Agents Ownership Setting by User Fingerprints

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Outline

- Agent Ownership
- User authentication
- Fingerprint Verification Systems
- Case studied: JADE-S platform
Fingerprints Verification Task

- Ink-on-paper Fingerprint Verification System
  - NIST 4 database; Sensor fingerprints
- Fingerprint Features: core, delta, ridge, furrow, minutiae.

![Fingerprints Diagram]
Minutiae

- Representative points: their position and orientation are used for verification;
- False minutiae must be ignored

False Minutiae:
- Close Endpoints;
- Cross;
- Spurs;
- Bridges;
- Triangles and ladders Structures.
The Fingerprint Verification System

- Image enhancement and preprocessing;
- Minutiae extraction;
- Matching.
The verification system

- Image enhancement and preprocessing:
  - Variance filter;
  - L.E.T. binarization;
  - Median filter;
  - Thinning.
- Minutiae extraction;
- Matching.
L.E.T. binarization

Ink-on-paper fingerprint image brightness is not constant.

No static threshold for image binarization

Local Energy Threshold is defined as the average level of the local energetic histogram (5x5 mask).

Pixel binary value will be established comparing its intensity and L.E.T.
The verification system

- Image enhancement and preprocessing;
- Minutiae extraction:
  - False minutiae erasing
  - Noisy zone erasing
  - Minutiae position and orientation extraction
- Matching.
The verification system

- Image enhancement and preprocessing;
- Minutiae extraction;
- Matching:
  - A new operator based on the well-known Tanimoto Distance
  - Decrease rotation and translation errors
Extended Tanimoto Distance

\[ F(W_j) \equiv \frac{V :\cdot W_j}{V \cup W_j} \]

\[ k_i \in (V :\cdot W_j) \iff \{ |X - X_i| \leq T_x; |Y - Y_i| \leq T_y; |\Theta - \Theta_i| \leq T_\Theta \} \]
## Experimental Results

<table>
<thead>
<tr>
<th>Images (NIST 4)</th>
<th>Minutiae required for positive matching</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>20</td>
<td>98.30</td>
</tr>
<tr>
<td>2000</td>
<td>25</td>
<td>95.44</td>
</tr>
</tbody>
</table>
On-Line Fingerprint sensor

- SecuGen Hamster sensor;
- 30 different users;
- No errors in the verification phase.
JADE Secure Agent Platform – JADE-S (TILab S.p.A.)

- User/agent authentication;
- User/agent authorization;
- Secure Communication (SSL protocol);
- Each component (agents and containers) are owned by a user;
- Permissions and Policies.
JADE-S authentication

- In JADE-S who starts-up platform owns the AMS, DF and the main Container;
- Authenticated users can own agents in the platform;
- Actually, user authentication is based on username and password;
- User fingerprint can be added.
JADE-S E-Authentication

- Platform and agent start-up require owner username, password and fingerprint;
- Check against password file and fingerprint file (minutiae features);
- Fingerprint Verification task.
UML Diagrams: user registration
UML Diagrams: user access request
JADE-S E-Authentication

Jade-S Boot Class
JADE-S E-Authentication

c sai.crypt package:

- Public/private key generation
- Fingerprint features sign
- Fingerprint verification
csai.util package:

- Password checking
- I/O vs fingerprint file
JADE-S E-Authentication

c sai.veryFinger package:

- Fingerprint image processing
- Fingerprint image Matching
- Ownership setting
Agents Registration

1. First security level
2. Second security level
3. Jade-S platform with “prova” agent (owner will be ferrara)
4. New user agent registration (owner will be alice)
Verification Time

- Intel Pentium III
- 384 MB RAM
- Windows XP operating system
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