Tackling the Iris Challenge Evaluation using Deformable Iris Matching Techniques

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Results : Experiment 1 & 2

Right eyes

Equal Error Rate : 0.27%

True Acceptance Rate at False Acceptance Rate = 0.1% : 99.63%

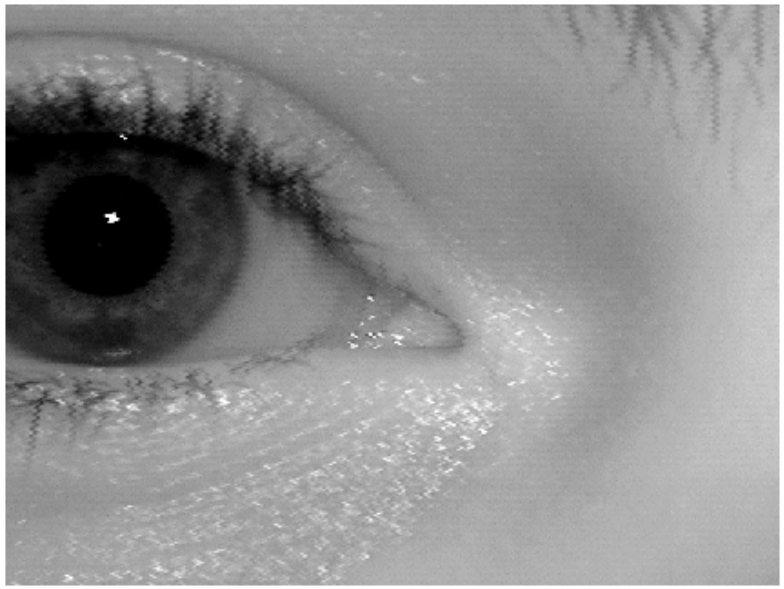
Left eyes

Equal Error Rate : 0.64%

True Acceptance Rate at False Acceptance Rate = 0.1% : 99.07%

Results : Analysis

Bad acquisition that DID NOT cause problem

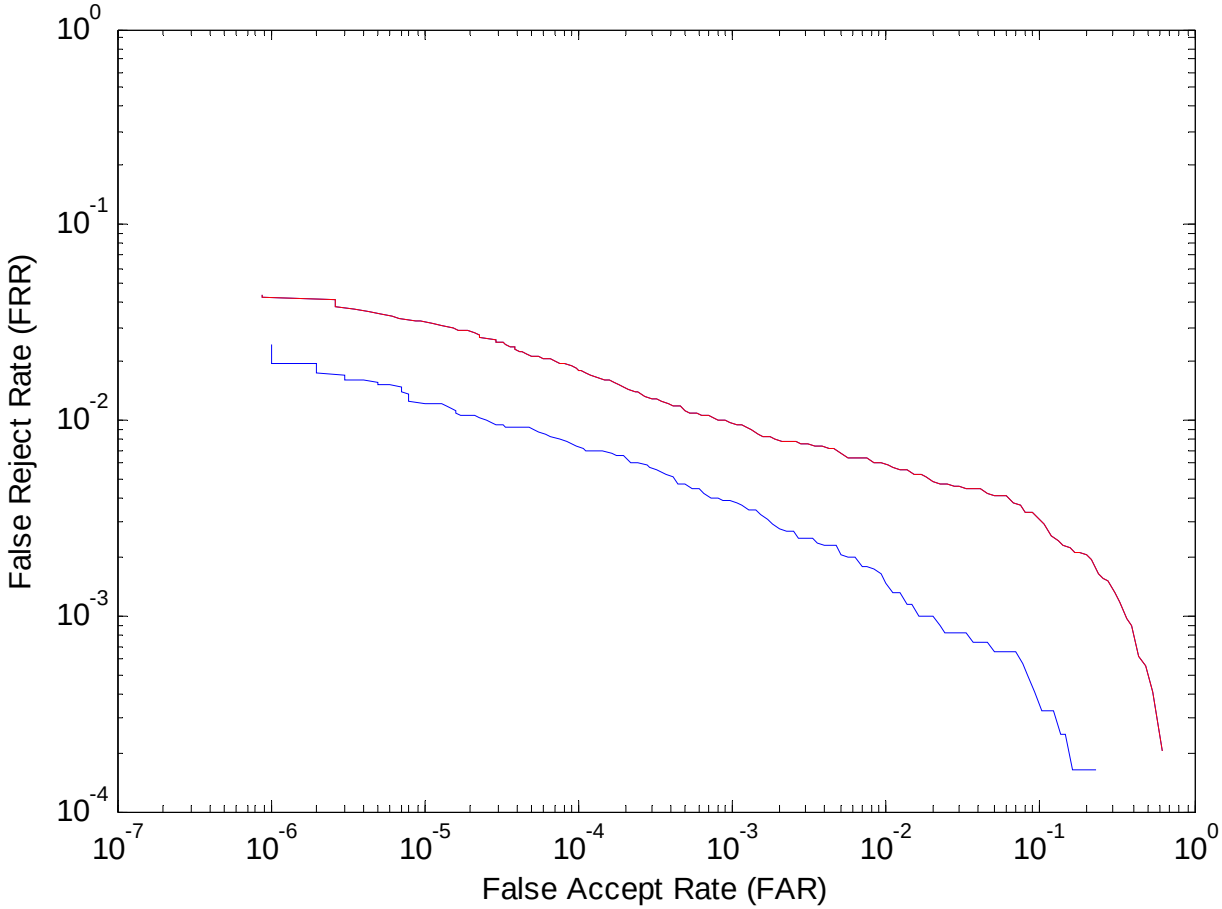


Example

- Image from first data set, with portion of iris not in captured frame.
- Was handled successfully by segmentation and partial matching.

Results : Experiment 2

ROC curves (Exp. 1: blue, Exp. 2: red)



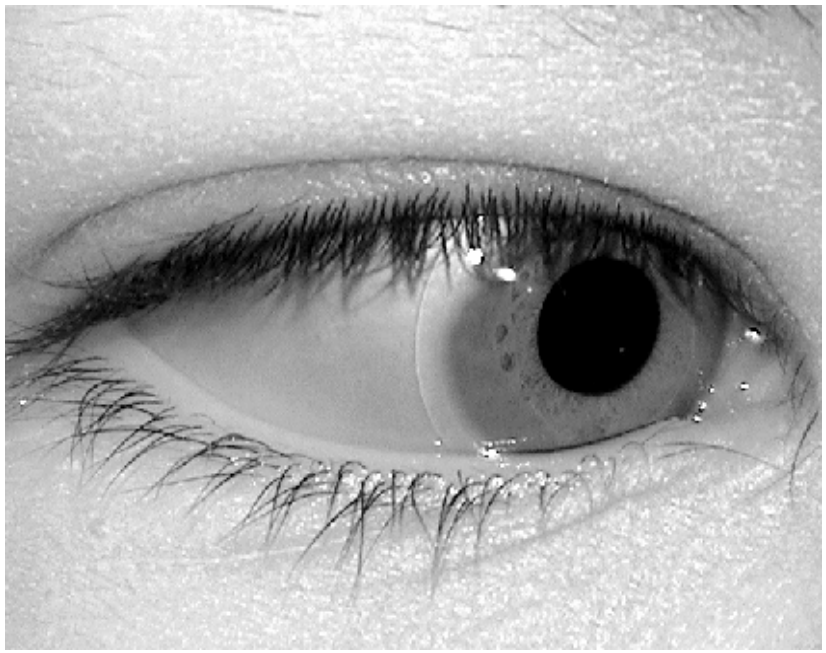
Results : Analysis

Most errors generated by a small set of images.

Example : Experiment 1, threshold set at FAR = 0.1% : 99.63%

- One of the problem images

Difficult image – off angle

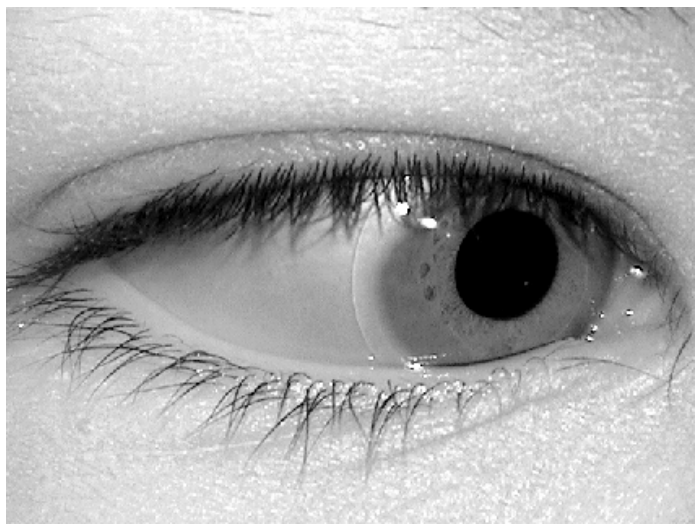


Results : Analysis

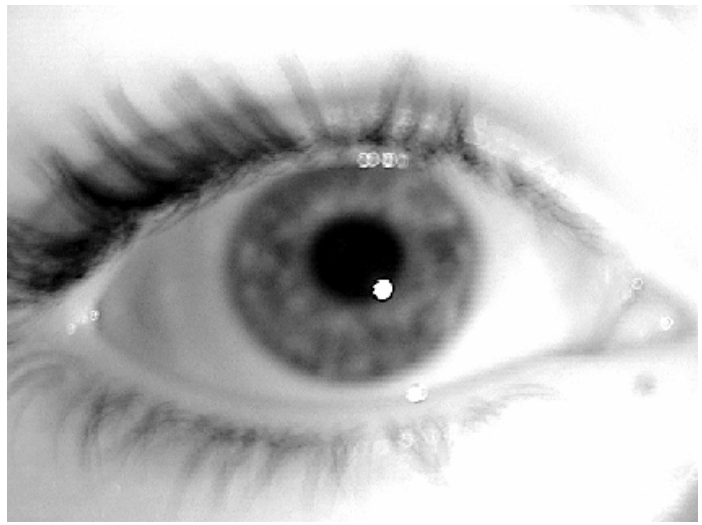
Examining errors:

- Come from several types of poor quality images.
- Can easily be detectable using a quality metric (not incorporated in this version)

Off angle – noncircular boundaries



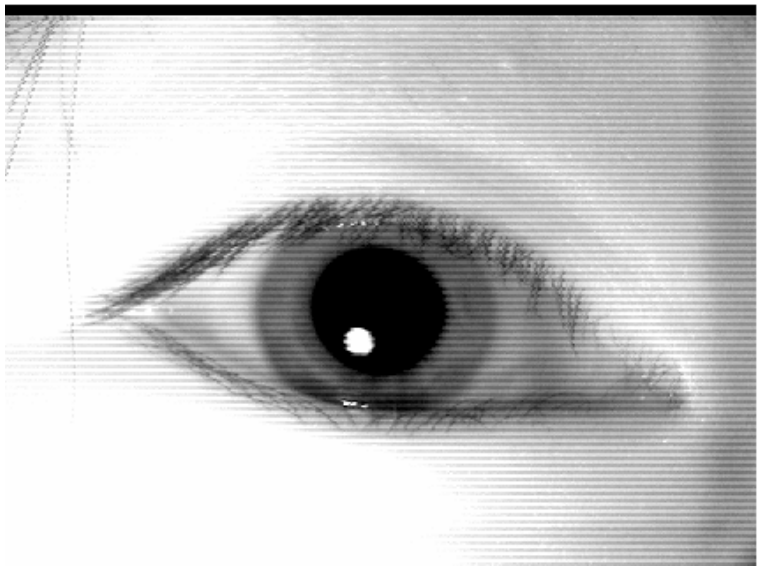
Badly focused

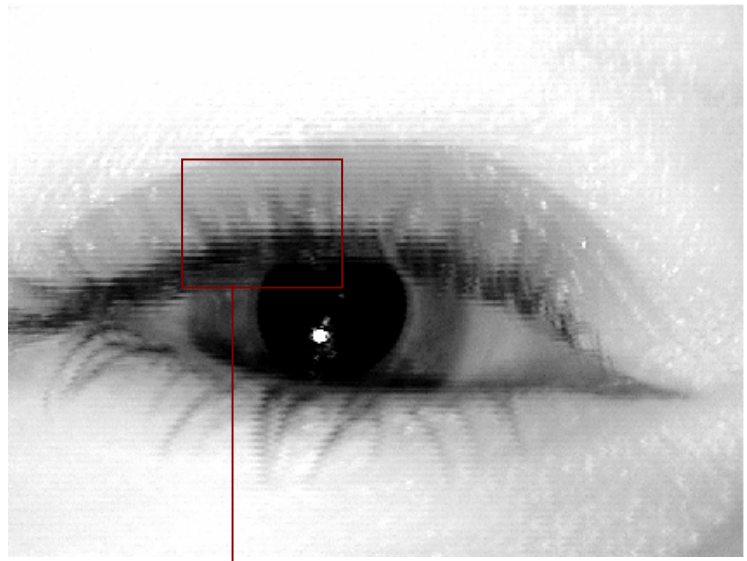


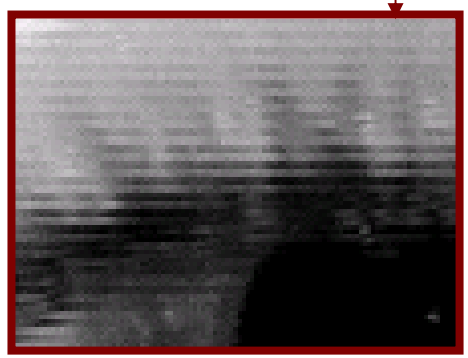
Results : Analysis

Examining errors:

Unexplained image acquisition artifacts



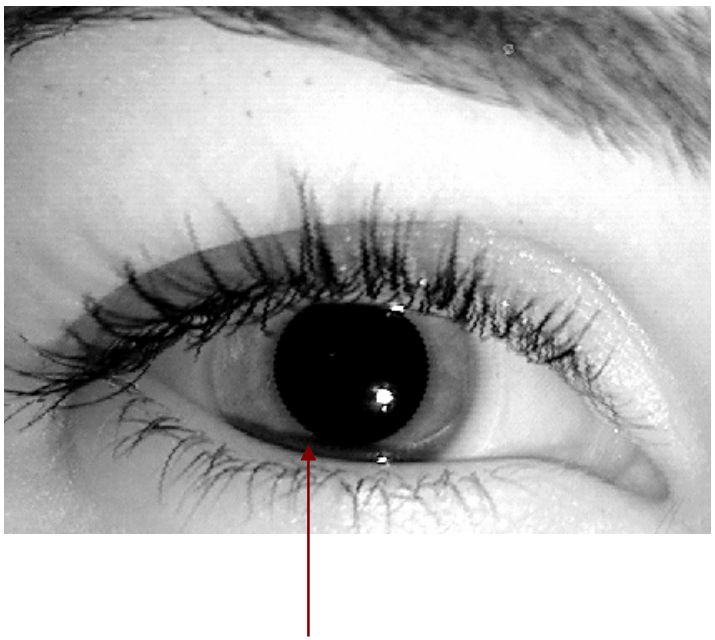




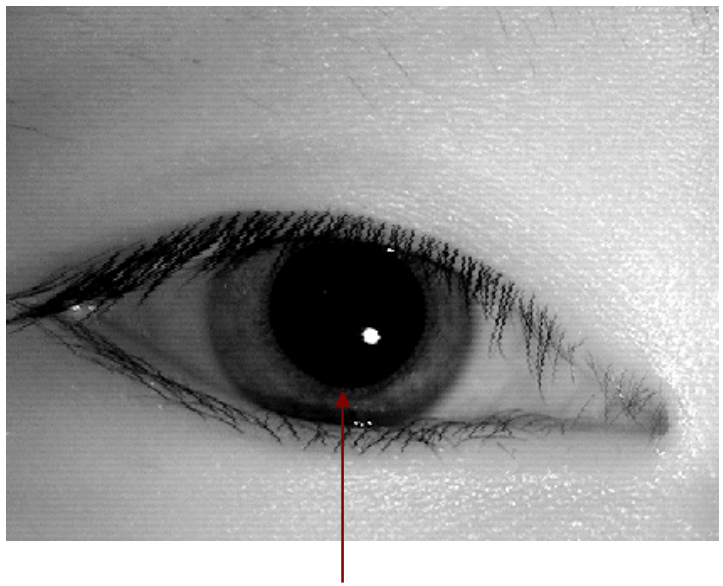
Results : Analysis

Examining errors:

Low pattern information - small iris width, and partially obstructed or shadowed



shadow effects



Results : Analysis

Experiment 1, threshold set at FAR = 0.1% :

These 6 low quality images account for **80%** of the false reject errors.

TAR at FAR = 0.1%:

Including these 6 images: 99.**6**3%

Excluding these 6 images: 99.**9**3%

@0.1 FAR!

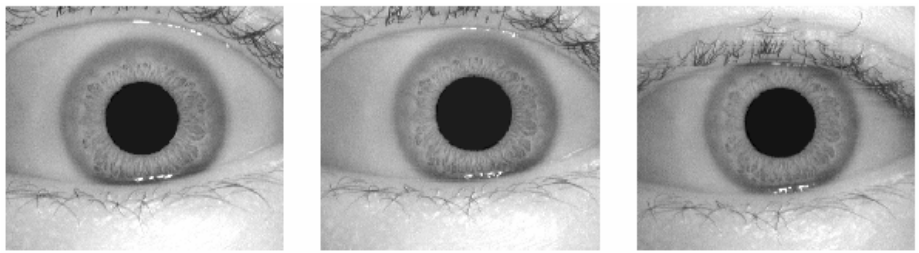
Outside Data : CASIA Iris Database

Method applied to CASIA[3] database:

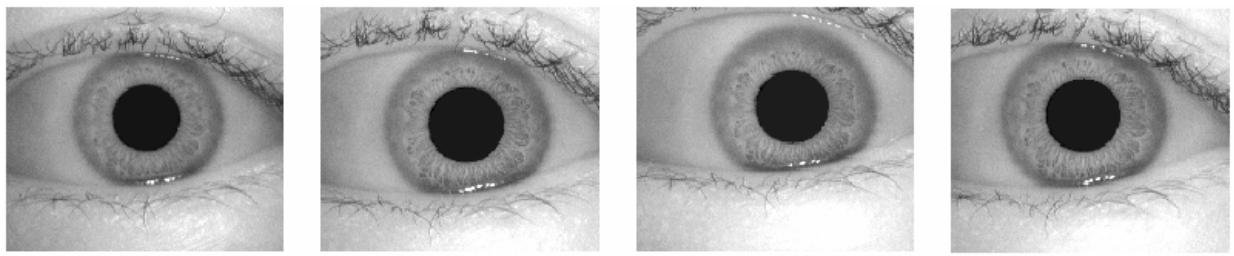
- Interesting database – not as much of a need for quality screening.
- 108 iris classes, 7 infrared images per class.

Sample CASIA iris class

First session
3 images



Second session
4 images



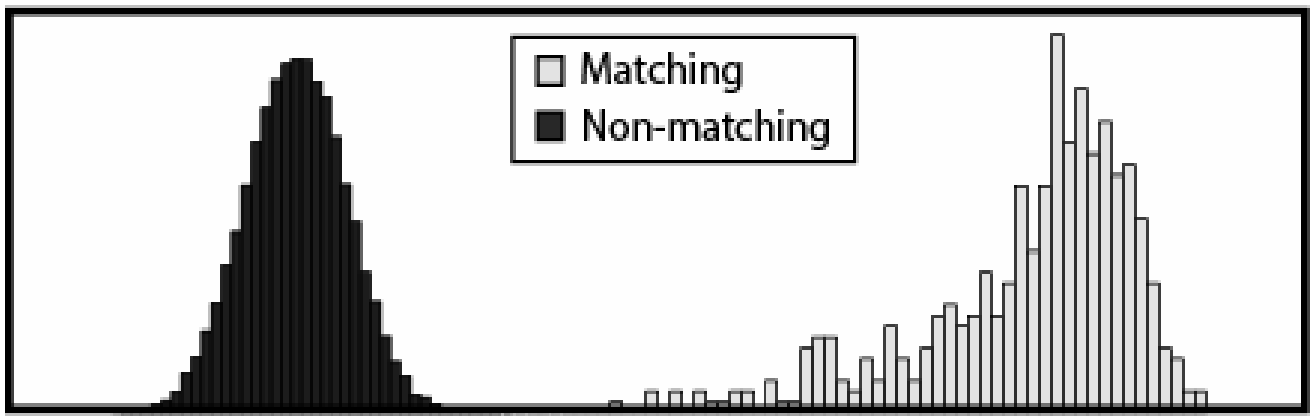
3 CASIA Iris Image Database, Chinese Academy of Sciences, http://www.sinobiometrics.com

Results : Outside Data

Results on CASIA database

- Zero error: complete separation between authentic/impostor scores.
- Separation margin: Fisher ratio = 32.9.

Separation of score histograms



Conclusions

We have had the best accuracy using

- A probabilistic (iris-specific) matching model,
- based upon reliable signal processing methods & cues,
- which we can derive from advanced correlation filter outputs.

The right quality screening process might:

- Eliminate poorest quality images and allow both TAR and TRR rates > 99.9%@ 0.1% FAR on the ICE data.

Future Work

- We have some very good ideas of how to handle off-angle iris image segmentation.

- Can we develop an iris information quality metric so that we can predict to be bad matches if we do have poor acquisition (e.g. out-of-focus blur) whether this person would be difficult to recognize? i.e. are some people's irises more informative than others and how to use this info?
- Automatically incorporate Iris image quality metrics (out-of-focus, occlusion) in the recognition process to weight decision scores.

Acknowledgements

- This iris research has been sponsored by CMU internal funds …….

…..which have run out of gas for some time now…….

Sponsors & Donations welcome!