Research Area: Image Fusion for Robust Iris Recognition

David Stoker
Program Manager, Optical Systems
SRI International
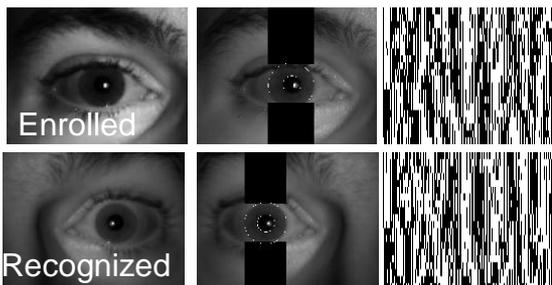david.stoker@sri.com
650-859-2243
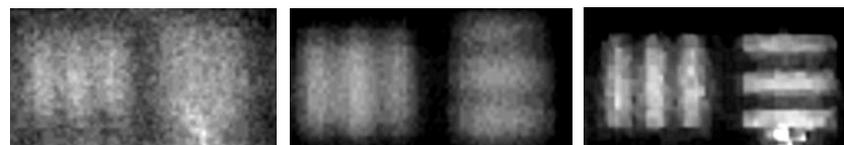6/10/2013

1. Recognition of Super-resolved Iris

Image   **Segmented**   **Template**

Enrolled

Recognized

Hamming Distance
= 0.30908

2. Atmospheric Turbulence Mitigation

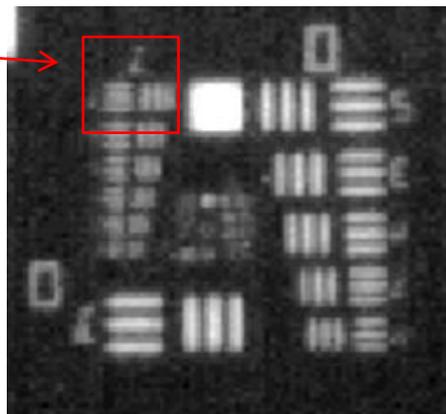**Single input frame**   **Fused images**   **Deblur out**
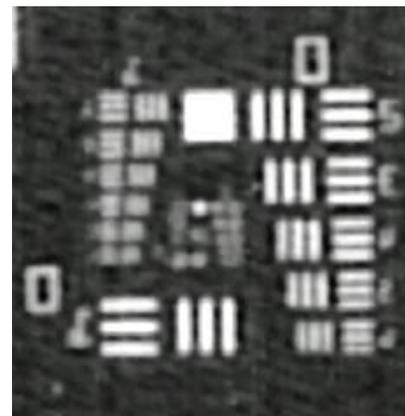
2 lp/mm @ 25 meters

Super-resolution methods

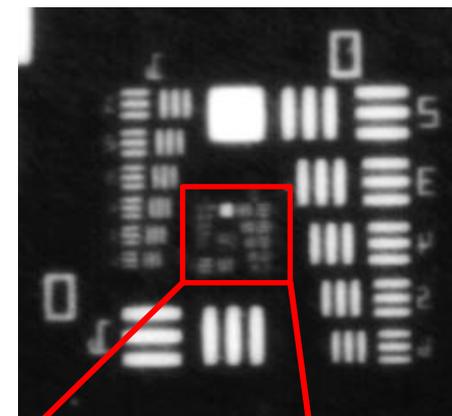*Several, noisy blurry frames are fused to produce a low noise, high resolution image !*

Low Res Input

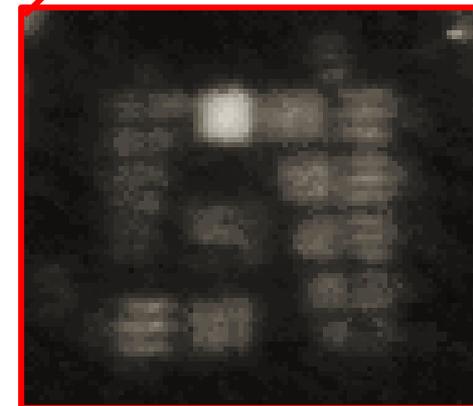**Ikena ™**

SRI

Iris feature size

- Multi-frame image fusion
- Reduces camera artifacts
- Reduces noise
- X4 increase in resolution

...means we can use *faster, lower resolution sensors*
...*also a wider field of view for a fixed resolution!!!*
These are significant advantages with practical applications

For example:

➢ *a single sensor to be used for both face and iris recognition*

Super-resolved Iris Performance

Hamming Distance Measured at 3 meters, stationary target, superresolved

Less than 1:200,000 chance of false match

20 meters – single frame

0.41 (No Match)

20 meters - fusion

0.349 (Match
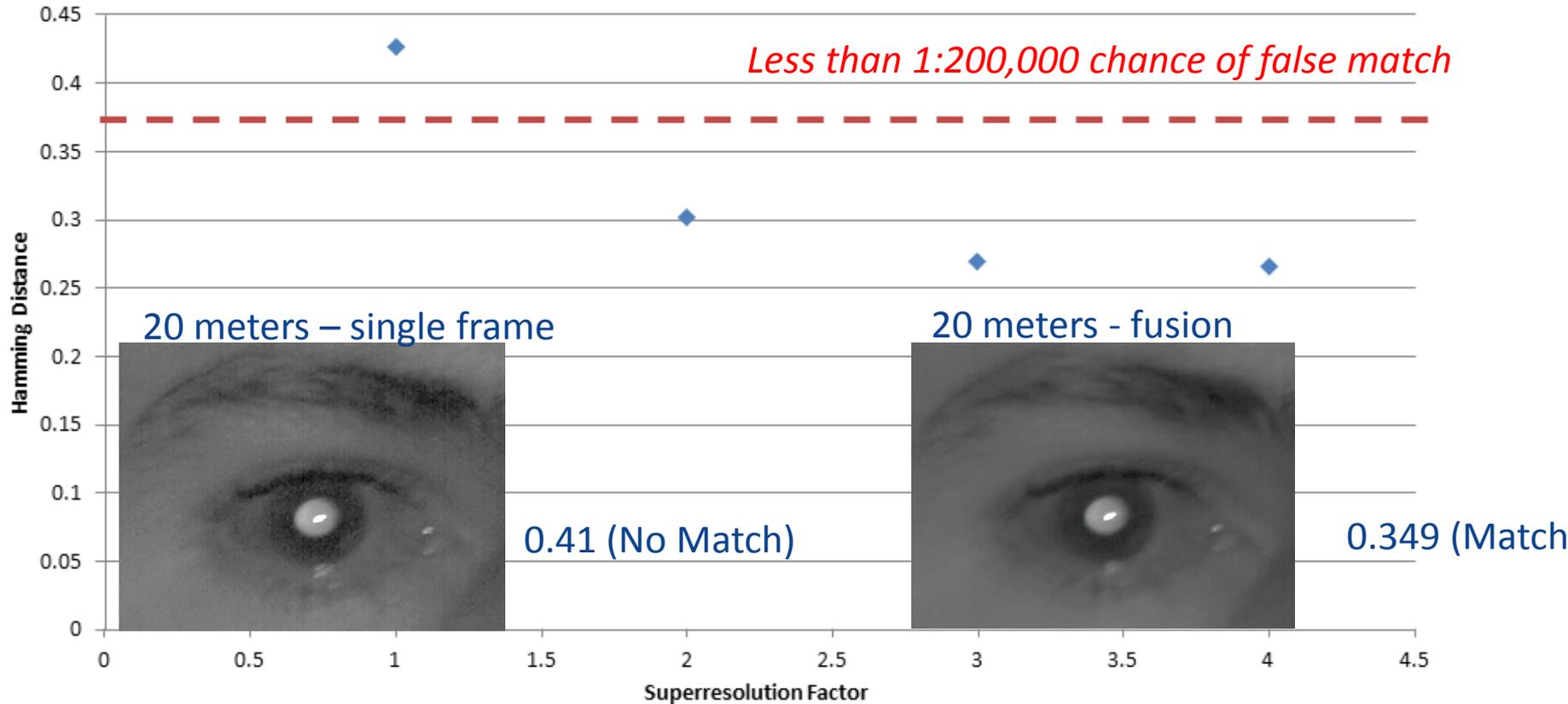
Super-resolution methods can achieve very good performance for short standoff.
Fair to good performance for > 20 meter standoff.
Ikena software outperforms on Irises, underperforms on targets.

Setup: Outdoor path length = 25 meters. Over black top during daylight.
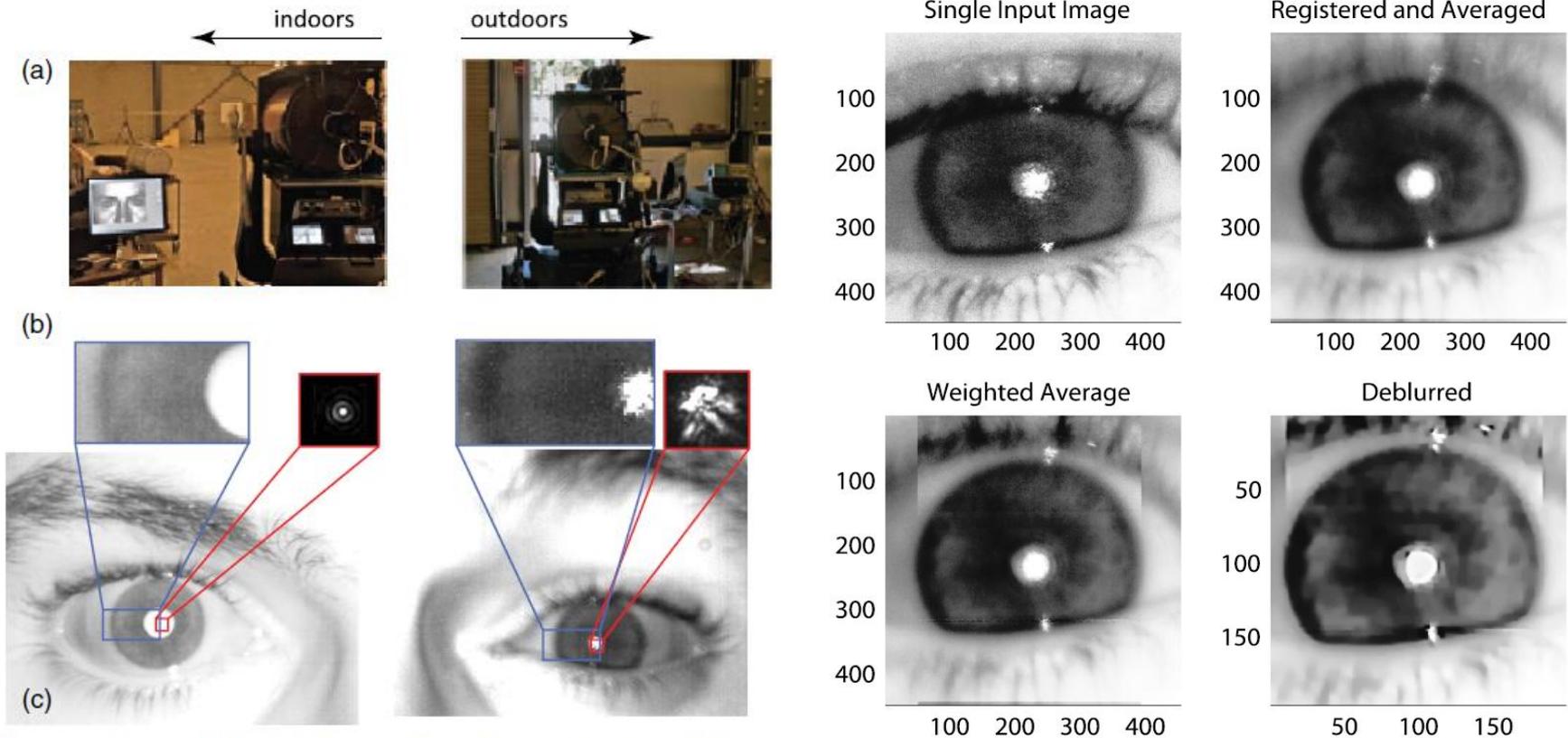

Fig. 4. (Color online) Indoor and outdoor (a) setup, (b) point spread function (measured from corneal glint), and (c) ocular images. PSF, point spread function.

20 March 2013 / Vol. 52, No. 9 / APPLIED OPTICS

Ocular Images were registered using computer-vision derived features (iris perimeter).
Frame weighting was used to remove occlusions from the eyelid.

Before restoration

Indoor–Indoor	Subject		
Subject	A	B	C
A	0.405	0.468	0.472
B	0.478	0.365	0.479
C	0.478	0.468	0.409
Indoor–Outdoor	Subject		
Subject	A	B	C
A	0.461	0.479	0.469
B	0.465	0.448	0.472
C	0.476	0.482	0.477

After restoration

Iris Registration	Subject		
Subject	A	B	C
A	0.298	0.458	0.441
B	0.440	0.338	0.461
C	0.469	0.440	0.363
Glint Registration	Subject		
Subject	A	B	C
A	0.291	0.451	0.445
B	0.435	0.366	0.456
C	0.476	0.442	0.353

True Positive: < 0.35 (avg)

False Positive: > 0.44 (avg ➡ 1:150,000 chance of false positive

- Direct application of SR doesn't always work, particularly in dynamic video data – proprietary Ikena software better though resolution poorer on fixed targets

- Apparent loss in resolution via image fusion offset by ability to enhance 'subspace' features leading to better recognition contrast

- Atmospheric de-warping may apply to the pose problem for facial recognition by normalizing feature locations

David Stoker

Program Manager, Optical Systems

SRI International

david.stoker@sri.com

650-859-2243

http://www.sri.com