Visualization of Operational Performance in Biometric Systems

The Zoo and Beyond

NIST Biometric Performance Conference

Dr Ted Dunstone
ted@biometix.com
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.

Standard Group Statistics
Zoo Analysis: Individual Analysis

Physiology, Data Capture, Behaviour


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

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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
Pearson product-moment correlation coefficient is computed between the users’ average genuine scores and their average imposter scores to determine relationship.

<table>
<thead>
<tr>
<th>System</th>
<th>Population</th>
<th>Genuine Matches</th>
<th>Impostor Matches</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fingerprint - Alg I</td>
<td>100</td>
<td>56</td>
<td>99</td>
<td>0.9%</td>
</tr>
<tr>
<td>Fingerprint - Alg II</td>
<td>100</td>
<td>56</td>
<td>99</td>
<td>3.4%</td>
</tr>
<tr>
<td>2D Face - Alg I</td>
<td>200</td>
<td>5</td>
<td>759</td>
<td>4.3%</td>
</tr>
<tr>
<td>2D Face - Alg II</td>
<td>200</td>
<td>5</td>
<td>759</td>
<td>1.7%</td>
</tr>
<tr>
<td>Speech</td>
<td>200</td>
<td>5</td>
<td>759</td>
<td>4.4%</td>
</tr>
<tr>
<td>Iris</td>
<td>208</td>
<td>3-11</td>
<td>1952-3600</td>
<td>2.4%</td>
</tr>
<tr>
<td>3D Face</td>
<td>249</td>
<td>1-120</td>
<td>4005-10000</td>
<td>1.6%</td>
</tr>
<tr>
<td>Keystroke - Alg I</td>
<td>289</td>
<td>3</td>
<td>37-128</td>
<td>5.3%</td>
</tr>
<tr>
<td>Keystroke - Alg II</td>
<td>289</td>
<td>3</td>
<td>37-128</td>
<td>3.8%</td>
</tr>
<tr>
<td>Synthetic Data</td>
<td>300</td>
<td>7-32</td>
<td>44-91</td>
<td>3.7%</td>
</tr>
</tbody>
</table>
(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.
Scores Distribution by Rank

Rank vs Score

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Rank - Genuine vs Impostor

![Graph showing the relationship between rank and score.]

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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

Contact
on ted @ biometix.com
Or +61 419990968

(www.biometix.com)