

Skin as a New Biometric

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**PRESENTED BY:
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Identix Inc.**

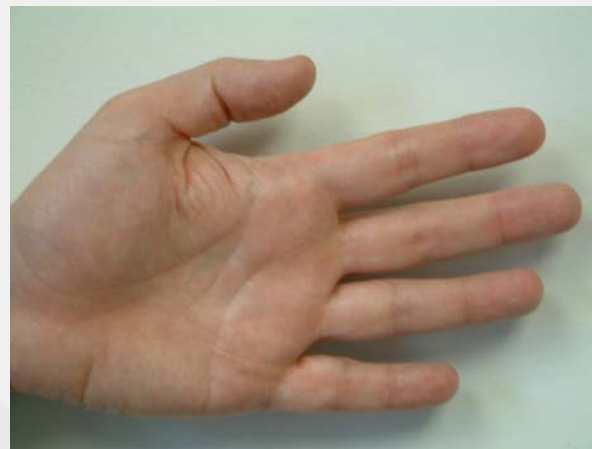
Skin in the Game



- Dermal texture is unique physical trait that is stable over time
- Can be used to distinguish between individual people
- Can be extracted from standard photos (of reasonable quality)

Skin: Multiple Sources

- Skin biometric can be extracted from images of a face, hand, palm, ...



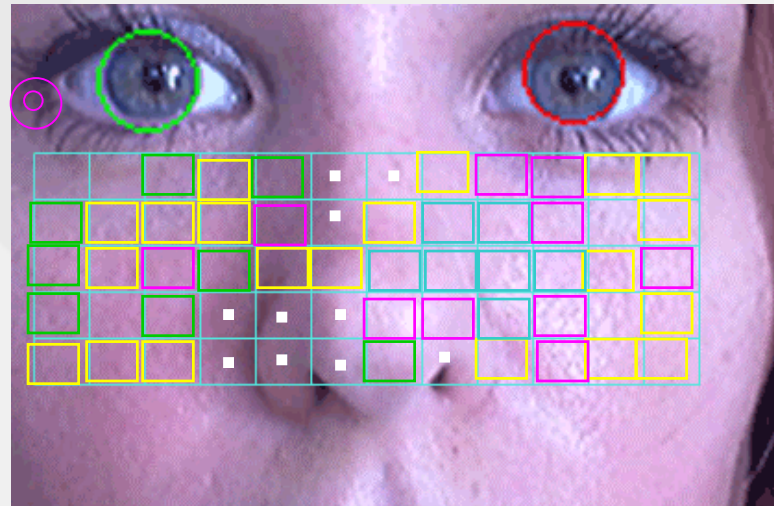
The Breakthrough: STA

- Discovery of Surface Texture Analysis (STA) by Bruno Delean: founder of Delean Vision, Inc. recently acquired by Identix
- Patents filed in 2002 & 2003; Technology has since been enhanced by Identix Research Center to even higher levels of performance
- New class of pattern recognition algorithms with broad applicability to matching textured surfaces:
 - e.g. skin, paper, currency, legal documents, etc

How Does STA work?

- Unlike traditional biometric approaches, STA does not rely on topographic points or predefined discernable features:
- STA analyzes areas of skin for uniqueness in texture: the "Skinprint"
- Matching uses a probabilistic approach

STA indicates the degree that two surfaces are same if the blocks match in *an orderly fashion*



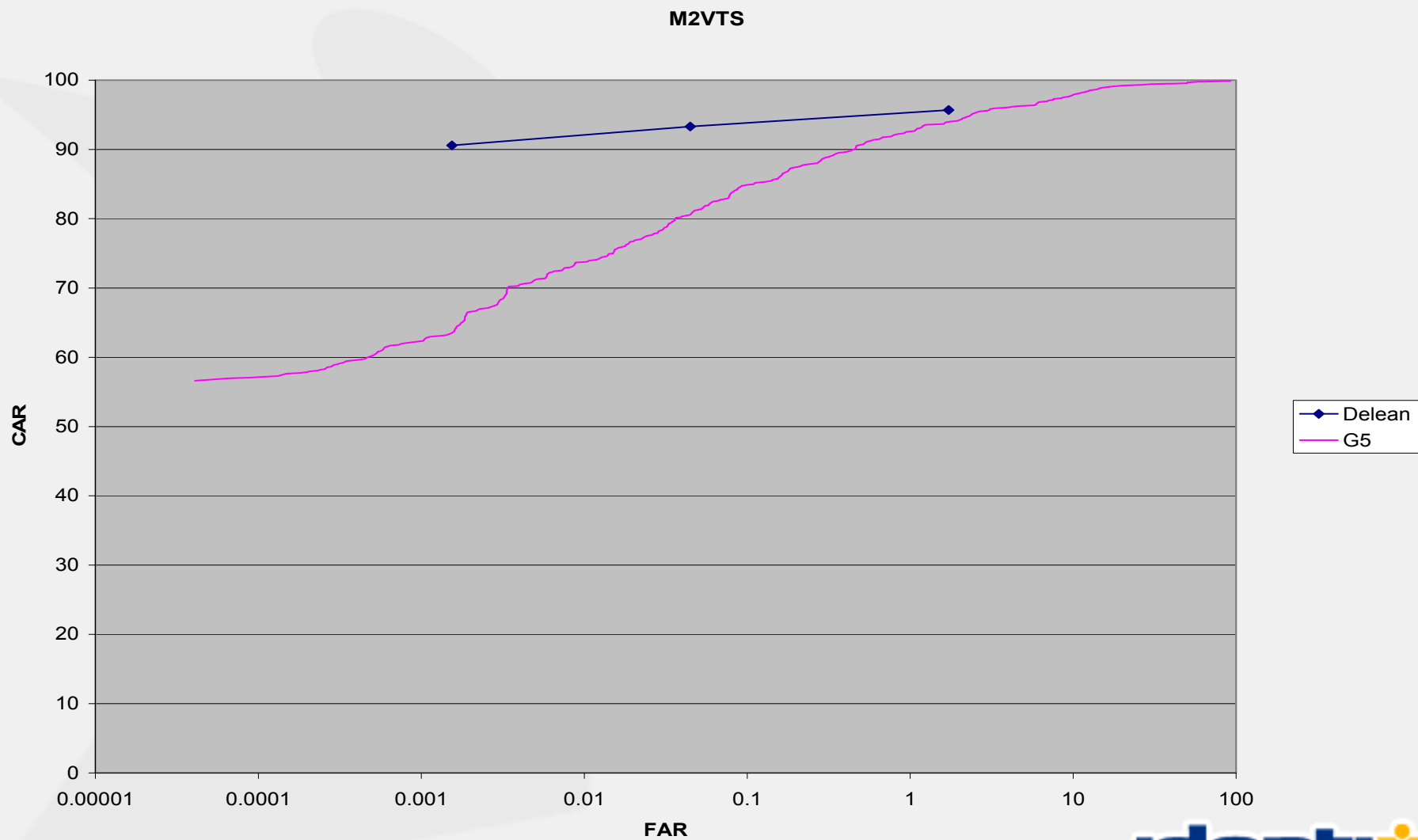
New Generation of Biometrics

- Early Biometrics: automate human process
 - Fingerprints, Facial Features, Hand Geometry,...
- New Generation: leverage capabilities of machines
 - Skinprint, Skin-Based Light Reflection, ...

Quality Requirements for STA / Skin

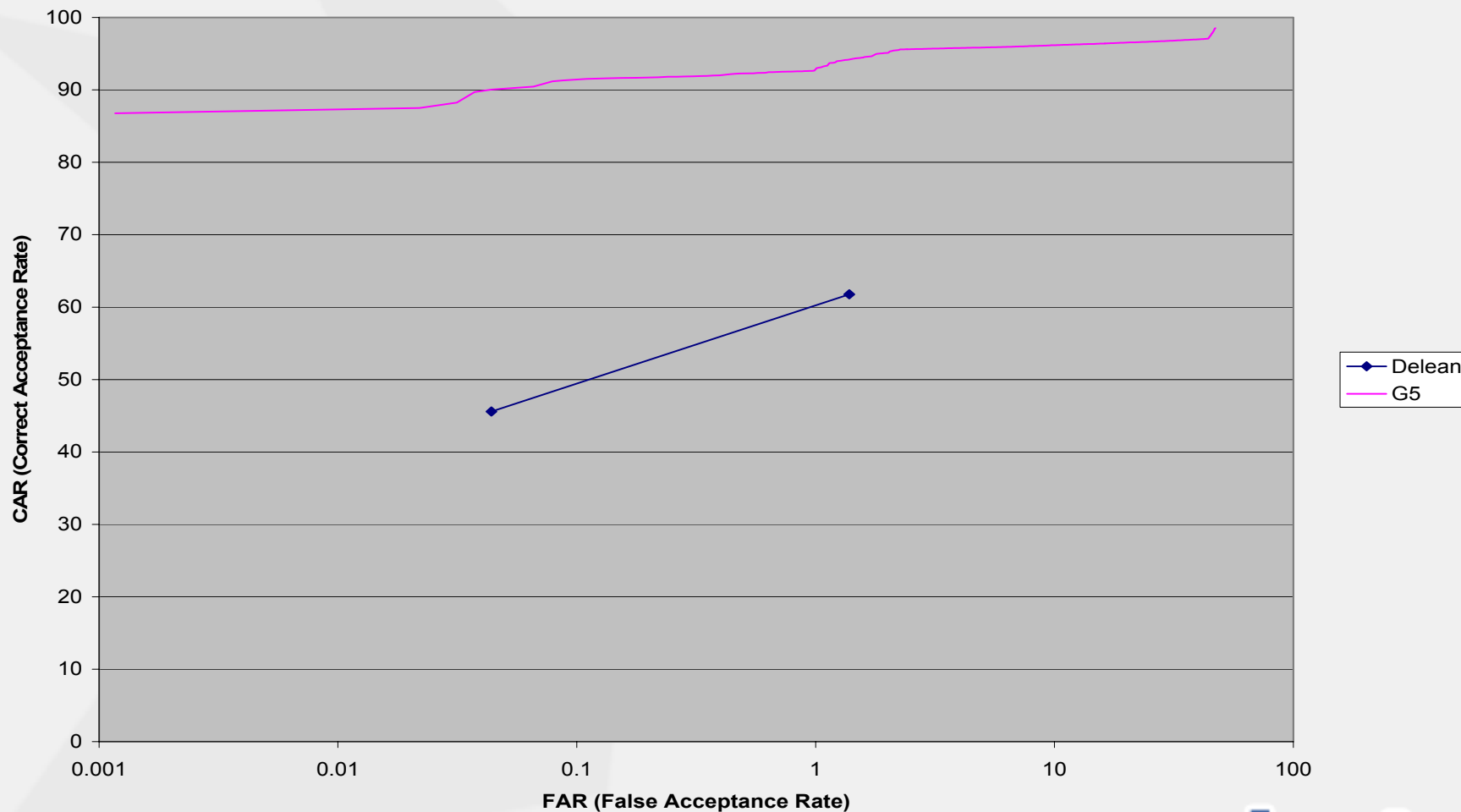
- Requires:
 - Good Resolution (90 pixels between the eyes min, 120 better)
 - Low Compression (no more than 10:1 on Region of Interest)
- Is Resilient to:
 - Lighting changes
 - Aging

High Resolution: Skin works well

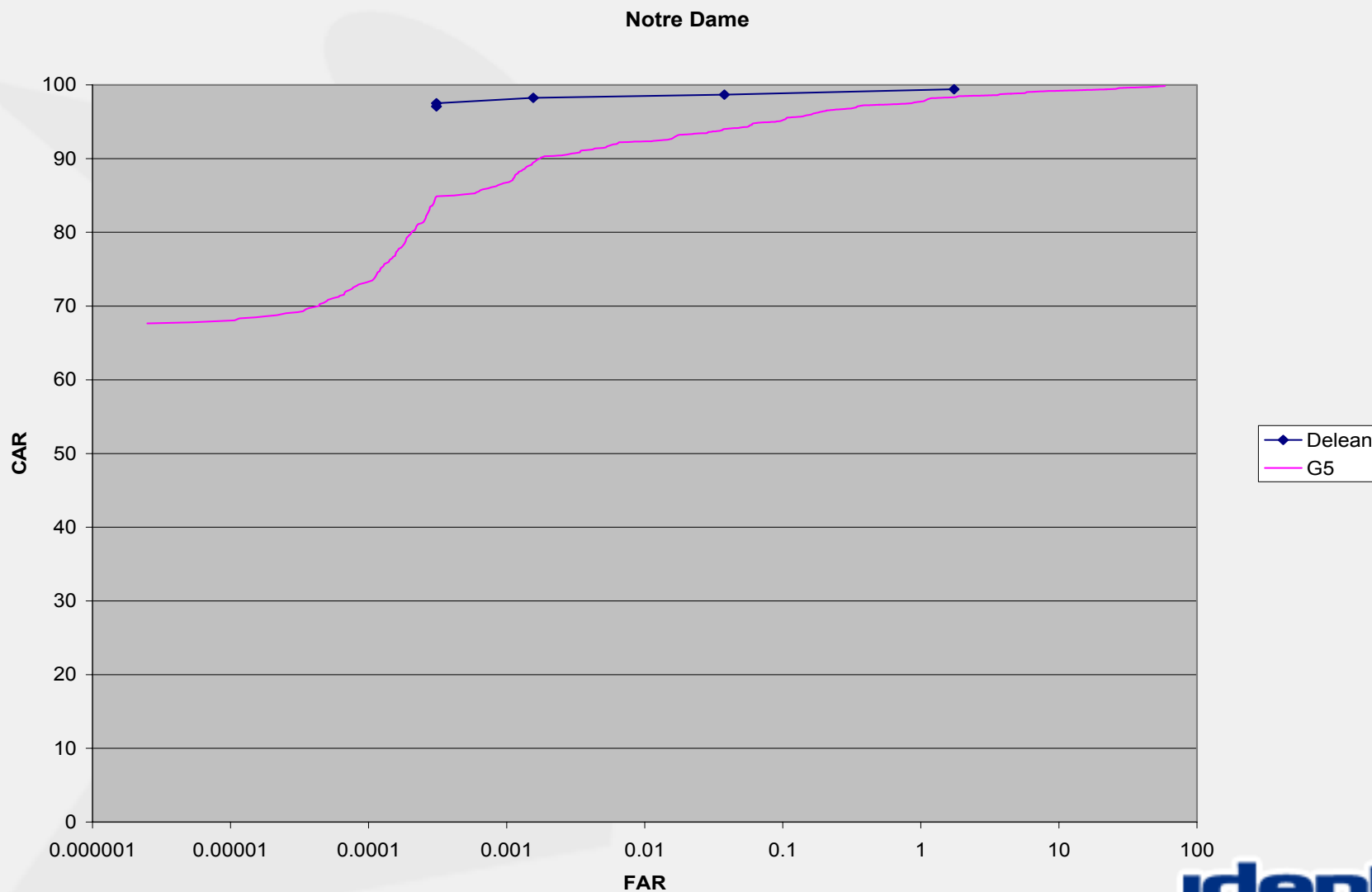


Low Resolution: Skin is affected

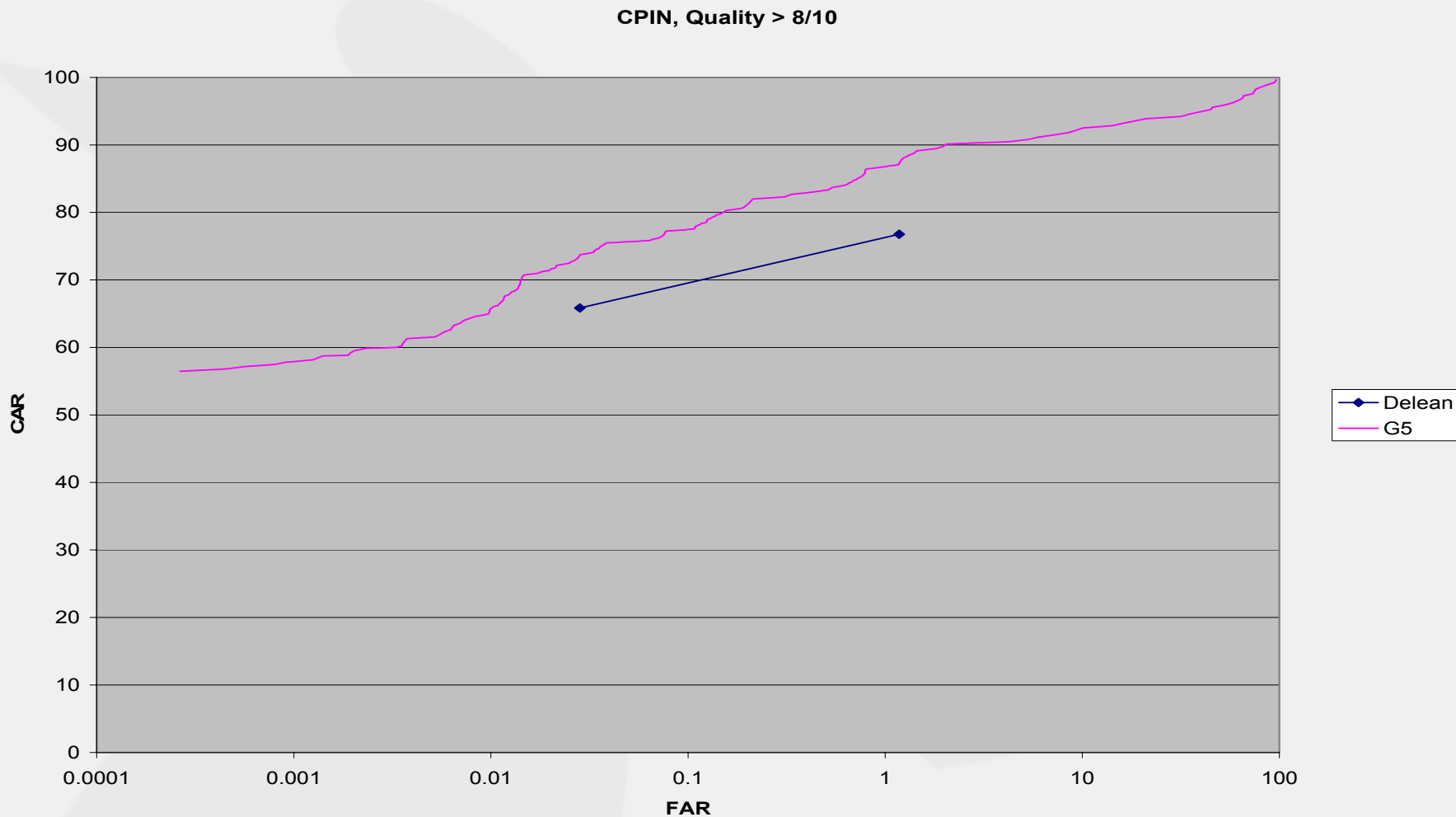
PIE Database flash vs. no Flash



Low Compression: Skin works well

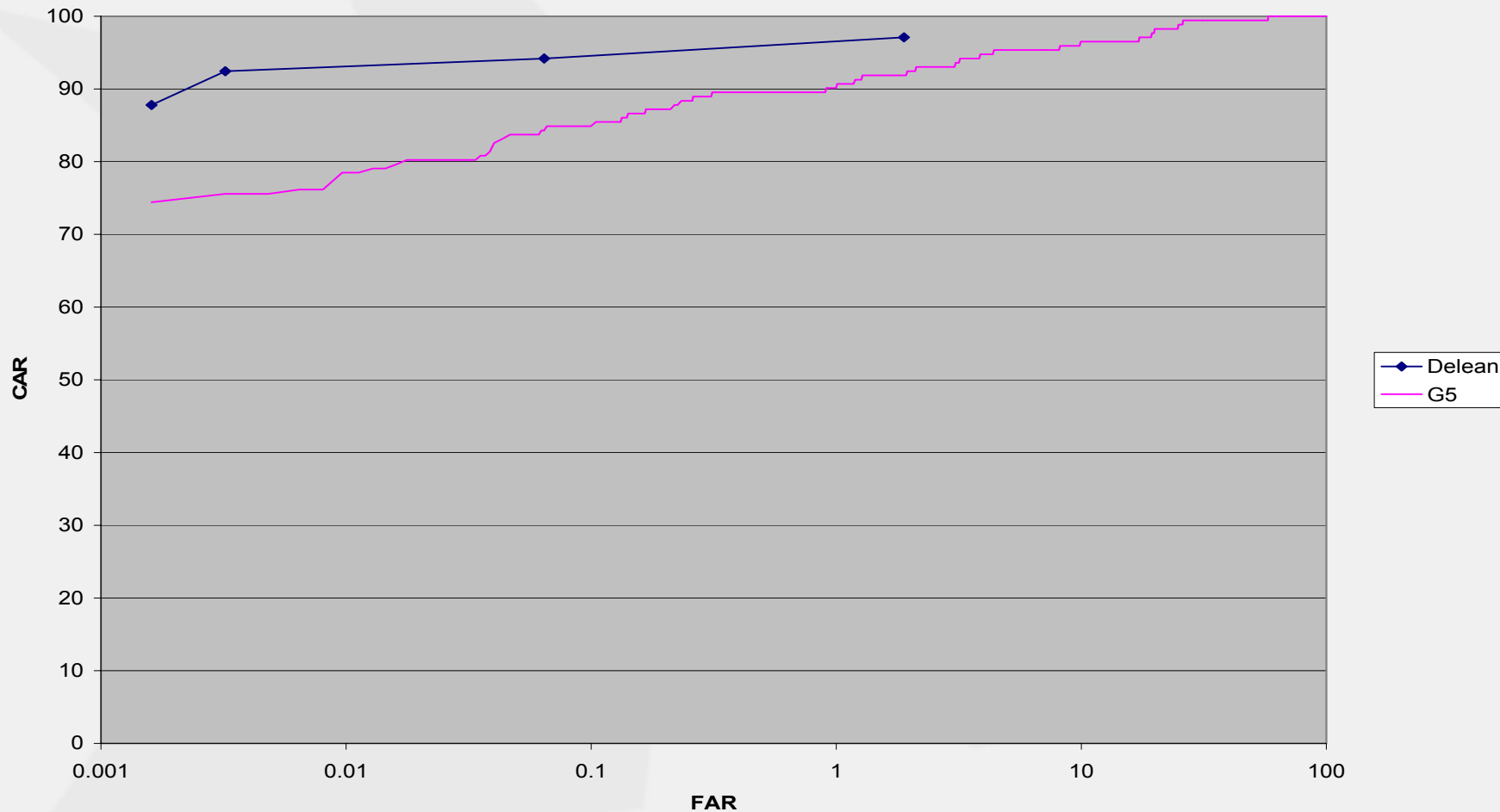


High Compression: Skin is affected

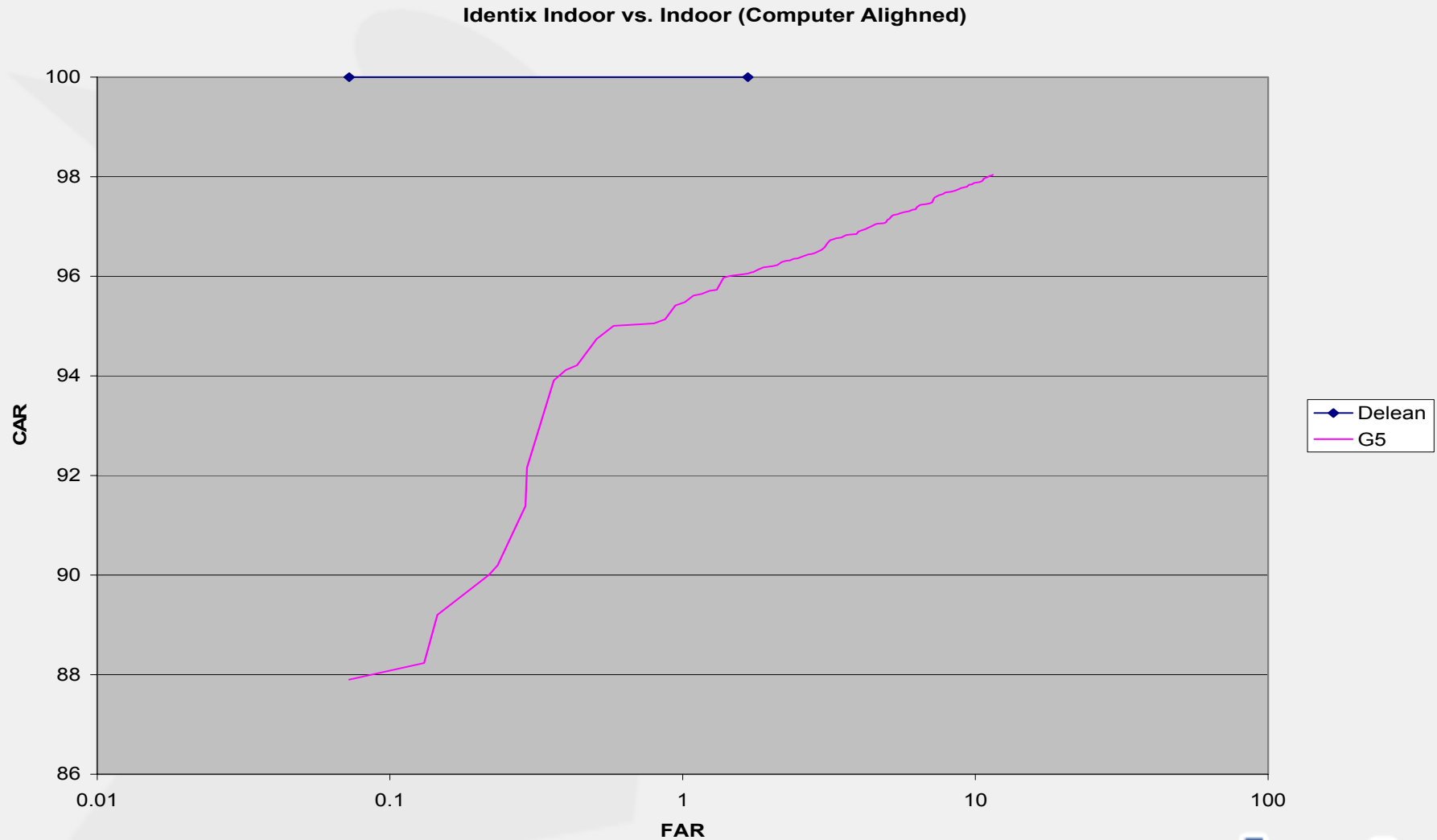


Aging: Skin Still Effective over Time

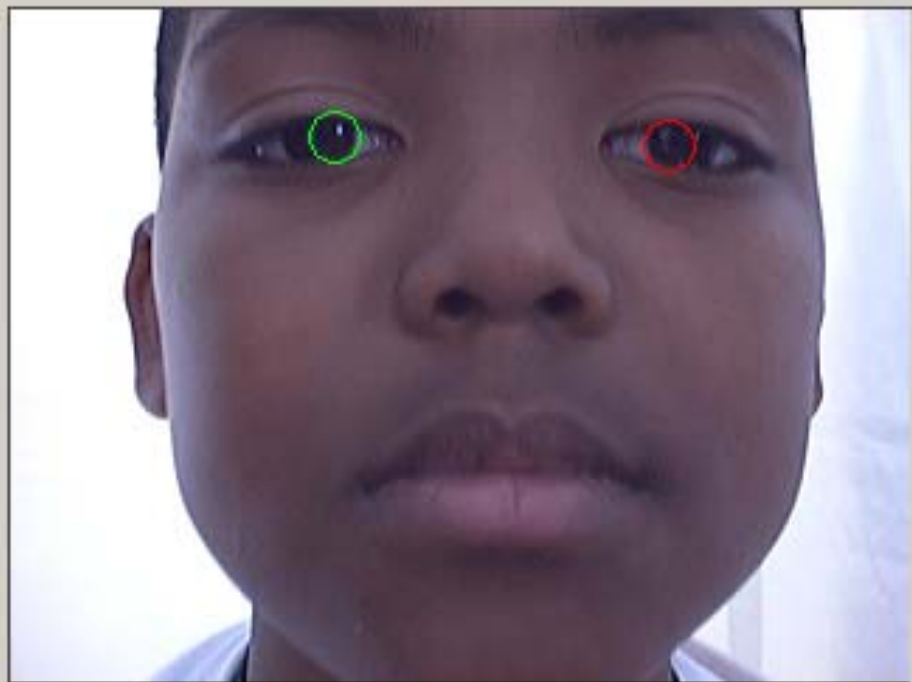
FerretHighRes Age Subset MA



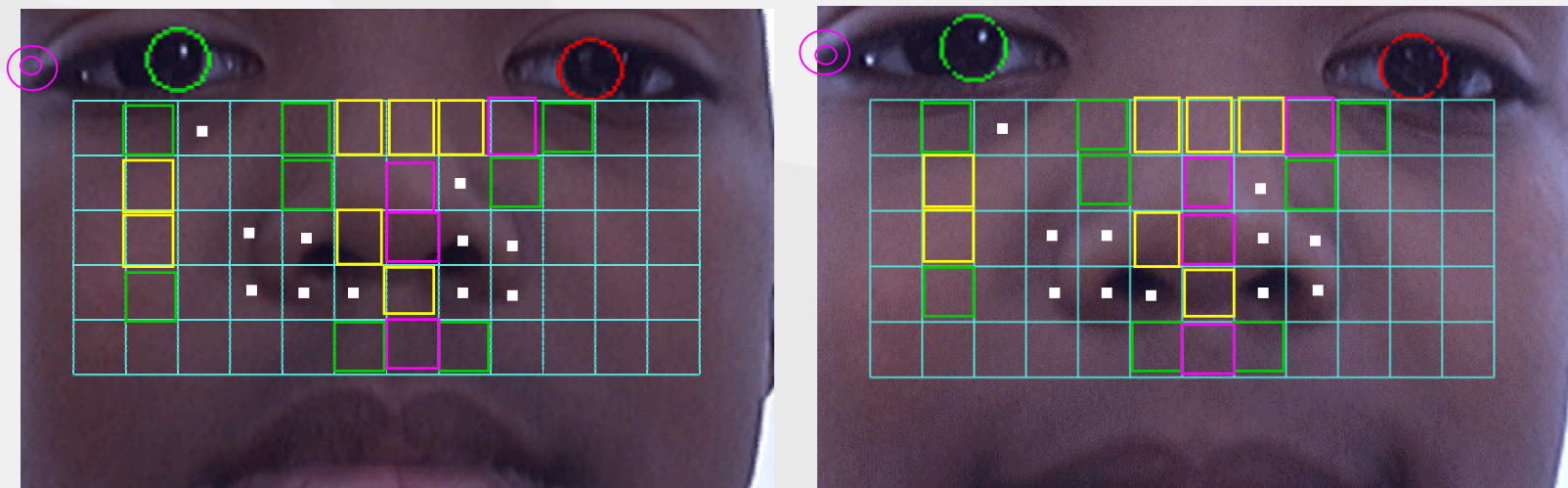
Lighting: Skin less affected than Features



Yves & Serge?

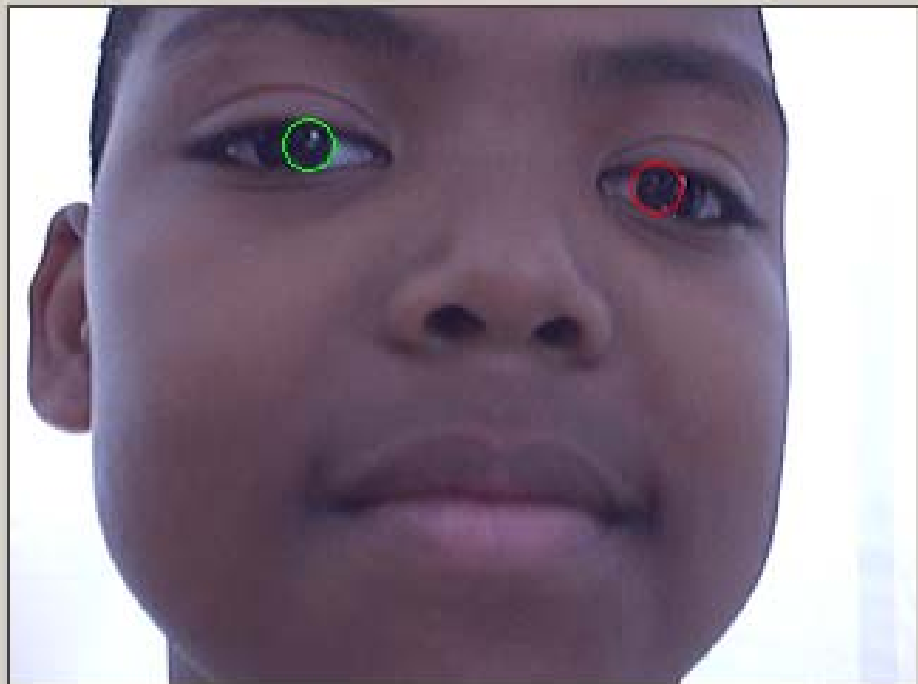
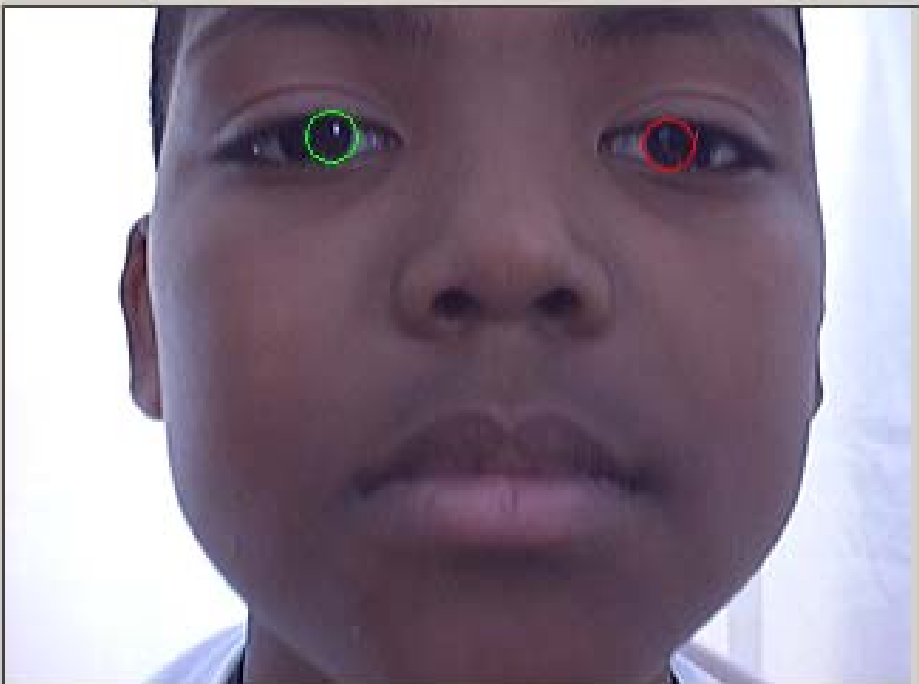


Yves Only

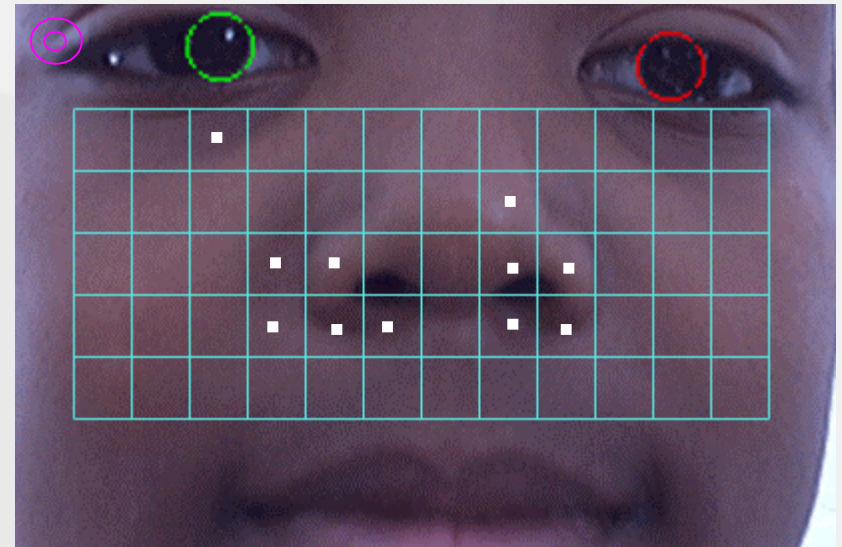
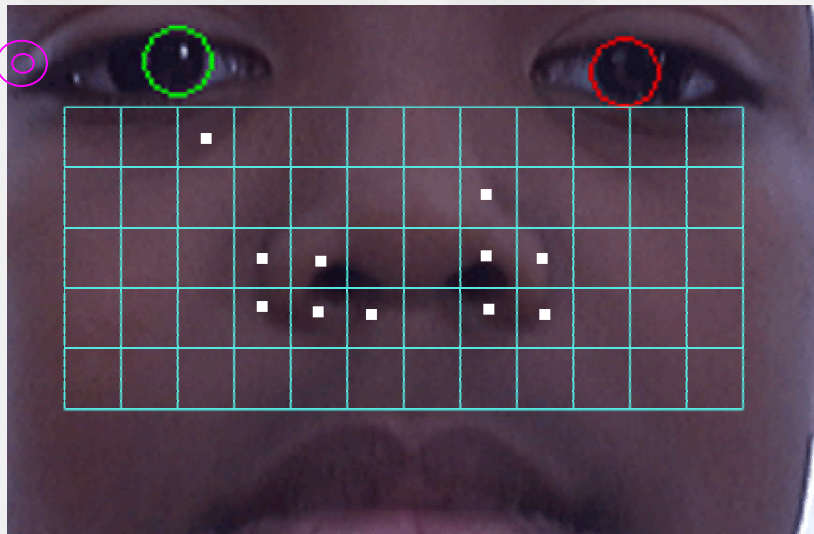


Score: 16

Yves & Serge?



Yves & Serge

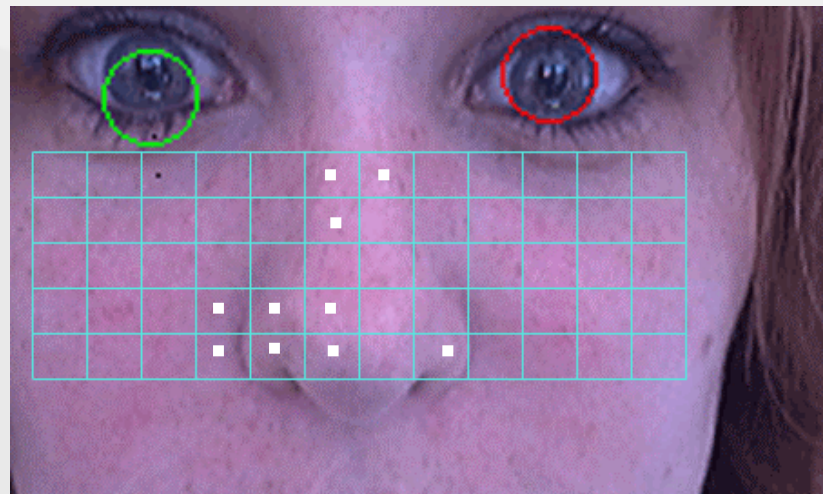
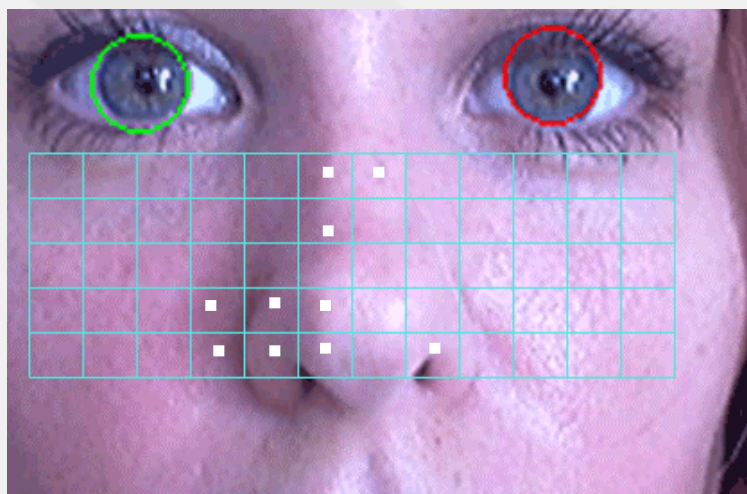


Score: 0

Nathalie & Josiane?



Nathalie & Josiane

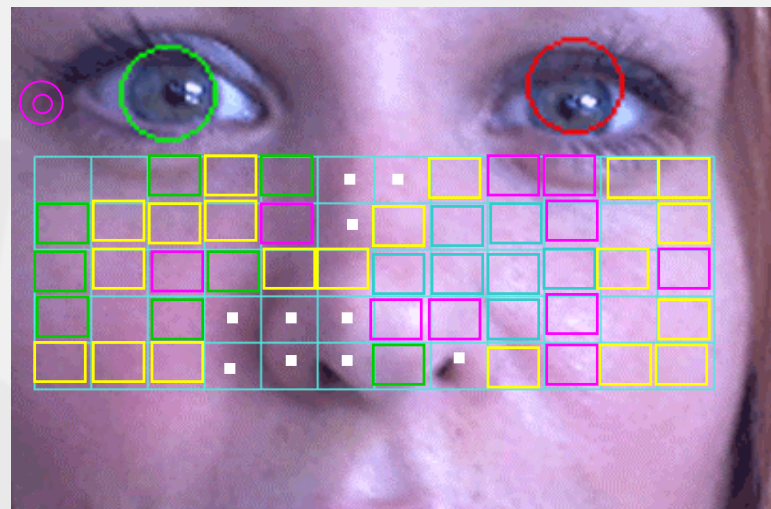
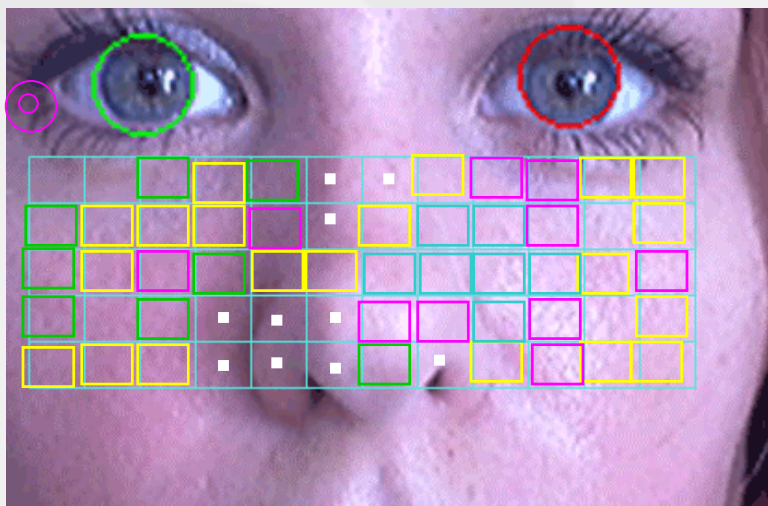


Score: 0

Nathalie & Josiane?

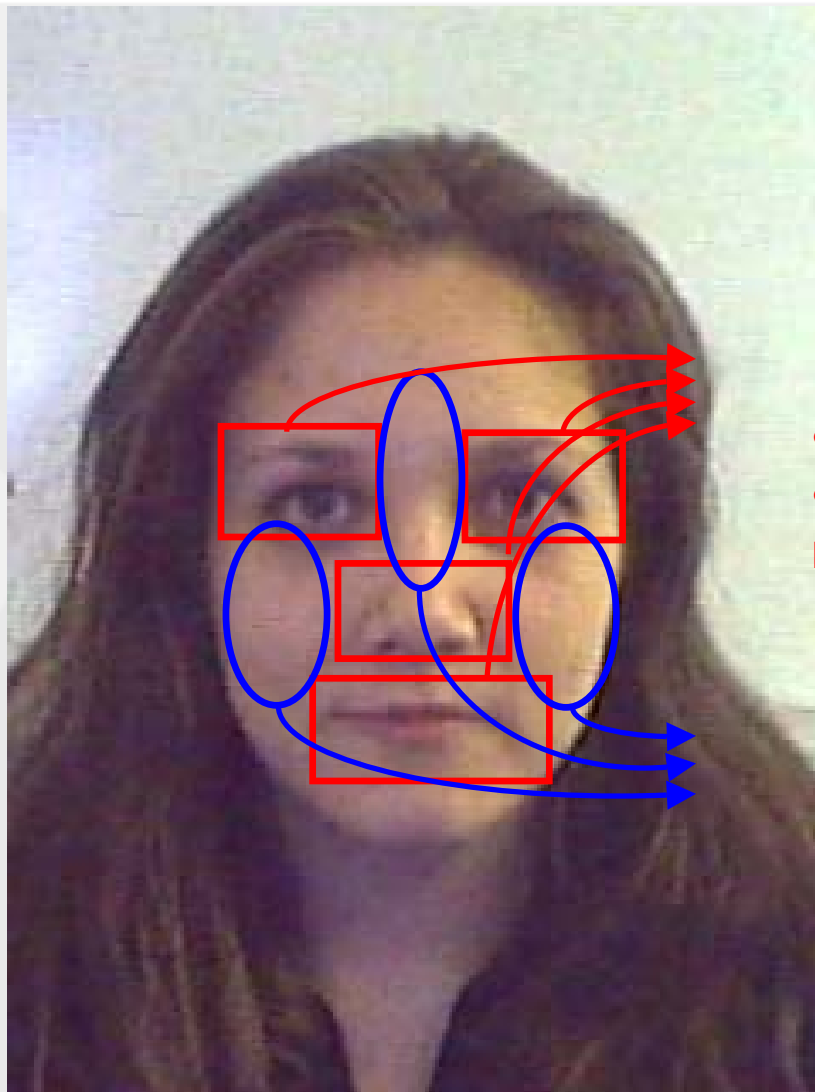


Nathalie Only



Score: 39

Multi-Biometric, Single Capture



Local Features:

- mouth, eyes, nose...
- applicable to low resolution

Skin Texture:

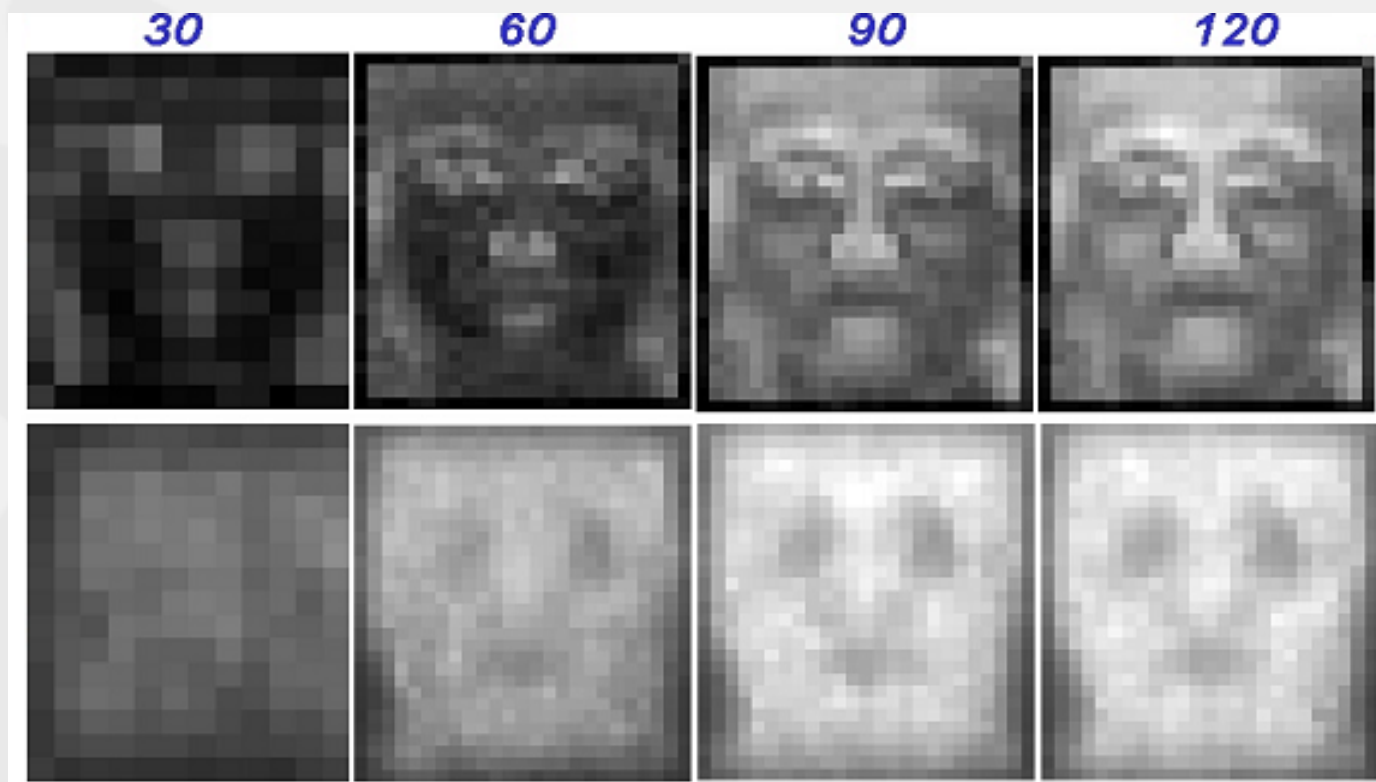
- random but unique per person
- requires higher resolution

Different Biometrics on the Face

Eye Pixels

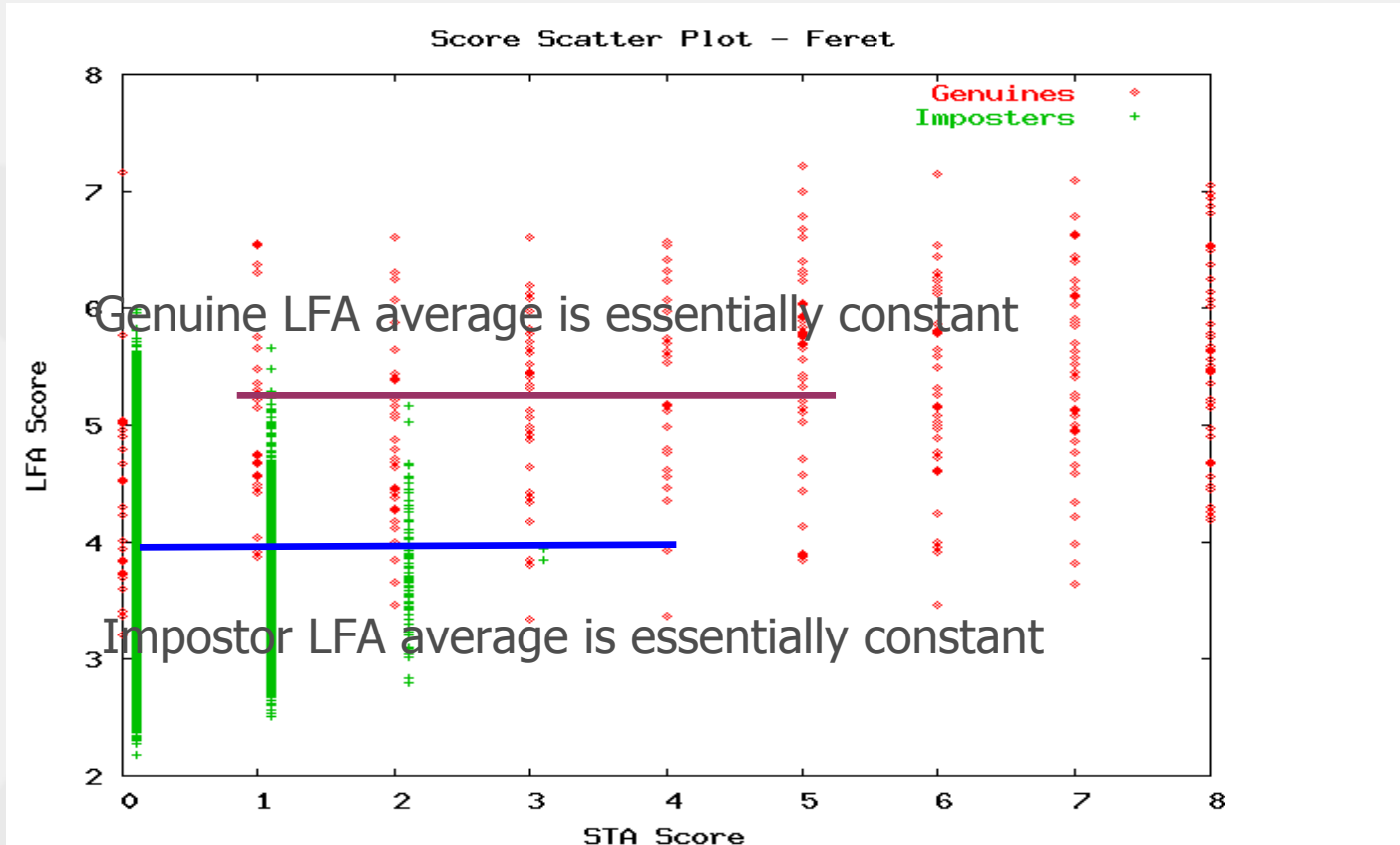
Face Features

Skin



- The images above indicate the resolving power between Genuine and Impostor for each portion of the face for either biometric as a function of resolution.

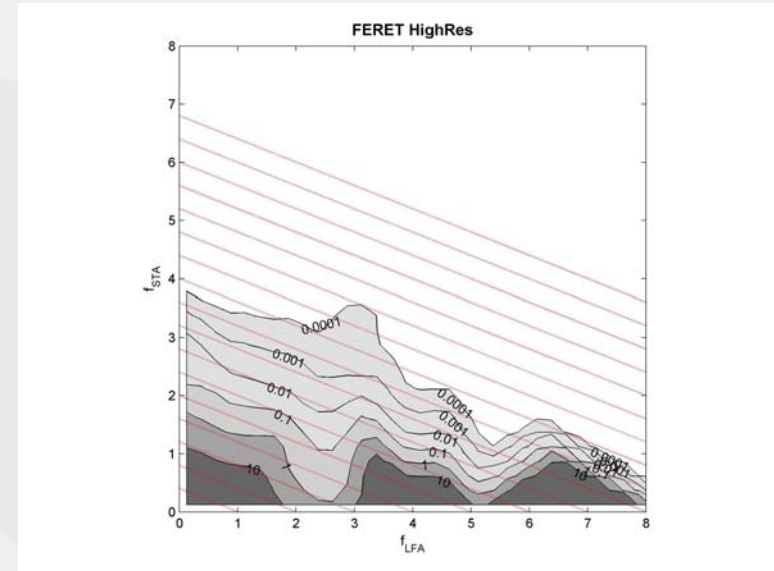
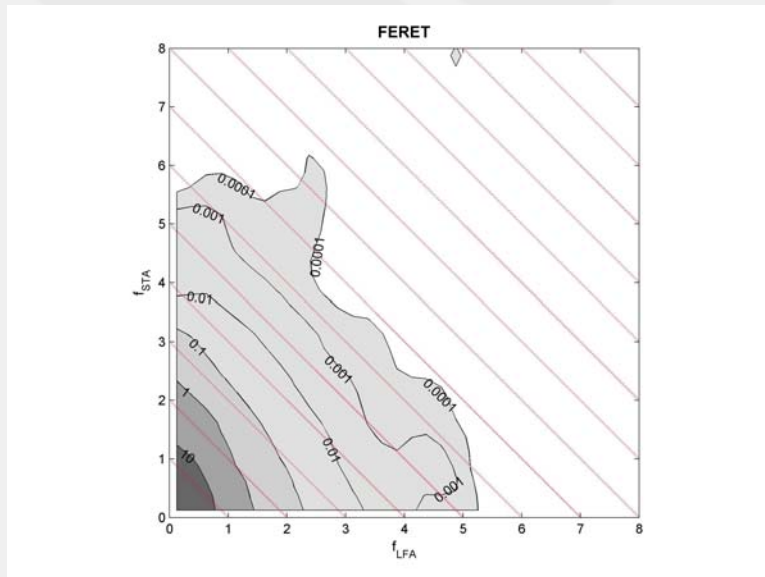
Uncorrelated Biometric Signals



As LFA (feature) score is essentially independent of STA (skin) score, the two algorithms can be treated as uncorrelated biometric signals

Leverage New Fusion Theory

- The Neyman-Pearson theorem states that optimal fusion is obtained by choosing decision boundaries that match equal density ratio contours.



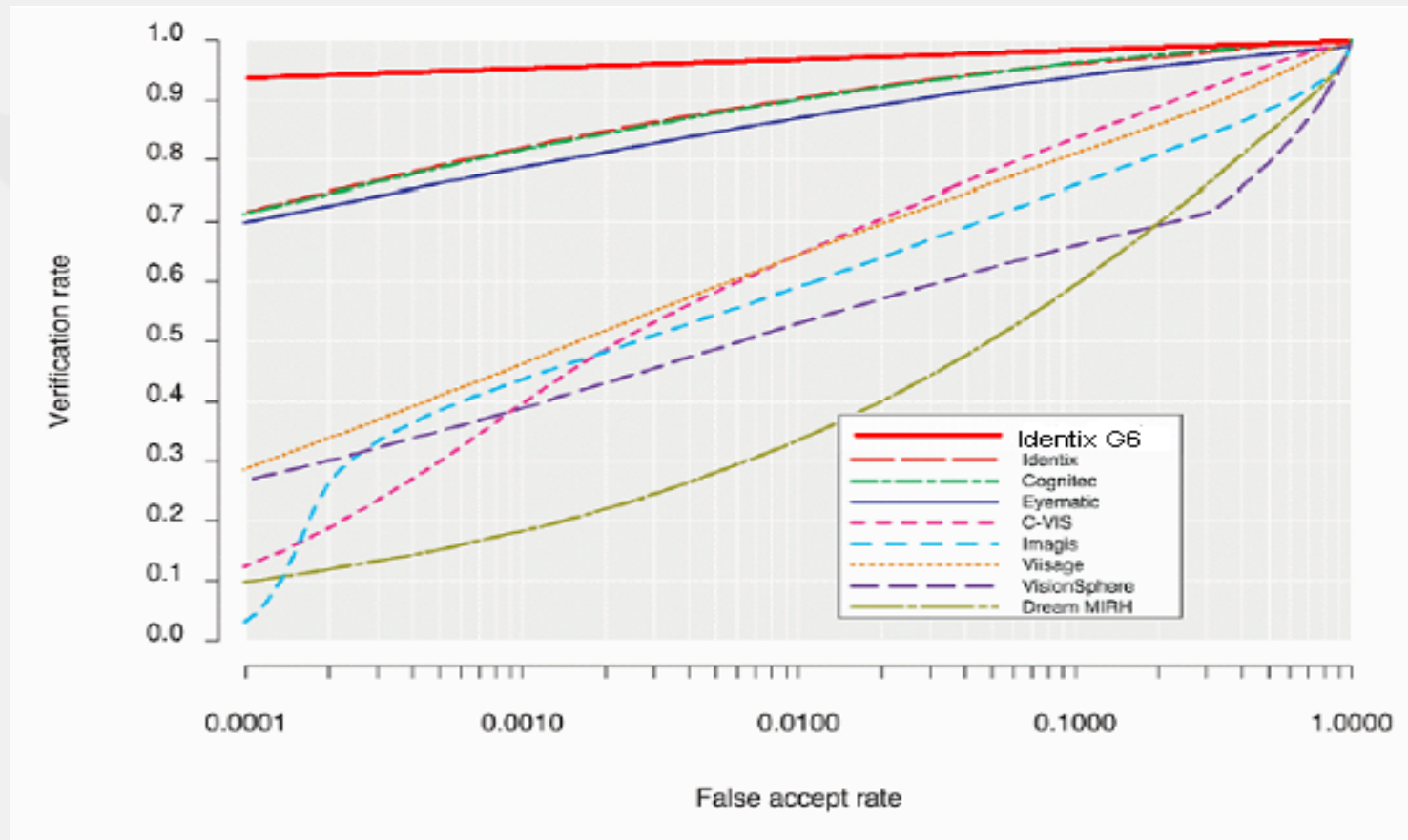
- The contours for Low-Res (left) and High-Res (right) are fit by the Linear Model with $\gamma=1$ and $\gamma=2.5$. The AND and OR contours do not fit.

Fusion Skin + Feature

- We favor using the Linear Model over the AND and OR rules
- This good performance is due to the “fit” to the constant density ratio contours



Skin + Features: Quantum Leap in Performance



Performance estimate is based on evaluation of G6 (Skin+Features) technology on the US Government FERET High-Resolution database and subsequent normalization to the FRVT 2002 results. The high curve on the FRVT test is the Identix G5 (Features only) technology.

For more information

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