Privacy Protection of Texture Based Fingerprint Templates

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Context

Storing biometric templates in a large number of applications introduces the following *privacy problems*

- Identity theft
- Biometric templates cannot be re-issued
- Cross-matching between databases
- Medical information leakage from template
- Legislation prevents central databases

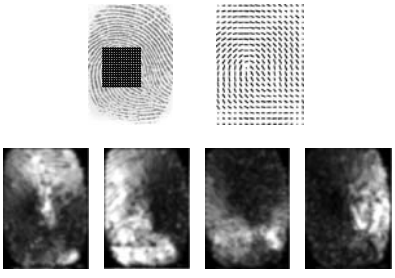
Solution

Template protection schemes store a versatile and private derivative of the biometric template [1].

Feature Vectors from Fingerprint Texture

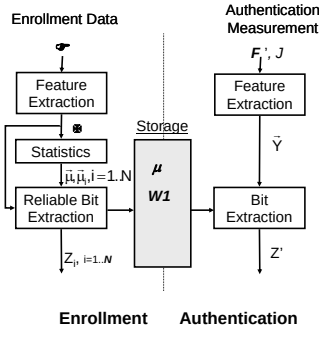
Real-valued feature vectors [2]

- Core detection and 16x16 grid around the core
- Directional field on grid points
- Four Gabor filter responses on grid points
- Feature vector $\vec{X} \in \mathbb{R}^{1536}$

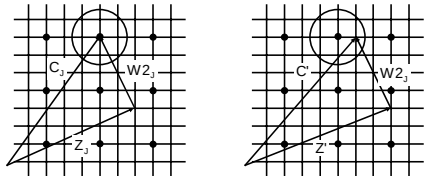


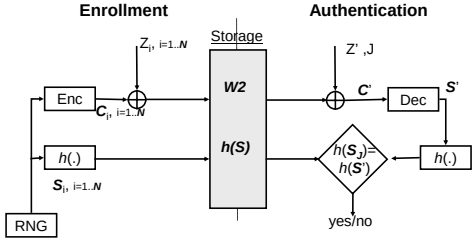
Binary feature vectors

- Mean of the population of $\vec{X}$ is $\vec{\mu} \in \mathbb{R}^{1536}$
- Quantize every enrolment vector around $\vec{\mu}$
- Choose for every person 511 *reliable components* with indices W1
- Feature vector $Z \in \{0,1\}^{511}$



Template Protection of Binary Templates [3]





Properties

- From the stored information W1,W2 and h(S) it is hard to retrieve Z
- Different information stored for every application
- Information stored in one application cannot be used to enter an other application
- Possible to re-enroll with the same template but different stored information

Classification Results

EER	Likelihood classifier $\vec{X} \in \mathbb{R}^{1536}$	Template Protection $Z \in \{0,1\}^{511}$
FVC2000	1.4%	5.3%
Univ. Twente	1.6%	4.5%

- Method effectively is a Hamming distance classifier
- Using binary vectors somewhat deteriorates classification quality
- The Error Correcting Code (ECC) limits the threshold of the Hamming distance classifier

Literature

[1] J.-P. Linnartz and P. Tuyls, *New shielding functions to enhance privacy and prevent misuse of biometric templates*, 4th International Conference on Audio- and Video-Based Biometric Person Authentication, 2003.

[2] A.M. Bazen and S.H. Gerez, *Systematic Methods for the Computation of the Directional Field and Singular Points of Fingerprints*, IEEE Trans. PAMI,2002, 24, 7, 905-919.

[3] P. Tuyls, A. Akkermans, T. Kevenaar, G.J. Schrijen, A. Bazen, R. Veldhuis, *Practical biometric template protection system based on reliable components,* Proc. 5th Int. Conf. on Audio- and Video-Based Biometric Person Authentication (AVBPA 2005)}, Springer LNCS 3546, pp436-446, 2005.