Analysis of Template Aging In Iris Recognition

Professor Kevin W. Bowyer
What Is Template Aging?

Longer time intervals generally make it more difficult to match samples to templates due to the phenomenon known as ‘template aging’.

ISO/IEC 19795-1:2006 "Information technology - Biometric performance testing and reporting -…", Section 6.4.6.
What Is Template Aging?

This refers to the increase in error rates caused by time-related changes in the biometric pattern, its presentation and the sensor.

ISO/IEC 19795-1:2006 "Information technology - Biometric performance testing and reporting -…", Section 6.4.6.
Iris Template Aging?

The prevailing view since the start of iris biometrics has been that there is no template aging for iris.
Iris Template Aging?

The iris of every human eye has a unique texture of high complexity, which proves to be essentially immutable over a person's life.

Iris Template Aging?

… the fine texture remains remarkably stable over many decades. Some iris identifications have succeeded over a period of about 30 years.

## 3-Year Experimental Data

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>subjects</th>
<th>images</th>
<th>short matches</th>
<th>long matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-09</td>
<td>88</td>
<td>4,553</td>
<td>11,986</td>
<td>30,470</td>
</tr>
<tr>
<td>08-10</td>
<td>40</td>
<td>2,097</td>
<td>5,829</td>
<td>14,282</td>
</tr>
<tr>
<td>08-11</td>
<td>32</td>
<td>2,338</td>
<td>5,244</td>
<td>20,888</td>
</tr>
</tbody>
</table>

LG 4000 sensor.

Results computed with VeriEye matcher.
Experiment Structure

baseline short-term matches: within spring 2008
1-year matches: spring 2008 – spring 2009, ...
2-year matches: spring 2008 – spring 2010, ...
3-year matches: spring 2008 – spring 2011
Experiment Structure

Note that this is a “laboratory study” –

- Same sensor throughout
- Same matcher version
- Same location for acquisition
- Same procedure for acquisition
- ...

May be able to measure effects that could not be measured in an application scenario.
One-year results: long-term matches have increased false non-match rate relative to short-term matches.
Iris Template Aging

Two-year results: additional change of same type as one year.
Iris Template Aging

Three-year results: additional change as in years one and two.
## Iris Template Aging

Change in FNMR at decision threshold for FMR = 1 in 2 M on overall dataset:

<table>
<thead>
<tr>
<th></th>
<th>FNMR change</th>
<th>95% conf. int.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2009</td>
<td>+27%</td>
<td>(5%, 61%)</td>
</tr>
<tr>
<td>2008-2010</td>
<td>+82%</td>
<td>(38%, 150%)</td>
</tr>
<tr>
<td>2008-2011</td>
<td>+153%</td>
<td>(85%, 307%)</td>
</tr>
</tbody>
</table>

95% confidence interval from N=1,000 bootstrap.
Iris Template Aging

Summary –

Iris template aging occurs in the form of an increasing FNMR.

May vary with sensor, matcher, subject demographics, and other factors.
Related Work

- Tome-Gonzales et al, BTAS 2008
- Baker et al, ICB 2009
- Fenker and Bowyer, WACV 2011
- Sazonova et al, SPIE 2012

Lots of work in face aging.
Much less known about fingerprint.
Is This Important?

This result motivates further research on template aging.

One could largely avoid the whole issue by moving to a scheme of “rolling re-enrollment”+.

+ term coined by John Daugman.
Questions?