Ad-Hoc Group on Finger Image Quality

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NIST INFORMATION TECHNOLOGY LABORATORY

Terms of Reference

- Review open **known issues** in NFIQ 2 v2.3.0 and ISO/IEC 29794-4:2024
- Review and discuss proposals for **additions to scope** of ISO/IEC 29794-4
- Identify **novel quality measures** from 2017 onward

Attendance

Organization	Count
🇫🇷 AFNOR	1
🇺🇸 ANSI	4
🇩🇪 DIN	10
🇪🇺 eu-LISA	1
🇪🇺 European Commission	1
🇫🇮 SFS	1

18 participants representing **6** organizations

- across 2 meetings (22 October, 18 November)
- including 3 guests (DIN)

Known Issues

Existing

- DFT windowing (#356)
- Background removal for ink cards (#355)
- Replace quadratic equation (#353)
- Rotation border handling (#354)
- Future training enhancements (#378)

Newly Identified

- Stabilize region of interest (#387)
- Minutiae extractor change/improvements (#388)
- Countering compression algorithm effects (#389)

https://github.com/usnistgov/NFIQ2/issues

Additions to Scope

Current Scope

- 500 PPI + 8 BPP Grayscale + Ink Scan/Optical Area + Contact + Plain impression

Ranked Priorities

1. Rolled impression
2. Mobile + other capture technologies (e.g., TFT)
    - Profiles based on factors?
3. 1000 PPI
    - Resampling strategy?

Novel Quality Measures

Chair's (Quick) Literature Search

- ISO/IEC 29794-4:2024 Non-normative Quality Measures
  - Radial power spectrum
  - Gabor filter bank
- Global sharpness/Canny edge detector
- Specification for Interoperability Testing of Contactless Fingerprint Acquisition Devices, v1.0
  - BSNR, Image entropy, alternate contrast methods
- Autocorrelation and DCT based quality metrics for fingerprint samples generated by smartphones
- Directional filter bank-based finger image quality
- MiDeCon
  - Minutiae quality
- Contactless (generally)
  - Measures of focus and blur
- BRISQUE?
- MANIQA?

No novel quality measures identified or discussed during the ad-hoc group meetings.

Other Topics – Standard

- Use of NN for minutiae extraction, etc.
  - Can NN models be used by major operational deployments?
  - Are NN embedded device and/or mobile unfriendly?
  - Can we require GPU? For training only?
- “Manual” quality components vs. similarity score NN
  - Limits/eliminates actionable feedback, explainability
  - Can we build in re-training so similarity scores are not far out of date?
  - How much data is needed?
- Alternate implementation possibility?
  - Guide by ISO/IEC 29794-5
- Publicly accessible training data?
  - This could be QC values, not images
  - Better selection criteria (e.g., no NFIQ 1 requirement)
  - Newer algorithms for similarity scores
- Consider computational complexity of changes

Other Topics – Implementation

- Clean implementation
  - Modern C++
  - Avoid bugs
- Native, supported language wrappers
  - Java/Kotlin (Android), Swift/Objective-C (iOS)
    - Important for mobile contactless support
  - Python
    - Important for researchers

Recommendations

1. Continue ad-hoc group through January 2026
   - Proposed next meeting: **29 January 2025, 14:00 UTC**
     - Meeting link in and agenda in document WG3N1610
   - New terms:
     - Determine roadmap for ISO/IEC 29794-4, edition 3
       - Vote at/after next meeting?
     - Develop and test reference implementation
       - Additions based on identified priorities (slide 5)
     - Provide status updates at July 2025 and January 2026 meetings
     - Advise on timeline for PWI or WD of ISO/IEC 29794-4, edition 3

Question 1: Similarity Score NN

Should “manual” quality components be eliminated in favor of a neural network based only on similarity scores?

(may impact ISO/IEC PWI 29794-12)

Question 2: Models

Should machine-learned models (trained outside of SC 37) be permitted in ISO/IEC 29794-4?

(assuming Question 1 is answered in the negative)

Question 3: Reference Implementations

Should affordances be made to allow for alternate reference implementations?

Implicates (at least):

- Minutiae extraction
- Publicly-available data for model training
- Compliance test output criteria

(assuming Question 1 is answered in the negative)