

The need for component quality metrics and weighting factors

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Opening Cliché

“Beauty is in the eye of the beholder”

Opening Cliché Analogy

“Beauty is in the eye of the beholder”

“Quality is in the context of the comparator”

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Conventional Wisdom

- 1 Face Pose Angle should be full frontal for high quality score
- 1 Iris Eyelid Occlusion should be minimal for high quality score

“Quality is in the context of the comparator”

Contradictory Illustrations

- 1 Face Pose Angle - insensitive for video surveillance, 3-D face model
- 1 Iris Eyelid Occlusion – insensitive for “bow tie” and inner iris texture dominated algorithms

“What is the worth of a Quality Score for a gallery entry?”

“Quality is in the context of the comparator”

Contradictory Illustrations

- 1 Face Pose Angle - insensitive for video surveillance, 3-D face model
- 1 Iris Eyelid Occlusion – insensitive for “bow tie” and inner iris texture dominated algorithms

“What is the worth of a Quality Score saved with gallery entry?”

“Quality is in the context of the comparator”

Where is quality used?

- 1 Cooperative Enrollment – to evaluate acceptability (or re-enroll)
- 1 Comparison Sample Acquisition - to evaluate suitability (or re-acquire if practical)
- 1 **Comparator – fusion scheme or algorithm selection based on quality**

Quality Computation - generalized

Quality Score (QS) is a scalar value computed by combining (***weighting***) several independently quantified ***quality components*** (metrics) derived from a biometric sample

Quality Vector (QV) is an array of ***quality component*** values

Weights (W) is an array of ***weighting*** factors that tune the QS to a particular comparator

$$QS = QV \bullet W$$

Limitations of Quality Score

- 1 QS is computed for a specific comparator (or set of similar comparators)
- 1 Applications using other comparators can not optimally utilize QS

IF the vector (used to compute gallery QS) were available, then application specific weights could be applied to compute a meaningful QS

Introducing “Unqualified Interoperability”

“Interoperability” requirements vary across applications

Unqualified Interoperability includes:

- 1 Fully open architecture
- 1 Multiple enrollment sources
- 1 Multiple comparator providers

Specific vs. Generic Quality Vectors

- 1 Various approaches for determining sample quality can/do coexist for a modality



Specific Quality Vectors

- 1 Unqualified Interoperability would best be supported by a standardized metric set



Generic Quality Vectors

Iris Quality

3 Specific Quality Vector definitions

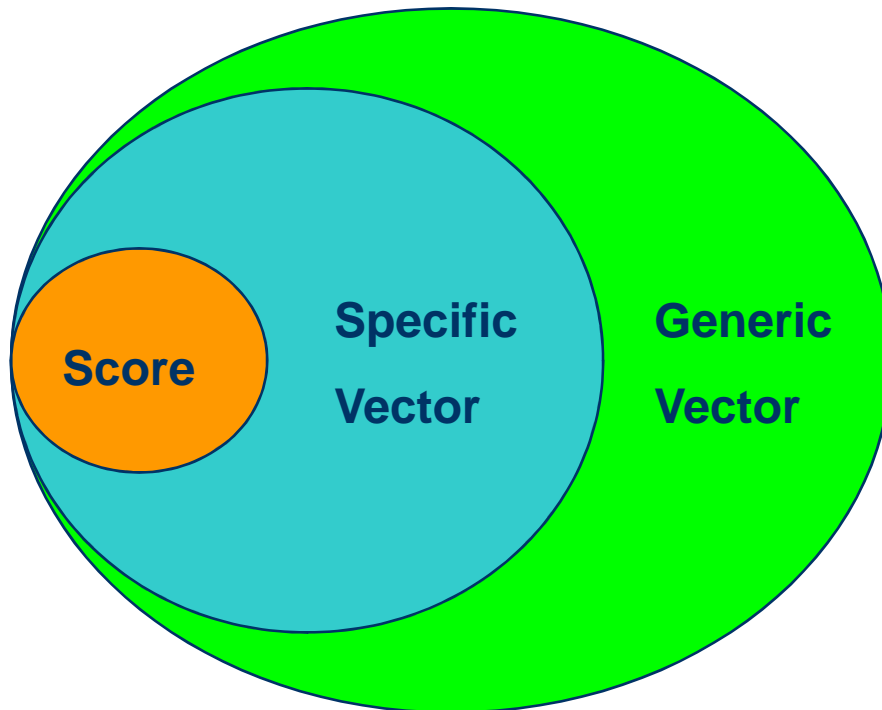
| Metric | ISO/IEC 19794-6-2005 | Iridian | WVU |
|------------------------------|------------------------------------|----------------------|----------------------------------|
| Resolution and iris diameter | X (Iris pixel resolution) | Iris radius | Pixel counts |
| Focus | X (Preserve spatial resolution) | | Defocus blur Motion blur |
| Grayscale density | X | Iris intensity | |
| Illumination* | X | | Lighting (illumination) |
| Contrast | X (iris-sclera contrast) | Iris-sclera contrast | |
| Visible iris | X (% of visible iris) | Visible iris | Occlusion Specular reflection |
| Pixel aspect ratio* | X | | |
| Image scale | X (Iris diameter & pixel count) | Iris radius | Pixel counts |

Iris Quality

3 Specific Quality Vector definitions

| Metric | ISO/IEC 19794-6-2005 | Iridian | WVU |
|---------------------|----------------------|---------|-----------|
| Optical distortion* | X | | |
| Image orientation | X | | Off-angle |
| Presentation | X | | |
| Pupil radius | | X | |
| Pupil-iris ratio | | X | |
| Texture Energy | | X | |
| Pixel counts | | | X |

Breadth of Interoperability Supported



Some applications fully interoperable using **Score**

More interoperability achieved with **Specific Vector**

Maximum interoperability would require standardized **Generic Vector**

Take-away Messages

- 1 Be mindful of all aspects of the comparator
“Quality is in the context of the comparator”
- 1 Focus on the Quality Vectors where the richness of quality information persists
- 1 Consider the value of Generic Quality Vectors for Unqualified Interoperability

Thanks for the applause!

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