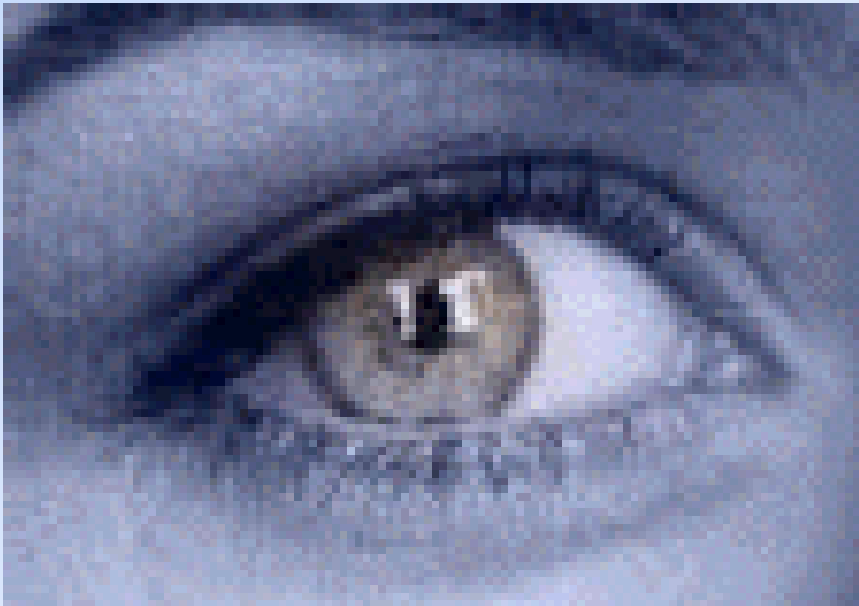


# Tools for building Iris Recognition Systems



Contact for further information:

Martin George, Smart Sensors Ltd, E-mail: [martin@smartsensors.co.uk](mailto:martin@smartsensors.co.uk)

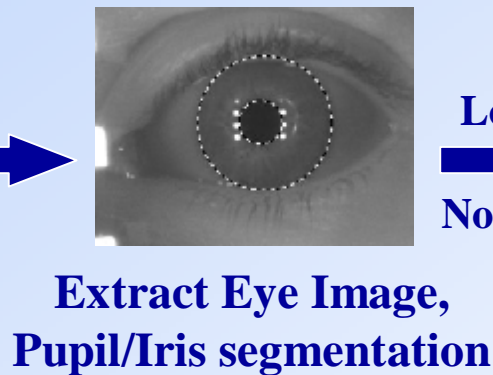
# Smart Sensors Limited

- Independent UK company developing and supplying iris recognition algorithms and iris recognition engines
- We work with camera manufacturers and systems integrators, aiming to be “agnostic” to image source
- “Small footprint” methods mean ability to scale to many different processor platforms (PC, PDA, Linux, DSP)
- MIRLIN = Monro Iris Recognition Library and INterface, based on work of Prof. Don Monro
- Very competitive performance
- Changing the iris biometrics business model to one that makes economic sense for both developers and end-user customers

# Elements of an iris recognition system



User passing through

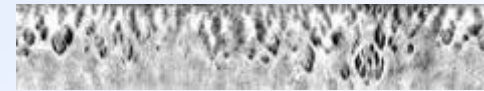


Localization  
Normalization

Unwrapped iris only



Image  
Enhanced



Feature  
Extraction



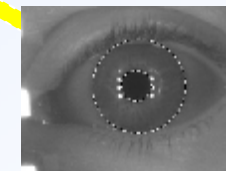
Feature Vector  
(Template)

**PASS**  
or  
**Divert**  
Decision

Classifier

Watch  
list

Enrolled  
Database

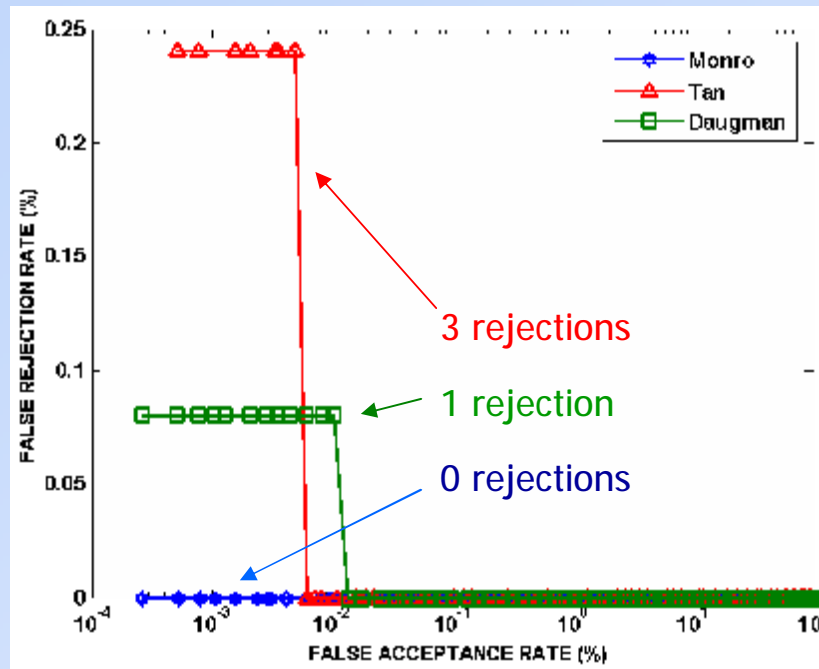


Enrolled image read  
from Card/Credential

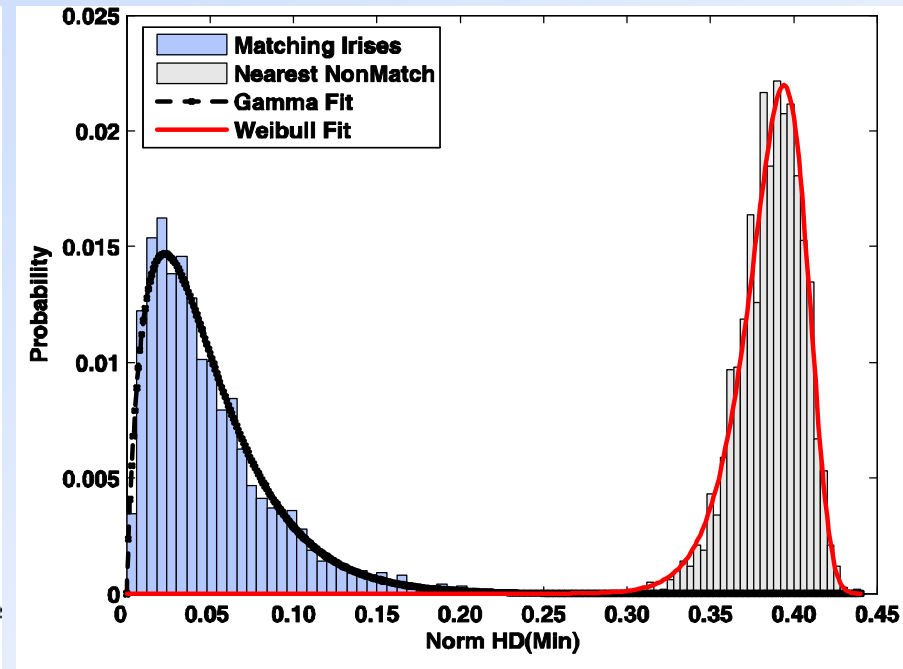
# MIRLIN - Basic Features

- Proprietary transform, Rapid Iris/Pupil finder, Rotation compensation, Specularity masking
- Quality metrics based on raw images, and on viability of iris information within segmented image
- Optimised for images acquired with NIR light sources: 720 – 900nm,  $>0.5 \text{ mW/cm}^2$  irradiance
- Image resolution conforming to ISO/IEC 19794-6
  - Minimum (in current image standard): 100 pixels
  - Recommended for claimed performance: 200 pixels
  - Reference image quality: 400 – 500 pixels
- Fast Hamming Distance template matching
  - Function based on simple XOR logic
  - Typically 500,000 per second with common PC configurations

# MIRLIN - Results



Receiver Operating Characteristic Curves



Statistical prediction of EER  $< 1 \times 10^{-4}</math>$

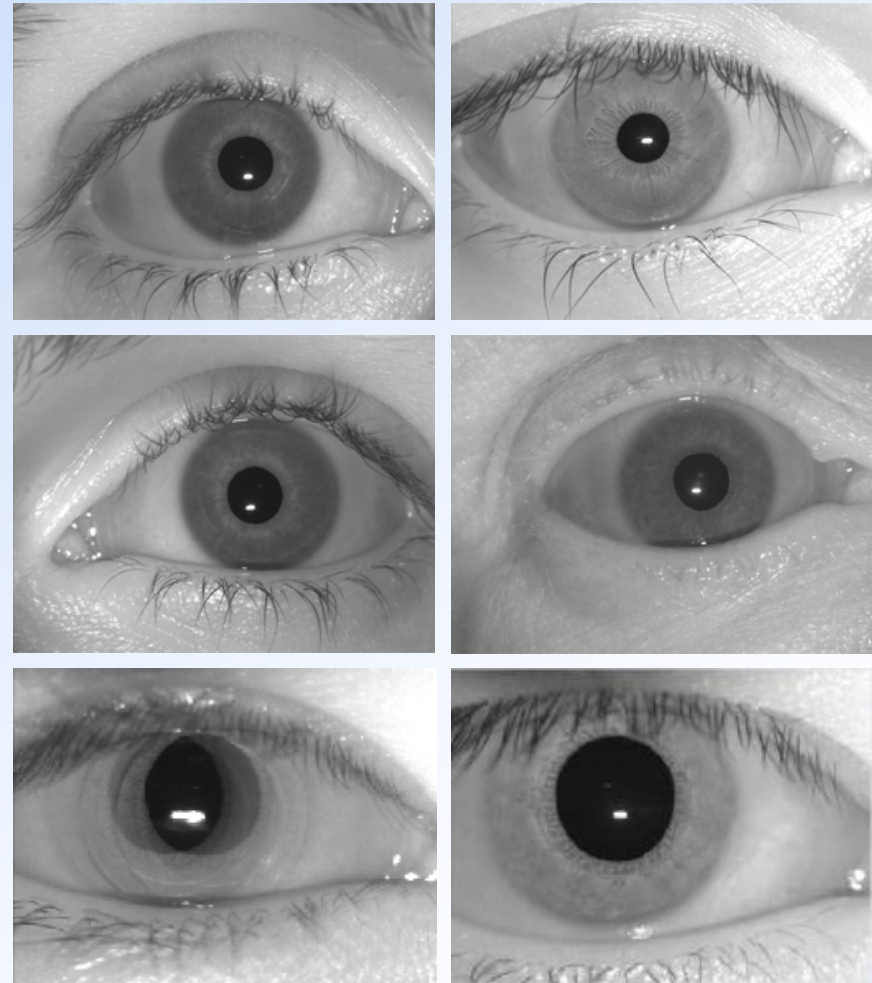
Relative timing of different methods studied

\*Masek 2PI implementation

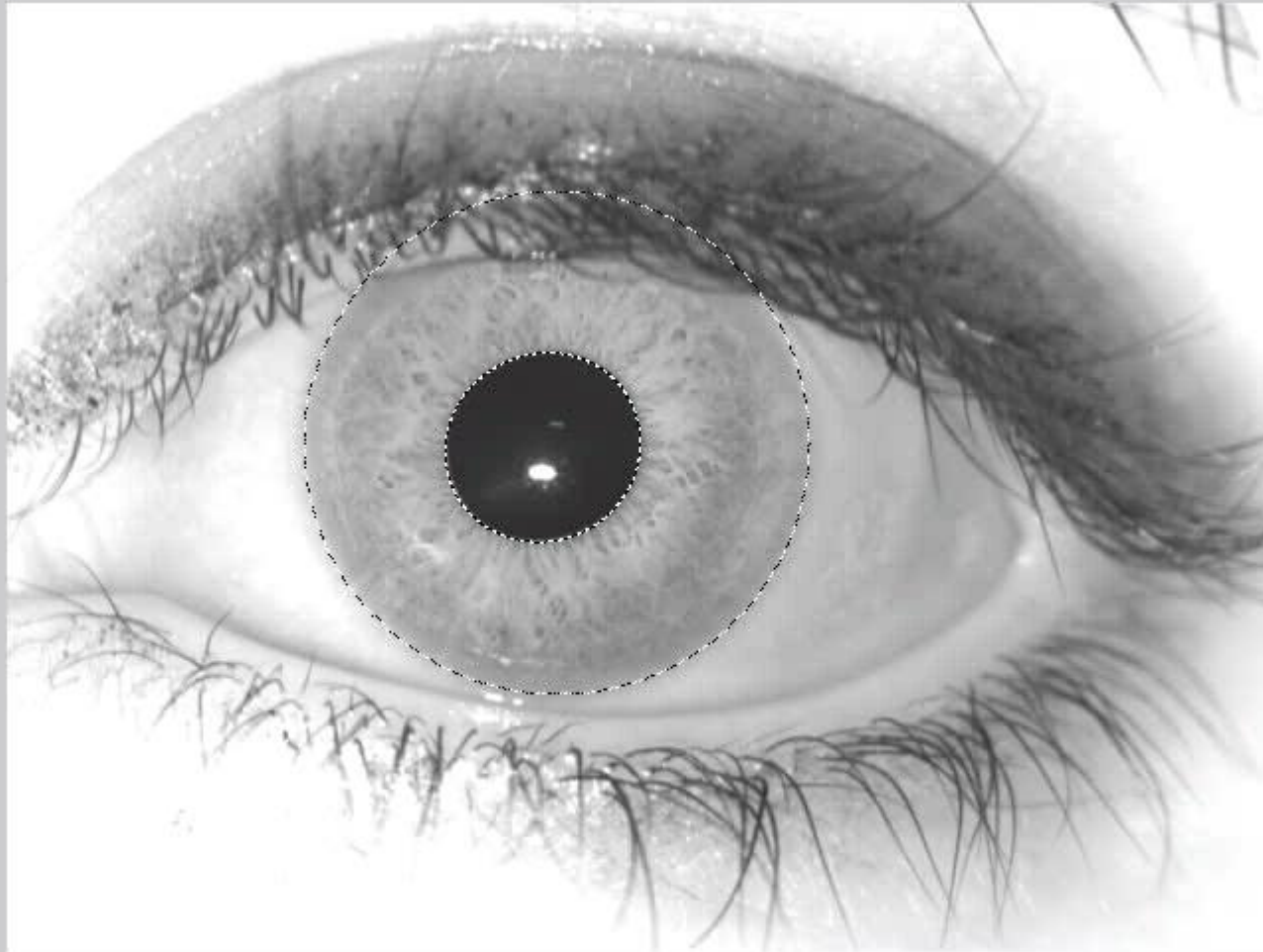
Method	Feature Extraction	Matching	Total
2PI *	422	31	453
Tan	125	68	193
Monro	45	31	86

# Bath Iris Database

- Reference quality images
- 1280 x 960 resolution
- Captured with COTS machine vision CCD camera
- Used optometrist's chin/head cradle to prevent head movement
- 0.5 mW/cm<sup>2</sup> irradiance, 810nm peak wavelength
- 800 people, 1600 eyes available, broad ethnic mix
- Set of 2000 "bad" images
- Ideal test and research resource



## Real-time segmentation with liveness detection



# Stand-off Iris Capture/Recognition

## AOptix "Glance and Go"



## Sarnoff Iris On the Move™



*MIRLIN compatible and demonstrated with these systems*

### Requirements of Stand-Off Iris Capture

- Require minimal user co-operation
- Cope with glasses, contact lenses, etc.
- Opportunity to integrate facial recognition
- Identification mode - no contact needed
- Handle 20 people per minute throughput
- Optics and photon budget MUST be right!
- Iris feature processing near frame rate
- *Adaptive Optics puts the icing on the cake*

# MIRLIN for Mobile ID terminals

- Runs on Windows CE
- Typical 1s iris enrolment
- Auto iris capture
- On-board capacity for 4000 data records, with local 4000:1 ID Match (all three biometrics)
- Wireless communication to server for unlimited template comparison capacity



New DSV2+ Turbo Multimodal mobile reader incorporates MIRLIN Iris Recognition Engine



# MIRLIN SDK availability

- Fully featured C Software Development Kit – versions:
  - LINUX (Fedora 9, Redhat)
  - Windows PC/XP/Vista – Microsoft Visual Studio .NET
  - Windows CE/Windows Mobile 5 - .NET framework
  - DSP embedded (compiled and optimised for your CPU)
- Low licensing costs – no enrolment fees, royalty only
- 576 byte template, 7 rotations
- 6 image QA metrics
- Full diagnostic output
- Flexible matching with optional two-eye data fusion
- Support for wide range of cameras and image sources

# Smart Sensors Product Summary

- **Iris/Pupil finder**
  - very rapid location of iris and pupil
  - ideal for camera developers
- **MIRLIN SDK**
  - fully featured toolkit for building iris recognition engines
  - excellent cross-platform support
- **Bath Iris Image Database**
  - up to 800 people / 1600 eyes / 32,000 images

Contact us:

[info@smartsensors.co.uk](mailto:info@smartsensors.co.uk)

[www.smartsensors.co.uk](http://www.smartsensors.co.uk)

Carpenter House Innovation Centre,

Broad Quay, BATH

BA1 1UD, United Kingdom

Tel: +44 (0) 1225 388690