Biometric Sample Quality Standards

Applications, Status, and Direction

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M1 Project Editor – Biometric Sample Quality Standard

ISO Project Editor - Biometric Sample Quality Standard - Part 1 (ISO/IEC 29794-1 CD)

Why Use Quality Scores?

- Screening of poor quality samples upon capture for match performance improvement
- Real-time quality analysis for autocapture
- Quality-based conditional processing
  - Use different feature extraction and matching algorithms for different quality score ranges
- Capture equipment performance monitoring
- Accumulation of relevant statistics
  - Collect data to assess correlation to various conditions, such as operator, device, weather, location, time of day, etc.

- …and surely other applications we will learn this week

Why Standardize?

- Primary goal is to enable harmonized interpretation of quality scores
- Ideally, reduced reliance on external data for score interpretation
- Differentiate between scores from different vendors, algorithms and versions
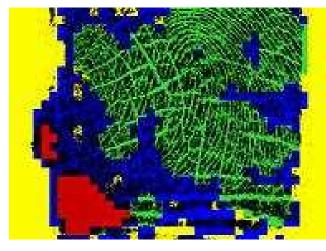- Enable a competitive multi-vendor marketplace
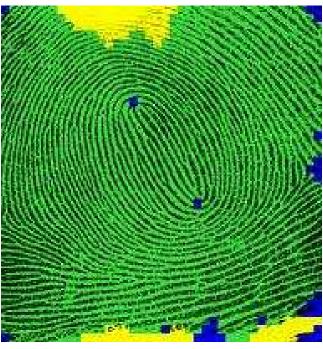
The Sample Quality Standards Gap

- Most ANSI/INCITS and ISO/IEC data interchange format standards currently support a quality score field, but its content is not explicitly defined
- BioAPI provides following quality scoring guidance, but it is somewhat subjective
  - 0-25: Unacceptable
    - "cannot be used for the purpose specified"
  - 26-50: Marginal
    - "poor performance for the purpose specified"
  - 51-75: Adequate
    - "good performance in most application environments based on the purpose specified"
  - 76-100: Excellent
    - "good performance for the purpose specified"

The Heart of the Challenge

- Quality scoring algorithms attempt to assess features and characteristics of a sample in order to predict its behavior in a matching environment
  - An important goal is to preemptively predict the likelihood of a false accept or false reject
- But beauty is in the eyes of the beholder…
  - Specific features of biometric samples affect performance of different matching algorithms in different ways
  - A sample yielding high performance in one matcher is not necessarily the result with another matcher
  - But…there is generally some degree of correlation between matchers in this regard
- Different applications and markets have different matching, quality and cost/performance requirements
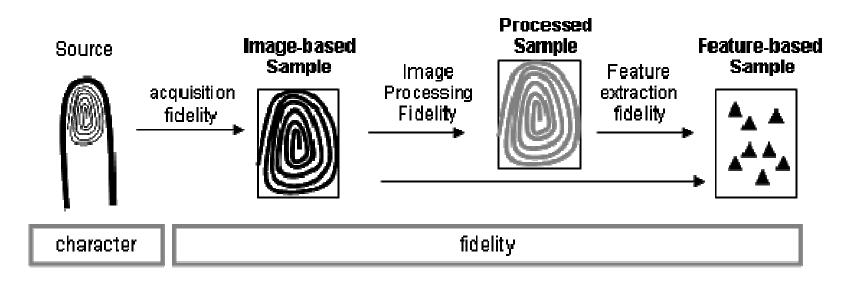
Fingerprint Image Quality Scoring Example

Score = 14

Score = 81

A 1-100 score is assigned

– good quality
– Poor ridge flow or poor minutiae
– too dark
– too light

Several Contributors/Detractors to Quality

- Can we differentiate between different sources of quality degradation? This could be very useful.

Quality Standard Background

- Work initiated at M1 in 2003
- The November 2004 in Paris resulted in the establishment (N0923) of Quality Rapporteur Group (QRG).
- The Quality Rapporteur Group met and produced a Report (N1128), which was presented in RSA in June/July 2005.
- The Report made several recommendations and suggestions
  - Quality score purpose
  - Quality score expression and definition
  - Discussion of several approaches, including
    - Quality algorithm ID (QAID)
    - Quality score normalization datasets (QSND)
    - Impairment bitfield
    - Percentile rank
- A project was approved to develop a multipart biometric sample quality standard (ISO/IEC 29794-1/4/5)

Standards Scope

- Work performed by WG3: data interchange format standards
- Intended to provide a means to assign, interchange, and interpret biometric sample quality scores in a way which is meaningful and useful
  - These standards are not intended to set minimum levels of quality for a given application
  - A quality score and the term "quality" is not used to describe the acquisition settings of the sample, such as image resolution, dimensions in pixels, grayscale/color bit depth, or number of features
- Quality scores should be predictive of sample behavior in a matching environment

- It is left to other work, (eg. Common Headers AHG, 19794 revision efforts) to define how to incorporate 29794 work

Status – M1

- Biometric Sample Quality Standard is currently on hold in anticipation of output from ISO/IEC SC 37, where work is ongoing

Standard Status – ISO/IEC SC 37

- A three-part Standard is in progress: ISO/IEC 29794-x:

- Part 1: Framework, CD (Community Draft, International Standard)
  - Modality independent content
- Part 4: Finger Image, TR, WD2, (Technical Report, Working Draft)
- Part 5: Face Image, TR, WD, (Technical Report, Working Draft)

Standardization Approaches Discussed

- Standardizing quality scoring algorithms
  - Analogous to standardized tests
- Utilizing percentile ranking
  - Achieves some normalization of scores, with algorithms expressing scores on the same scale
  - Analogous to grading students on a curve
- Building a database of samples and assigning scores (QSND)
  - Datasets would serve as targets for vendors
  - Analogous to publishing a reference set of papers graded by "expert" teachers
- Quality algorithm identification (QAID)
  - Let score recipient know the algorithm used to generate the score
    - adds fields to data interchange formats
  - Analogous to giving a student's grade and also identifying the teacher that gave the grade;
    - assumes availability of data on teachers' grading history, etc.

Current Focus: Quality Algorithm ID

- The Quality Algorithm ID (QAID) is an identifier of the quality algorithm used to calculate the quality score of the sample

- It is useful to enable the recipient of the BIR to differentiate between quality scores generated by different algorithms and adjust for any differences in processing or analysis as necessary

- The existing CBEFF Format Owner Registry provides a list of two-byte codes for vendors, which will be used to indicate the vendor of the quality algorithm used to score the sample in the INCITS-compliant data file

- The algorithm is more specifically identified with vendor-supplied identifier

QAID Fields

description	size	valid values	Note
Quality Score	1 byte	[0,100] 254, 255	0: lowest 100: highest 254: no attempt made 255: failed attempt
Quality Algorithm Vendor ID	2 bytes	"0" if Quality Score = 254 [1,65535] otherwise	Vendor ID registered by IBIA.
Quality Algorithm ID	2 bytes	"0" if Quality Score = 254 [1,65535] otherwise	Algorithm ID provided by the vendor (optionally registered with IBIA)

Thank you!

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