High quality image acquisition

Standard-compliance is the prerequisite for consistent data quality, interoperability and performance of the EES for all EU member states.

High-Quality Facial Image Acquisition | Why?

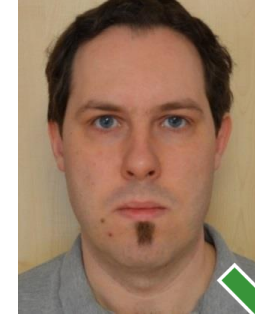**Regulation for European Entry / Exit System (EES) requires ISO/IEC 19794-5:2011 compliant facial images**

- For all Third Country Nationals (TCN) – of **any age or body height**

- Only maximum +/- 5 degrees deviation from **frontal pose**

- **High resolution cropped full-frontal images** (800x600 px minimum)

- **Homogeneous illumination** needed

» Flexible, fast and convenient camera solution for stationary border control desks required!
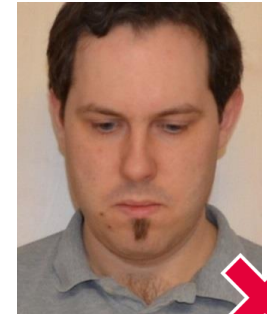
Why is a high-quality biometric acquisition according to the EES regulation so important?

- EES database will contain several hundred millions identities of TCN

- EES regulation rules for each first-time registration (enrolment) a full 1:N identification to perform deduplication and check for misuse

  - ›› Every falsely classified identity has to be manually checked by a border guard

  - ›› Results in higher processing times and certainly longer queues

- For low error rates, high quality acquisition of biometric data is the key

  - ›› EES regulation rules compulsory compliance to ISO/IEC 19794-5:2011 for the acquisition of facial images

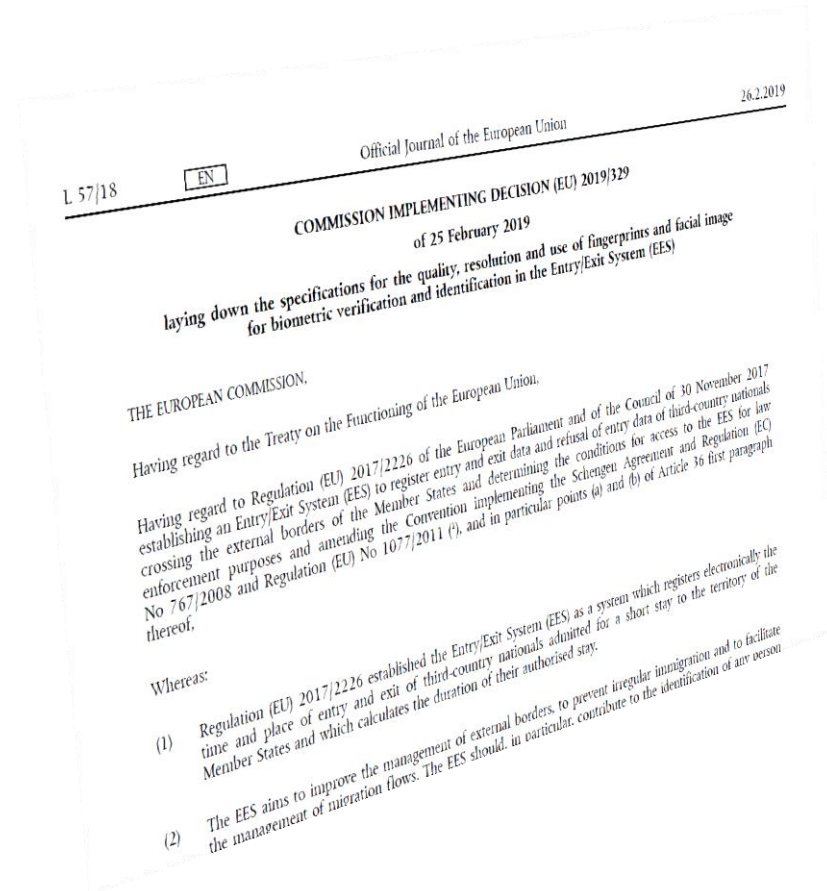
ISO/IEC 19794-5:2011 compliant

ISO/IEC 19794-5:2011 non-compliant

Biometric requirements – Face
Implications of EES regulation for facial image acquisition

- Database for Identification and Verification

- Commission Implementing Decision (EU) 2019/329
  - Specifications for quality, resolution and use of fingerprints and facial image for EES
    - FPIR < 0.1%, FNIR < 1%
  - Acquisition and quality compliant to ISO/IEC 19794-5:2011 Frontal image type required

- Photographic requirements from ISO/IEC 19794-5:2011
  - Pose of head (Pitch, yaw: < 5°, roll: < 8°)
  - Neutral expression required: closed mouth, open eyes
  - Equally distributed lighting on the face, no hot spots
  - Contrast, sharpness, colours, lens distortion

Biometric requirements – Face
The problem with pose correction

■ Impact on the EES

» Biometrics are probabilistic

» Performance depends heavily on a high quality of the features

» Processing is error-prone and introduces more error sources

» Worsened by multiple algorithms

▶ Low probability of meeting the requirements of the Central System

■ Implications in terms of ISO/IEC 19794-5:2011 compliance

» When using pose correction, the Frontal subtype must be "Post-processed", not "Full" (table 19)

» Original image needs to be sent (section 10.3.2)

» Not possible in the current data format of the central EES

» Post-processing discouraged, introduced for cases without alternatives (section 5.7.7)

» Legacy databases

» Data sources which cannot be controlled (e.g. CCTV cameras)

» "Age progression" of the subject

» New Self-Service Systems hardly meet this requirement

Biometric requirements – Fingerprints
Capturing fingerprints

- Four fingers of right hand

  >> In rare cases, left hand has to be captured

- Quality assured by NFIQ 2.0

  >> Exceptions for verification
  >> QA must also be available on-device at the border

„NFIQ 2.0" = 89 ✅

„NFIQ 2.0" = 1 ❌

Fingerprint image source: https://www.nist.gov/document/nfiq2qualityfeaturedefinitionspdf

Why it matters
Impact of bad image quality on biometric recognition performance

- NISTIR 8238 Ongoing Face Recognition Vendor Test (FRVT) Part 2: Identification by NIST (Nov. 2018) and NISTIR 8272 (September 2019)

  » Evaluation of large-scale datasets for 1:N searches / identification

  » Evaluation of different data sets

  » Executive summary clearly says:

  ▶ "With good quality portrait photos, the most accurate algorithms will find matching entries, when present, in galleries containing 12 million individuals, with error rates below 0.2%. The remaining errors are in large part attributable to long-run ageing and injury. However, for at least 10% of images - those with significant ageing or sub-standard quality - identification often succeeds but recognition confidence is diminished such that matches become indistinguishable from false positives, and human adjudication becomes necessary."

Limitations of Face Recognition
Collisions

- In large-scale biometric databases false matches can occur

  - ›› Lookalikes
  - ›› Monozygotic twins

- Probability of false matches increase with database size

  - ›› Identification transactions require one-to-many comparison
  - ›› An increased number of comparisons increases the probability for one (or more) false matches

- Demographic Bias

  - ›› Differential impact of demographic factors in face recognition system performance
  - ›› Demographic bias may exist depending on the distribution of demographic attributes in the gallery

Obama look-a-like Ilham Anas   Barack Obama

Biometric Fusion
Combining Face and Fingerprints

- Biometric performance improvement via information fusion
  - >> Increased amount of information prevents from false matches

- Biometric fusion techniques
  - >> Normalized score-level fusion
  - >> Rank-level fusion for identification

- Weighted biometric fusion
  - >> Four fingerprints are expected to contain more biometric information compared to a face image
  - >> Quality-weighted fusion
  - >> Cascaded fusion

- Challenges with biometric fusion
  - >> Score normalization is required

ISO/IEC 19794-5:2011 compliant

Efficient high-quality face acquisition.

- Fast, efficient, frontal and illuminated facial capture.

- Intuitive, convenient and easy to use (with user guidance).

- Stand-alone system for flexible mounting in indoor environments.

- Automatic height adjustment ensures fast frontal acquisition

EES-compliant.

High-end camera solution **guarantees fulfillment of EES quality requirements.**

Diffuse lighting and quality assessment based on ISO criteria.

Stand-alone system allows flexible mounting in all possible set-ups and environments while providing high-quality facial images.

Also accessible by **wheelchair users as well as accompanied children.**

How can high quality image acquisition be achieved?

secunet easytower

- Frontal image acquisition with height adjustable camera system at every border crossing point where TCNs are registered for EES

- Diffuse lighting to ensure homogenous illumination throughout the captured face and to avoid shadows and hot spots

- User guidance and process indicators in self-service systems to let travellers capture their faces and fingers easily, intuitively and fast

secunet.com

Kurfürstenstraße 58, 45138 Essen, Germany

info@secunet.com

secunet