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Federal Office for Information Security

Motivation and Use Cases for NFIQ 2.0

on behalf of
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Fingerprint Applications

- Official documents with fingerprints
  - European ePassports
  - European Residence Permits
  - Identity Cards (partially)
- European Visa Information System (VIS)
  - Tenprints from all Schengen (short-time) Visa applicants
    - Data stored for 5 years
  - Target size up to 100 Mio. records
  - Biometric verification at Schengen border checks has started
- Criminal AFIS
- Future RTP programs might use fingerprints

Challenges for Operators

- Problems
  - Technical
    - Heterogenous environments
    - Different software vendors and versions
    - Interoperability issues
  - System design
    - At enrolment stage, typically the biometric verification or identification system vendor is unknown
    - Large scale identification scenarios (AFIS) have high quality requirements

Challenges in fingerprint biometrics deployment (2)

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- Timing considerations
  - Timing constraints are the biggest driver in the design of an enrolment and verification process
  - For many instances, quality correlates directly with time
    - No only technical, but also organizational, e.g. user guidance
  - Time is expensive
    - Officers are expensive
    - Room is expensive
  - Which quality is required by the system?
    - How much time (on average) do I need to reach the desired level?

Stages of possible quality control

- Scanner level
  - Hardware built-in auto capture
  - Hard to tweak to a specific application scenario
- Capture software level
  - Beyond the vendor SDK
  - Run things like NFIQ, vendor software kits, other QA algorithms
  - Implement target system specific thresholds
- Process level
  - A background system rejects the fingerprints
  - Trigger recapture only when necessary
    - Avoid this as often as possible because of timing considerations, especially when round trips to central systems are involved

Problem statement

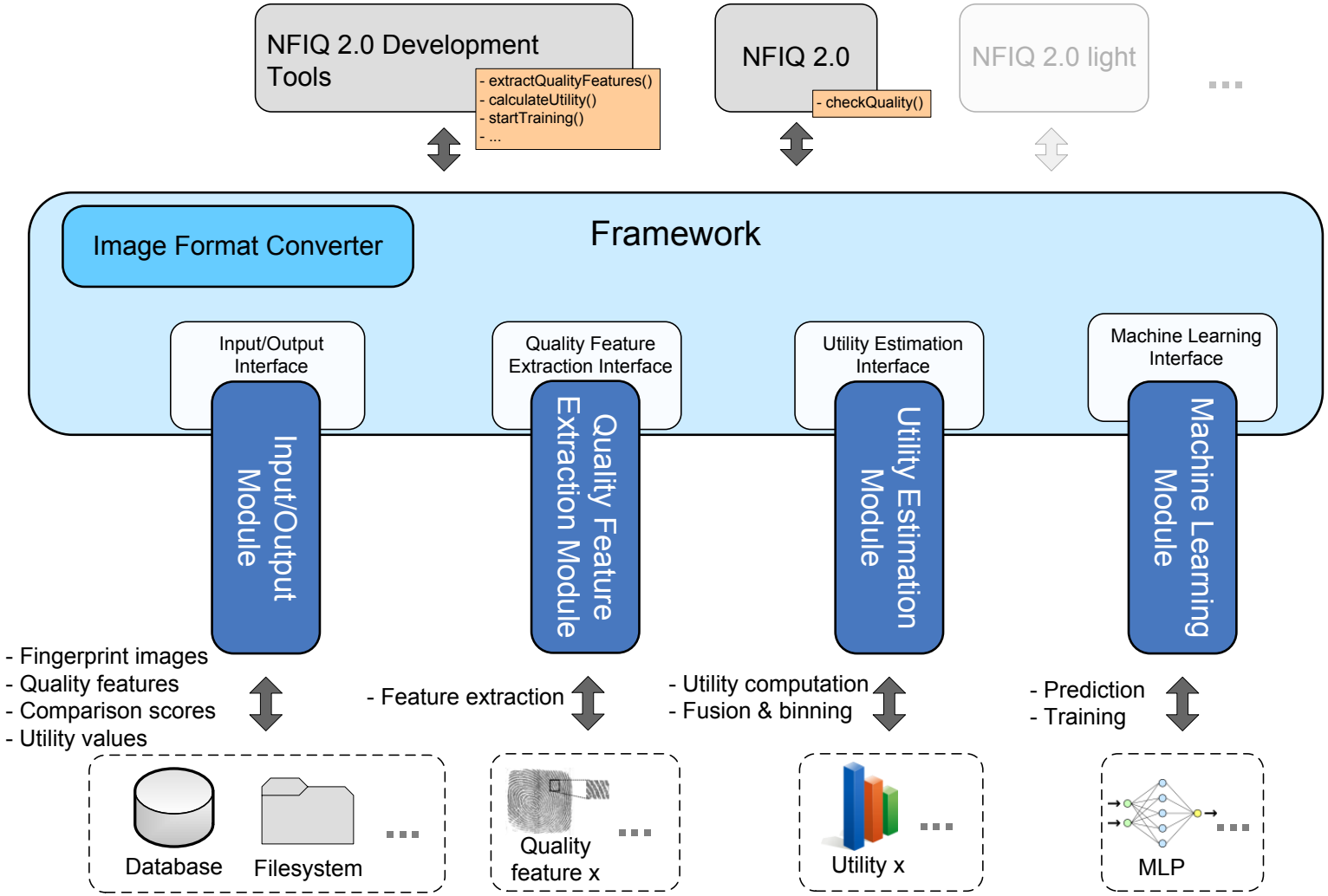
- There‘s no universal understanding of a term like fingerprint of sufficient quality
  - Sufficient for which application?
  - Quality requirements differ a lot for different applications (e.g obviously between 1:1 and 1:n)
  - But there‘s quality in the standards.
    - An algorithm should produce a value in [0, 100].
    - Some do so... most don‘t
    - But still scores are not calibrated to an accepted base line.
    - And there is no consensus of thresholds for specific applications

- OK, let‘s try … NFIQ2.0

Motivation for NFIQ2.0 Framework

- Modular approach for NFIQ2.0 development is desired
  - to be flexible regarding the implementation
  - to have a common basis of functionality needed for NFIQ2.0 development which might then be extended by exchange of certain modules
  - because project team is distributed and located all over the world
  - because only certain project partners have access to certain fingerprint databases
  - because work can be shared and re-used by others
  - to simplify the development process

Architecture of NFIQ2.0 Framework



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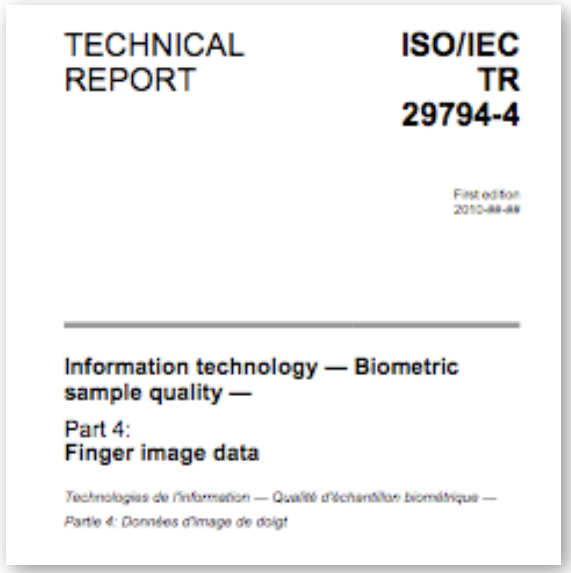
Context - I

- Based on ISO/IEC IS 29794-1:2009
  "Information technology - Biometrics sample quality Part 1: Framework"
- Definitions
  - **quality**: *"the degree to which a biometric sample fulfils specified requirements for a targeted application*"
  - **quality score**: "*a quantitative expression of quality*"
  - **utility:** "*the observed performance of a biometric sample or set of samples in one or more biometric systems*"
- Biometric data quality blocks
- Quality score
  - 0: lowest quality
  - 100: highest quality
  - 255: failed attempt to assign a quality score

description		size	valid values	notes
Number of Quality Blocks		1 byte	[0,255]	This field is followed by the number of 5-byte Quality Blocks reflected by its value A value of zero (0) means that no attempt was made to assign a quality score. In this case, no Quality Blocks are present.
Quality Block	Quality Score	1 byte	[0,100] 255	0: lowest 100: highest 255: failed attempt to assign a quality score
	Quality Algorithm Vendor ID	2 bytes	[1,65535]	Quality Algorithm Vendor ID shall be registered with IBIA as a CBEFF biometric organization. Refer to CBEFF vendor ID registry procedures in ISO/IEC 19785-2.
	Quality Algorithm ID	2 bytes	[1,65535]	Quality Algorithm ID may be optionally registered with IBIA as a CBEFF Product Code. Refer to CBEFF product registry

Context - II

- Linked to ISO/IEC rev 29794-4:201x
  "Information technology - Biometrics sample quality
  Part 4: Finger image data"
- Quality feature classes
  - Global features
  - Local features (blockwise)
- Expected return of research investment
  - Revision of ISO/IEC IS 29794-4:201x
  - Upgrade to an IS (International Standard)


TECHNICAL REPORT

ISO/IEC TR 29794-4

First edition

Information technology — Biometric sample quality —

Part 4:
Finger image data

Technologies de l'information — Qualité d'échantillon biométrique —
Partie 4: Données d'image de doigt

Problem statement (2nd try)

- There‘s no common language to establish an interoperable definition of **fingerprint of sufficient quality** for a specific application scenario
  - When developing an application scenario, define a common understanding of the required image quality
  - We need the language for doing this
  - And we need a baseline tool for doing this

Expectations for the future

- NFIQ2.0 will be good enough to be used as baseline tool for defining fingerprint of sufficient quality
- NFIQ2.0 will be the calibration base for vendor QA tools
  - Vendor QA tools will not go away, but – at least – for large scale applications will be comparable (statistically, not on a by-image-basis) to NFIQ2.0
  - Vendor QA tools should not have a need to augment NFIQ2.0 itself, but it should be sufficient for a vendor to define a specific threshold for a specific application
- NFIQ2.0 will be used in all major fingerprint-based biometrics systems.
- NFIQ2.0-lite will provide feedback on mobile devices

- Of course, the term of fingerprint quality will not be stable, but the biometric community will have a way to adapt, refine, reformulate it according to the evolution of fingerprint technology

Questions

Contact

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