Secure Fingerprint Recognition using Optical Coherence Tomography

NTNU

Motivation

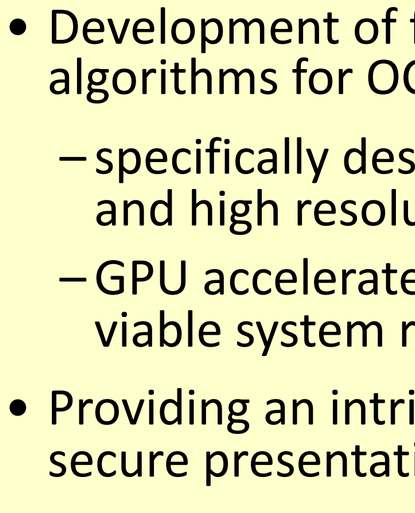
- Fingerprints are still one of the most widely used traits in biometric recognition.
- Conventional fingerprint techniques often fail to acquire good fingerprint samples in difficult imaging conditions:
  - Damp or dry, abraded or swollen skin
  - Fingerprints of infants and elderly people
  - Medical conditions
- Fingerprint artefacts pose a serious security risk, especially if the artefact is tailored towards the sensor solution being used.
- Optical Coherence Tomography (OCT) is a promising solution to these problems.

Objectives

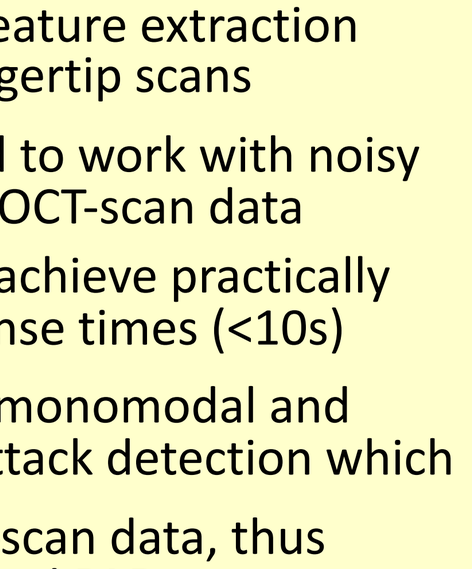
- Development of fast feature extraction algorithms for OCT-fingertip scans
  - specifically designed to work with noisy and high resolution OCT-scan data
  - GPU accelerated to achieve practically viable system response times (<10s)
- Providing an intrinsic/monomodal and secure presentation attack detection which
  - relies solely on OCT-scan data, thus requiring no additional PAD sensors
  - is robust against known fingerprint artefacts
- Implementation of application specific biometric template protection which ensures the security of personal data with no significant performance degradation.

Approach

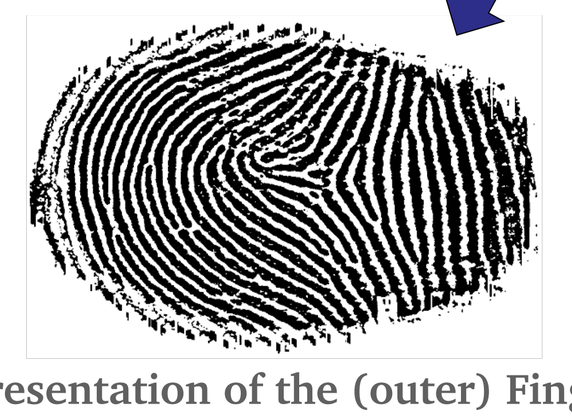
- Construction of a representative fingerprint database comprised of high resolution OCT fingertip scans of varying quality.
- Extension of the traditional fingerprint feature space by a set of subsurface features found in OCT-scans of fingertip skin:
  - The inner/subsurface fingerprint
  - Sweat ducts
  - Blood flow & microvascular patterns
- Application specific extraction and comparison techniques for the extended fingerprint feature space.
- Presentation attack detection based on the structural consistency of inner and outer fingerprint features in genuine fingers.



Volumetric OCT Fingertip Scan



Fingerprint Layer Detection



2D-Representation of the (outer) Fingerprint

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