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

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

“Quality is in the context of the comparator”

Contradictory Illustrations

- Face Pose Angle - insensitive for video surveillance, 3-D face model
- 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

- Face Pose Angle - insensitive for video surveillance, 3-D face model
- 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?

- Cooperative Enrollment – to evaluate acceptability (or re-enroll)
- Comparison Sample Acquisition - to evaluate suitability (or re-acquire if practical)

- **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

- QS is computed for a specific comparator (or set of similar comparators)
- 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:

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

Specific vs. Generic Quality Vectors

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

  → **Specific Quality Vectors**

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

  → **Generic Quality Vectors**

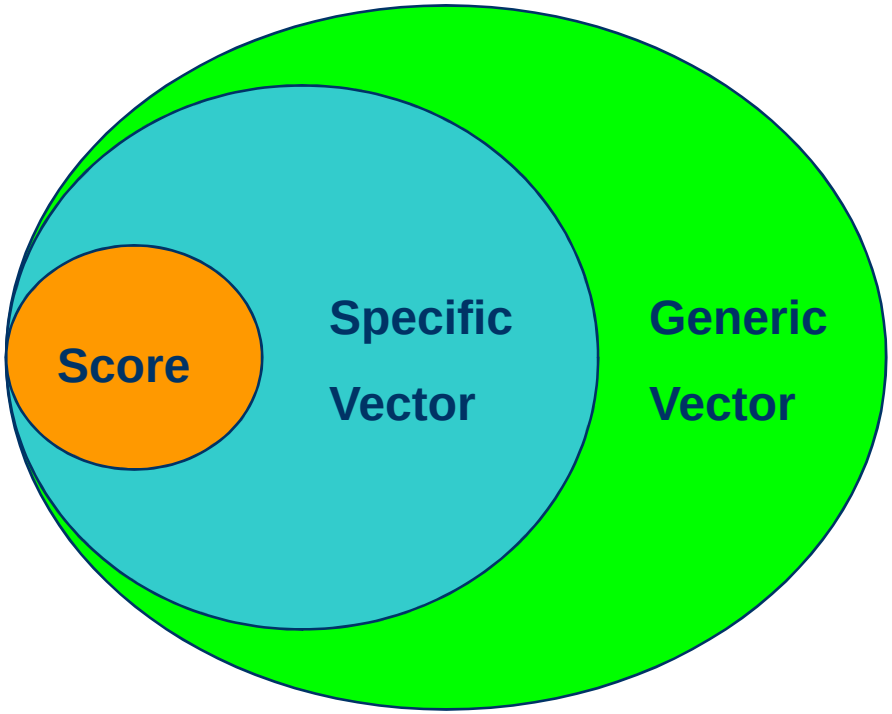
Iris Quality
3 Specific Quality Vector definitions

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

- Be mindful of all aspects of the comparator

  "Quality is in the context of the comparator"
- Focus on the Quality Vectors where the richness of quality information persists
- Consider the value of Generic Quality Vectors for Unqualified Interoperability

Thanks for the applause!

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