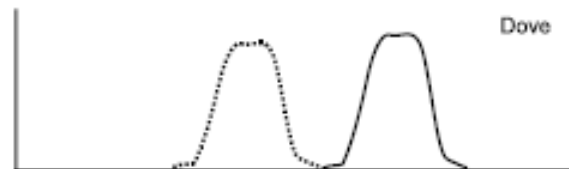
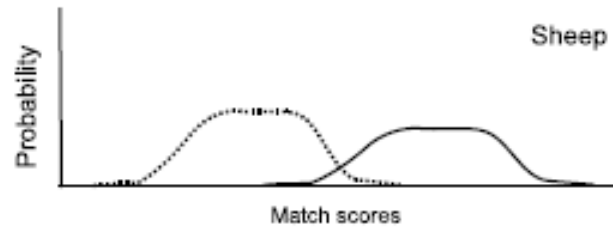
<http://www.computer.org/portal/web/computingnow/0210/theme/tpami>

Yager, N., Dunstone, T.: The Biometric Menagerie. IEEE PAMI Feb 2010

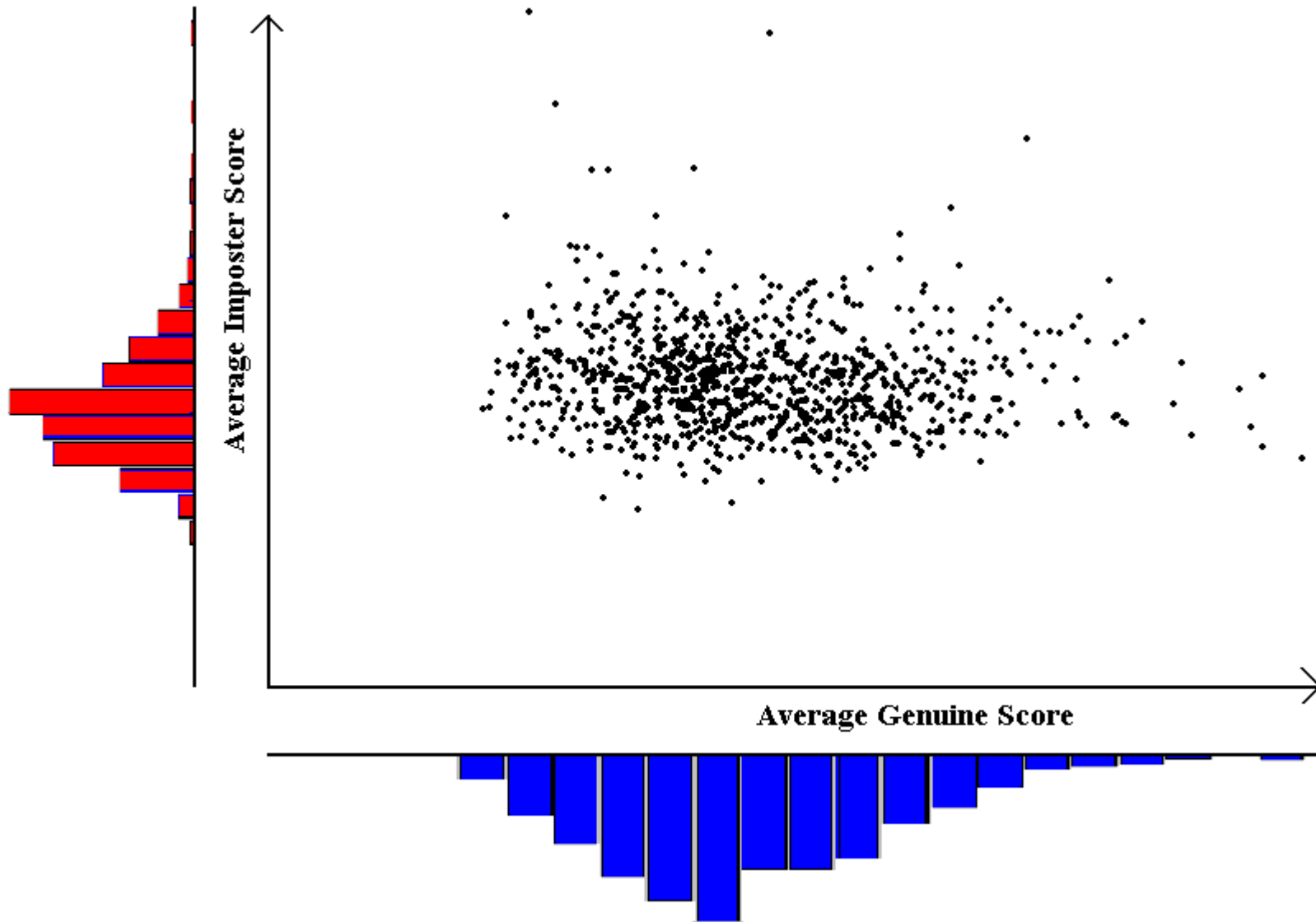


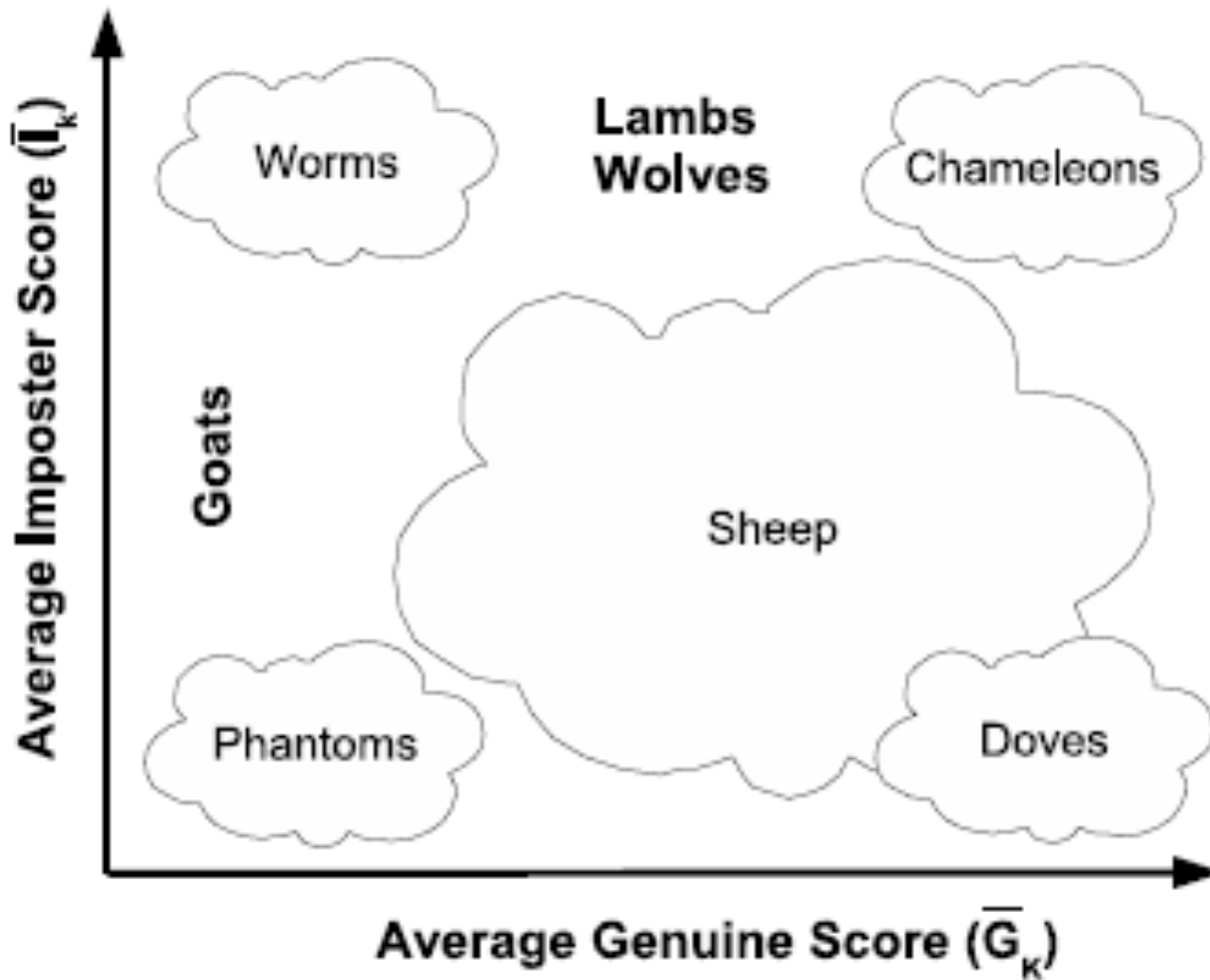
Biometix





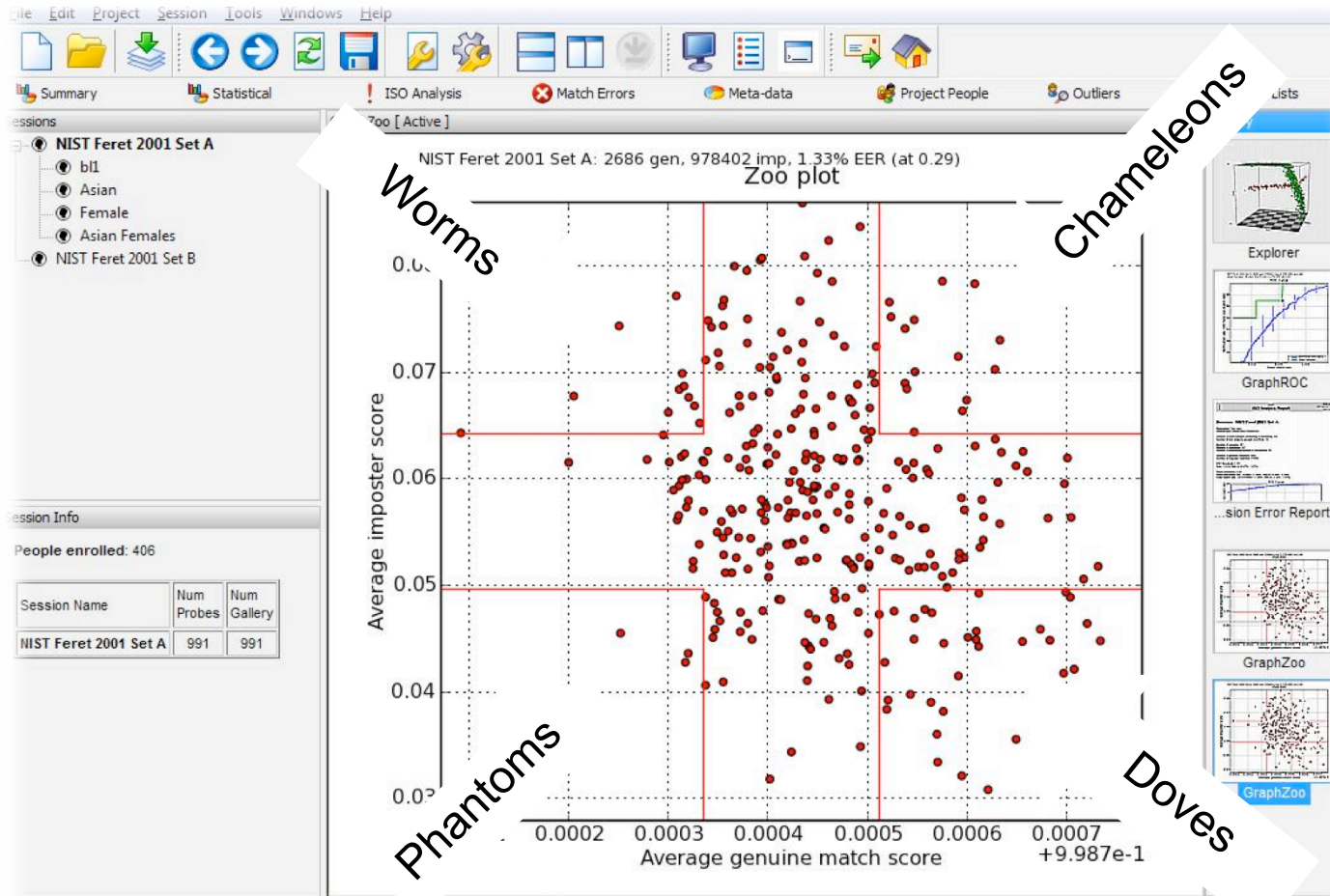
— Genuine  
..... Impostor





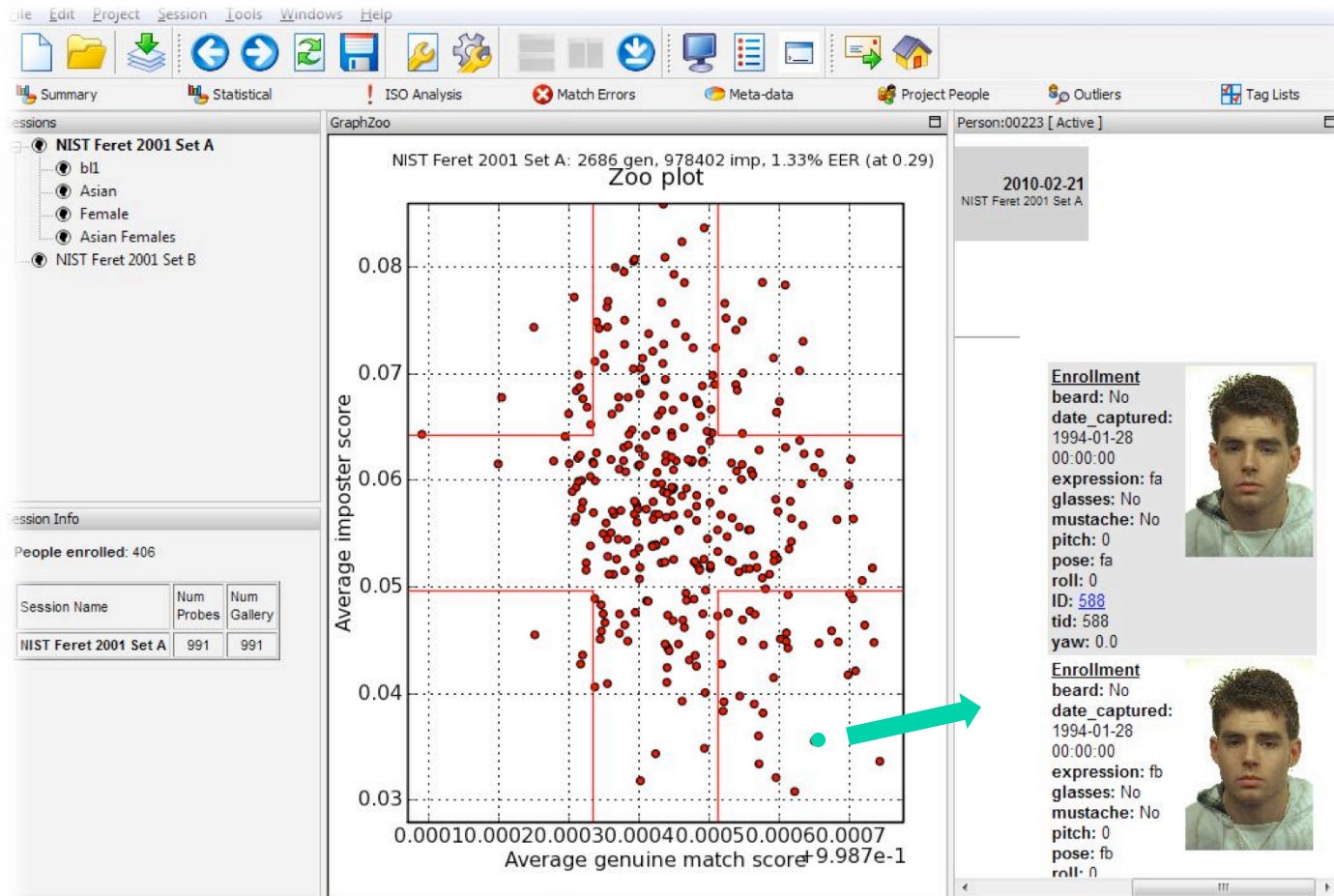


# Basic Zoo Graph





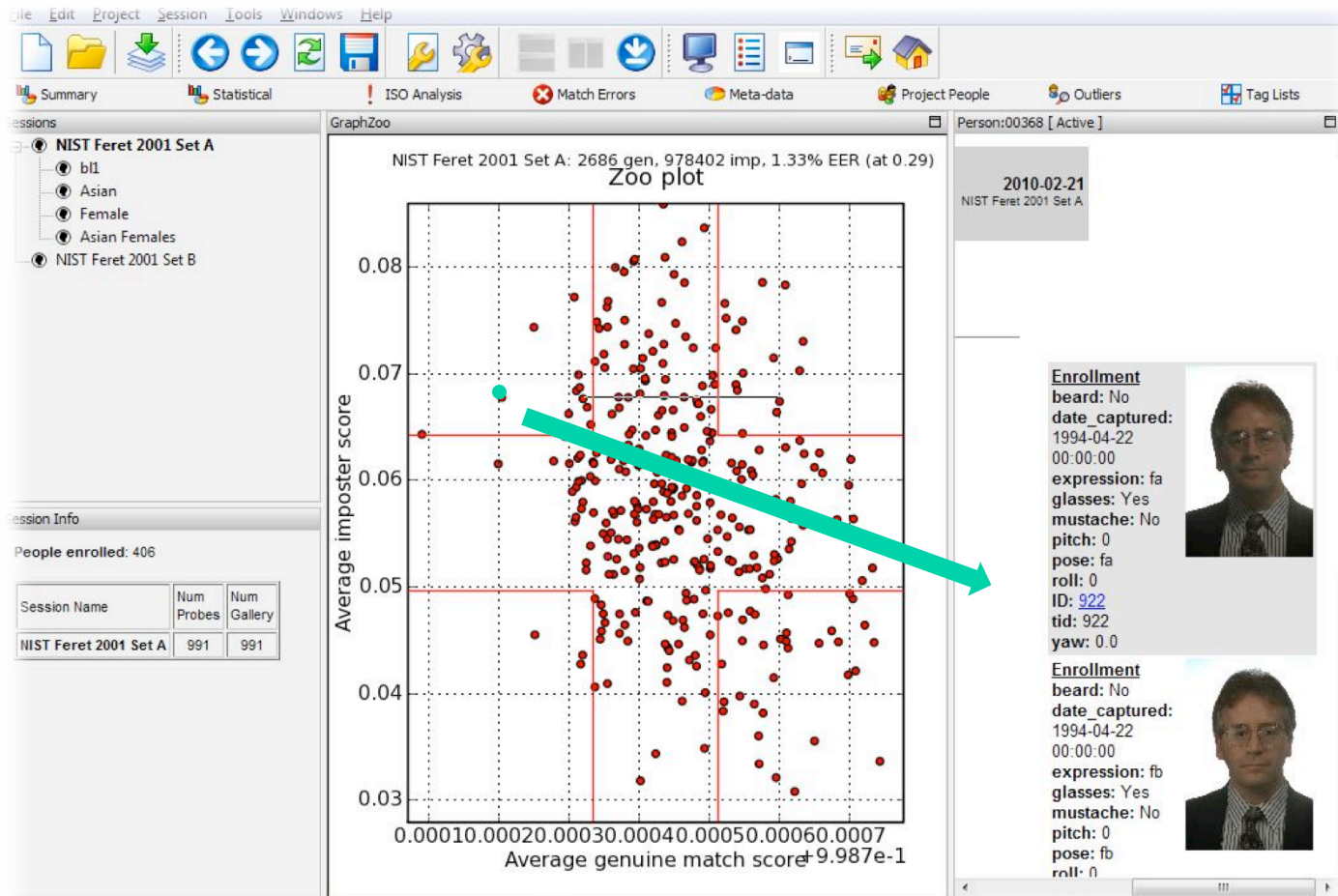
# Zoo – Dove (Good Users)







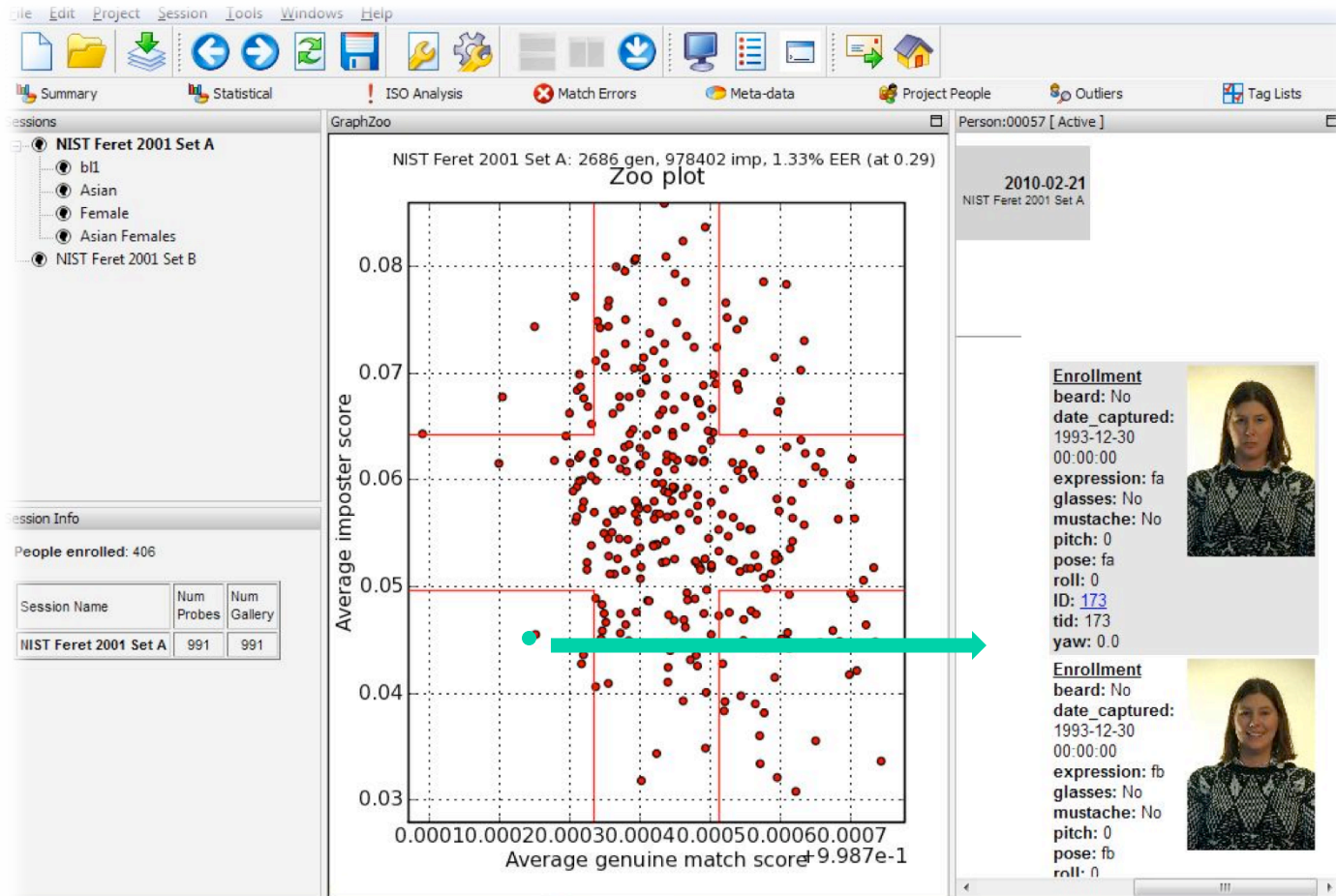
# Zoo - Worms (Bad) – Fix: Reduce Glasses Glare





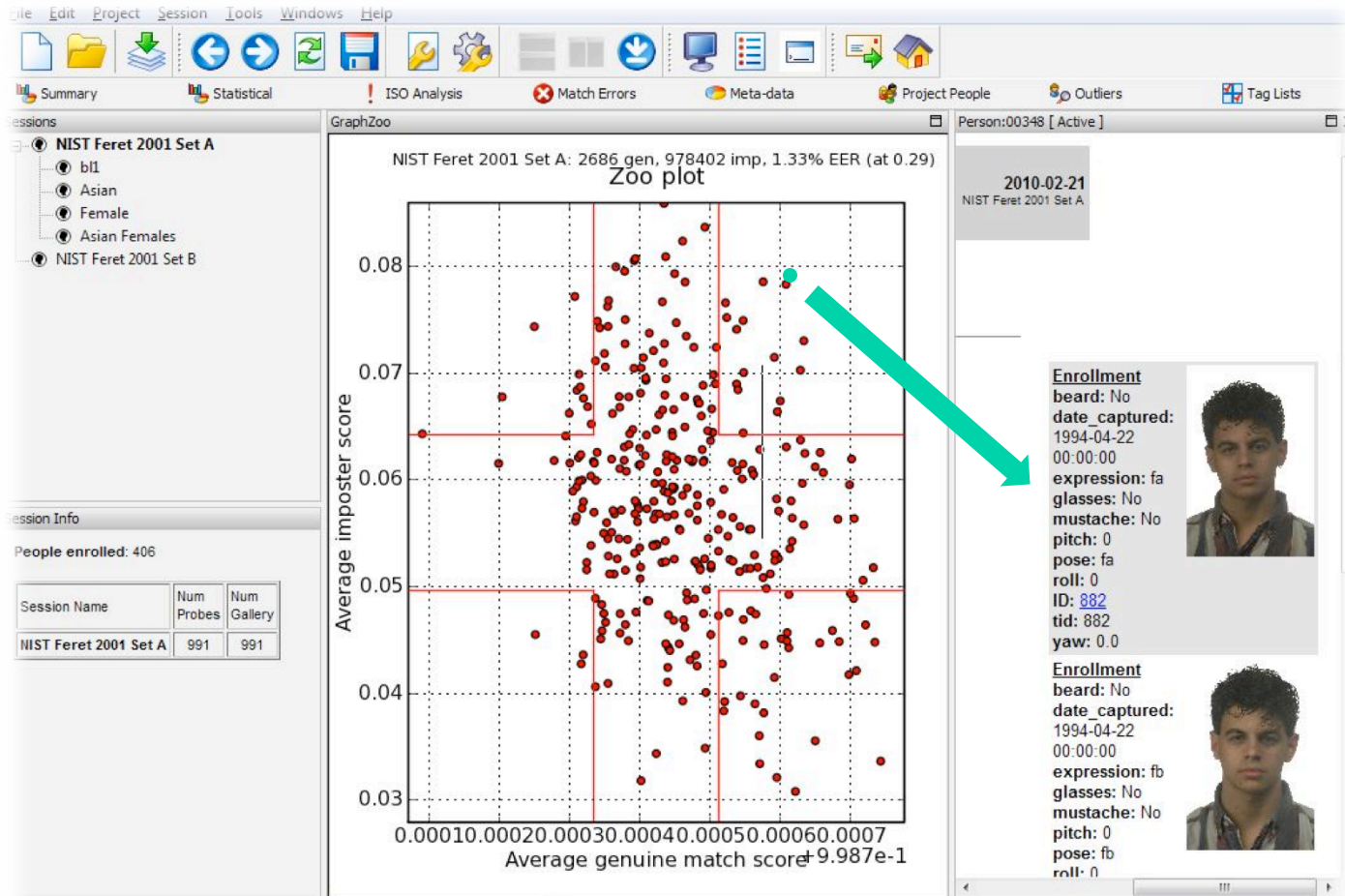


# Zoo – Phantoms(Bad) - Fix: Improve Lighting





# Zoo – Chameleons (Bad) - Fix: Look for Vulnerabilities





# Zoo Explorer - Investigation

File Edit Project Session Tools Windows Help

Summary Statistical ISO Analysis Match Errors Meta-data Project People Outliers Tag Lists

Person:00256 [Active]

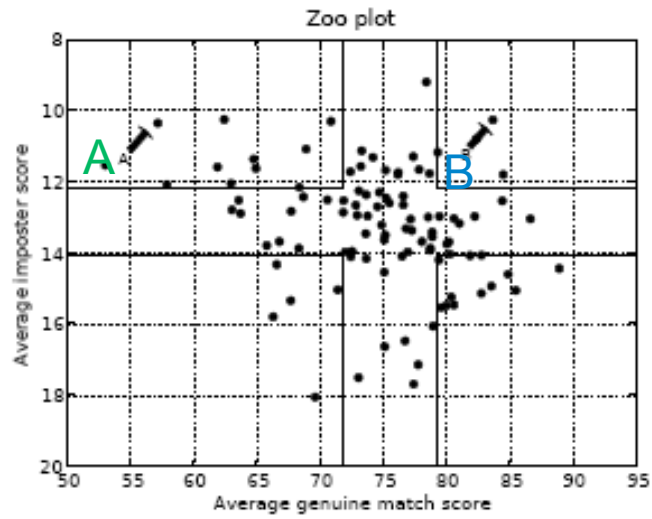
**Enrollment**  
beard: No  
date\_captured: 1994-01-28 00:00:00  
expression: fb  
glasses: No  
mustache: No  
pitch: 0  
pose: fb  
roll: 0  
ID: [653](#)  
tid: 653  
yaw: 0.0

**Enrollment**  
beard: No  
date\_captured: 1994-09-28 00:00:00  
expression: fa  
glasses: No  
mustache: No  
pitch: 0  
pose: fa  
roll: 0  
ID: [654](#)  
tid: 654  
yaw: 0.0

**Enrollment**  
beard: No  
date\_captured: 1994-09-28 00:00:00  
expression: fb  
glasses: No



(phantom)



(a)

(dove)



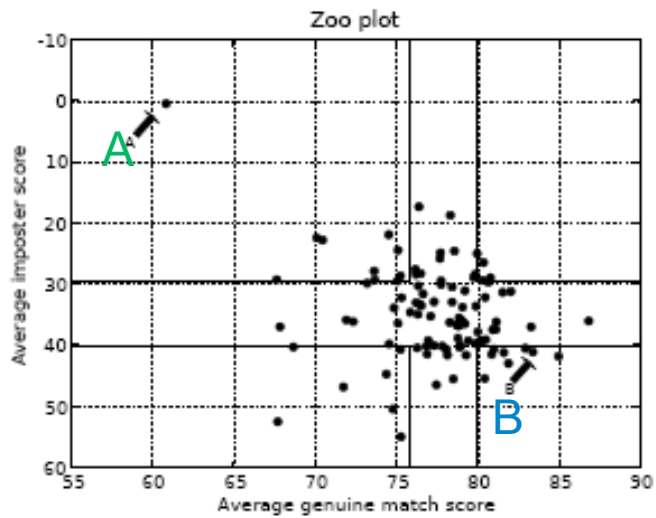
(c)

(d)

A

B

(phantom)



(b)

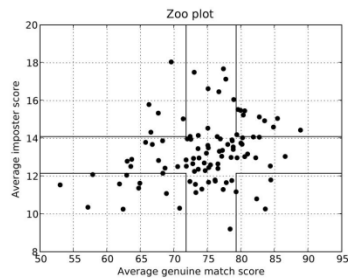
(chameleon)



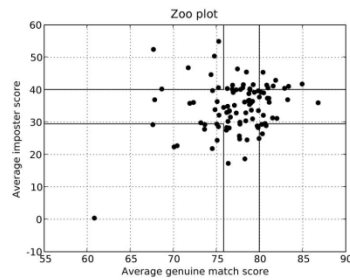


System	Population	Genuine Matches	Impostor Matches	EER
Fingerprint - Alg I	100	56	99	0.9%
Fingerprint - Alg II	100	56	99	3.4%
2D Face - Alg I	200	5	759	4.3%
2D Face - Alg II	200	5	759	1.7%
Speech	200	5	759	4.4%
Iris	208	3-11	1952-3600	2.4%
3D Face	249	1-120	4005-10000	1.6%
Keystroke - Alg I	289	3	37-128	5.3%
Keystroke - Alg II	289	3	37-128	3.8%
Synthetic Data	300	7-32	44-91	3.7%

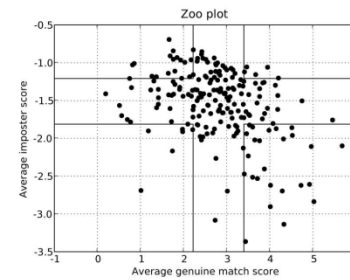
Pearson product-moment correlation coefficient is computed between the users' average genuine scores and their average impostor scores to determine relationship



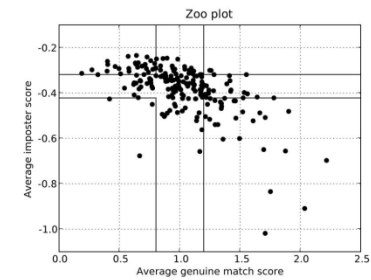
(a)



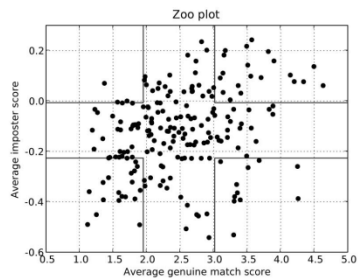
(b)



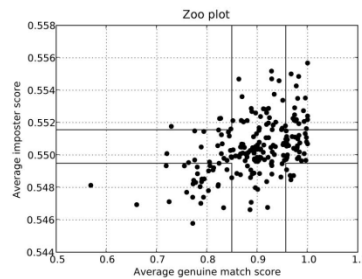
(c)



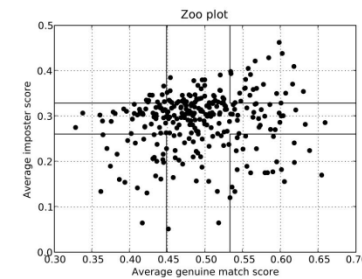
(d)



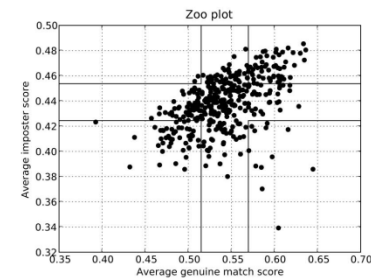
(e)



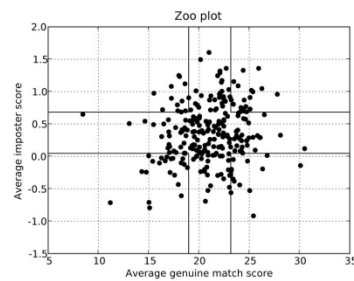
(f)



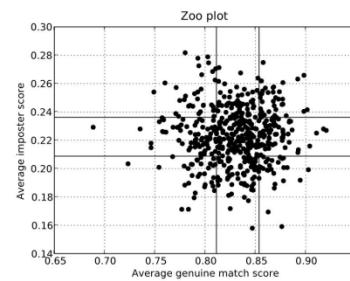
(g)



(h)



(i)



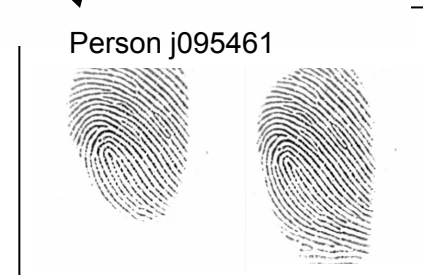
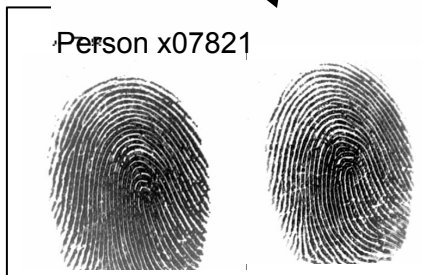
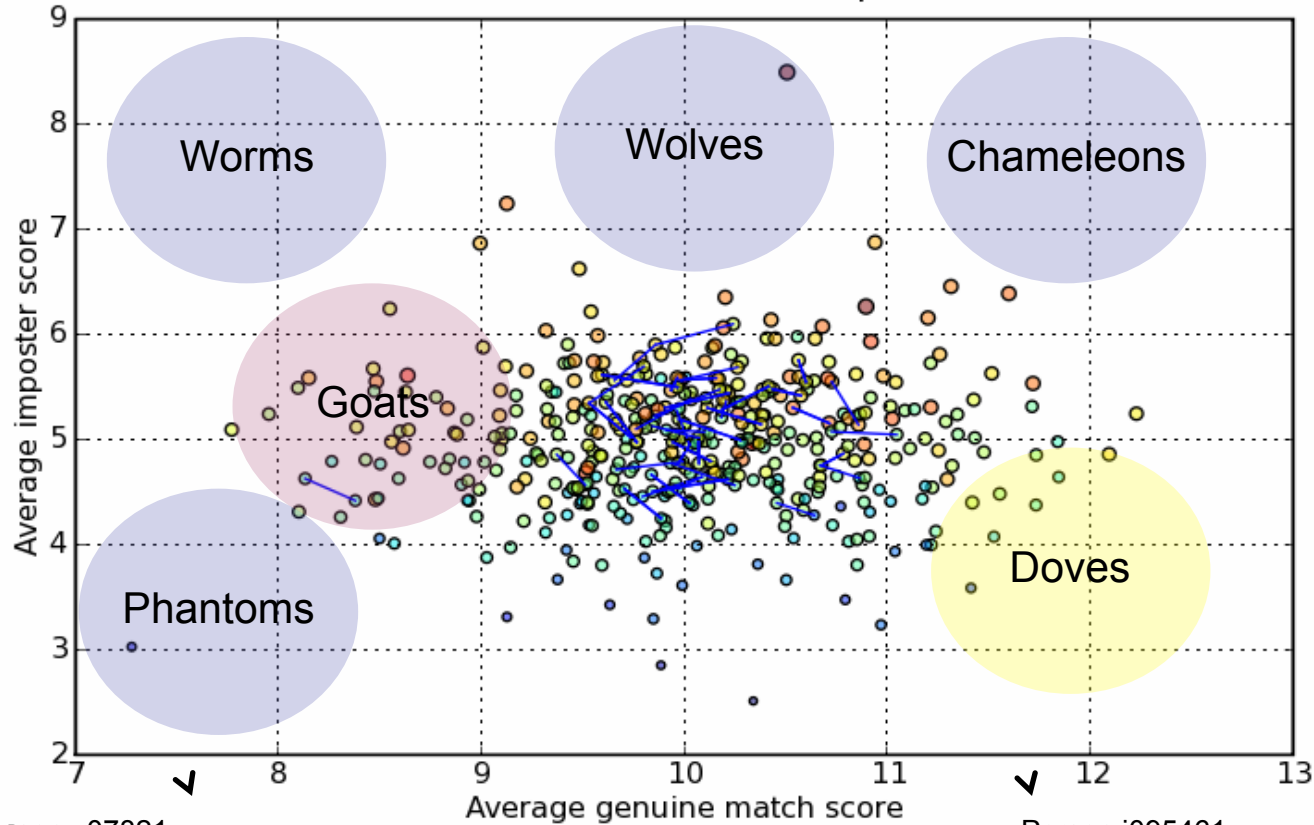
(j)

(a) Fingerprint - Alg I. (b) Fingerprint - Alg II. (c) 2D Face - Alg I. (d) 2D Face - Alg II. (e) Speech. (f) Iris. (g) Keystroke - Alg I. (h) Keystroke - Alg II. (i) 3D Face. (j) Synthetic



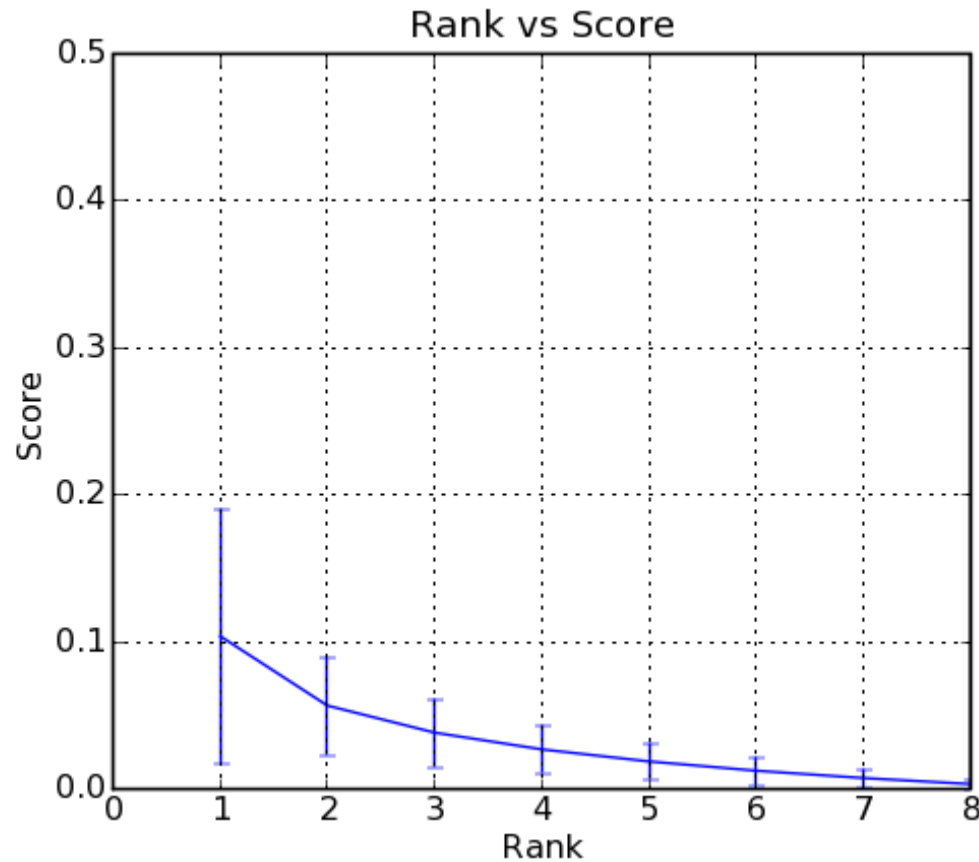
# Performix Explore – Zoo Analysis

User match scores (Zoo plot)





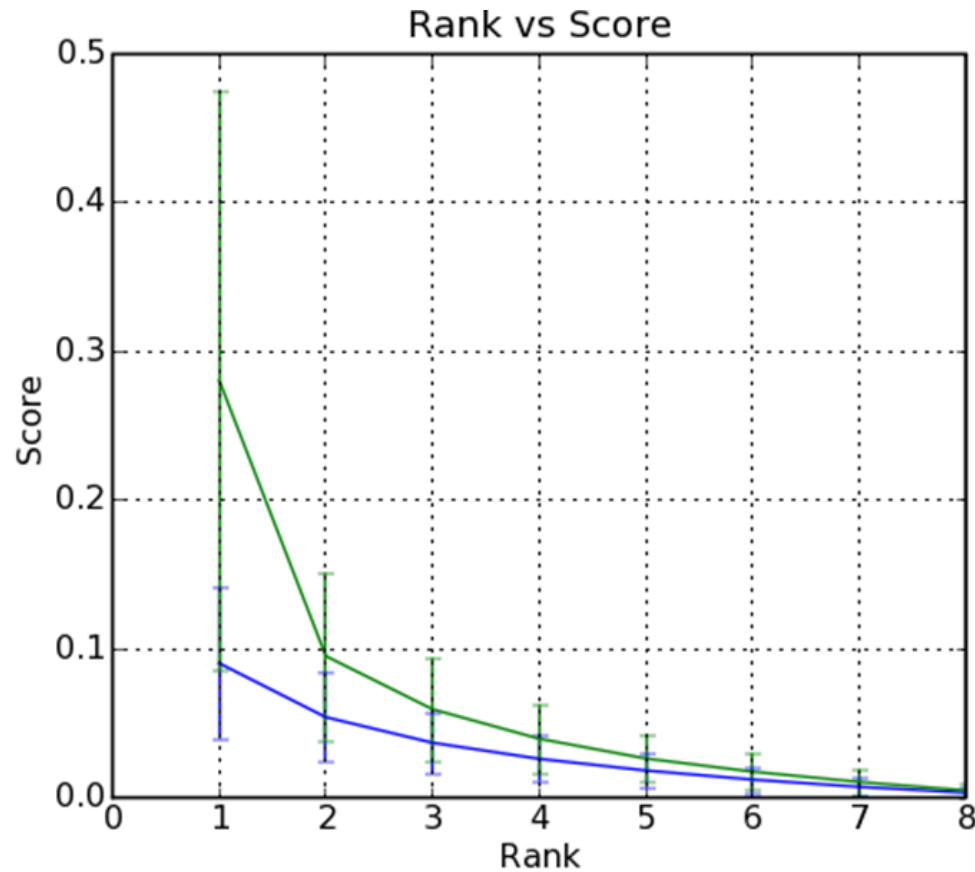
# Scores Distribution by Rank







# Rank - Genuine vs Impostor





# Performix Demos

- FERET
  - Quality vs Score
  - Waterfall Diagram
  - Simulated Clearance
- Surveillance
  - Hotspot Analysis
  - Frame Analysis
  - Comets



# Human Operator Evaluation

- Performix can assist with Operator Training and Evaluation
- Matchers = Operators
- Training
  - Identity Weakness
  - Report on operator improvements
  - Provide feedback to supervisor



# Questions

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([www.biometix.com](http://www.biometix.com))