

# Note on CASIA-IrisV3

## 1. Introduction

With fast development of iris image acquisition technology, iris recognition is expected to become a fundamental component of modern society, with wide application areas in national ID card, banking, e-commerce, welfare distribution, biometric passport, and forensics, etc. Since 1990s, research on iris image processing and analysis has achieved great progress.

However, performance of iris recognition systems in unconstrained environments is still far from perfect. Iris localization, nonlinear normalization, occlusion segmentation, liveness detection, large-scale identification and many other research issues all need further investigation. The success of investigations into such issues often depends on the availability of carefully designed iris image databases of sufficient size. Such publicly available datasets are however very limited. Therefore we are pleased to release to the public domain CASIA Iris Image Database V3.0 (or CASIA-IrisV3 for short) in order to further promote research and progress on iris recognition.

## 2. Brief Descriptions and Statistics of the Database

CASIA-IrisV3 includes three subsets which are labeled as CASIA-Iris-Interval, CASIA-Iris-Lamp, CASIA-Iris-Twins. CASIA-IrisV3 contains a total of 22,034 iris images from more than 700 subjects. All iris images are 8 bit gray-level JPEG files, collected under near infrared illumination. Some statistics and features of each subset are summarized in Table 1. Almost all subjects are Chinese except a few in CASIA-Iris-Interval. Because the three data sets were collected in different times, only CASIA-Iris-Interval and CASIA-Iris-Lamp have a small overlap in subjects.

### 2.1 CASIA-Iris-Interval

Iris images of CASIA-Iris-Interval were captured with our self-developed close-up iris camera (Fig.1). The most compelling feature of our iris camera is that we have designed a circular NIR LED array, with suitable luminous flux for iris imaging. Because of this novel design, our iris camera can capture very clear iris images (see

Fig.2). CASIA-Iris-Interval is well-suited to study the detailed texture features of iris images.

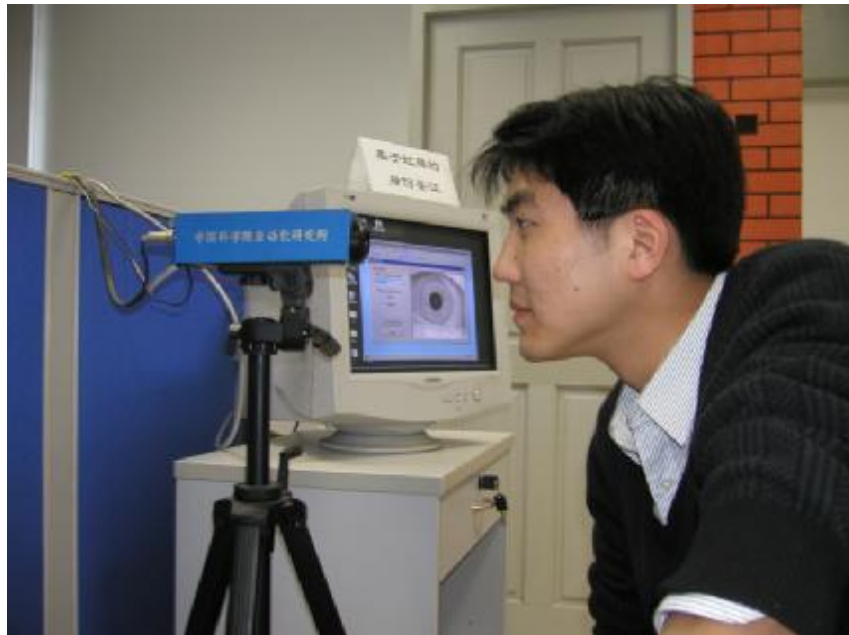


Fig.1 The self-developed iris camera used for collection of CASIA-Iris-Interval

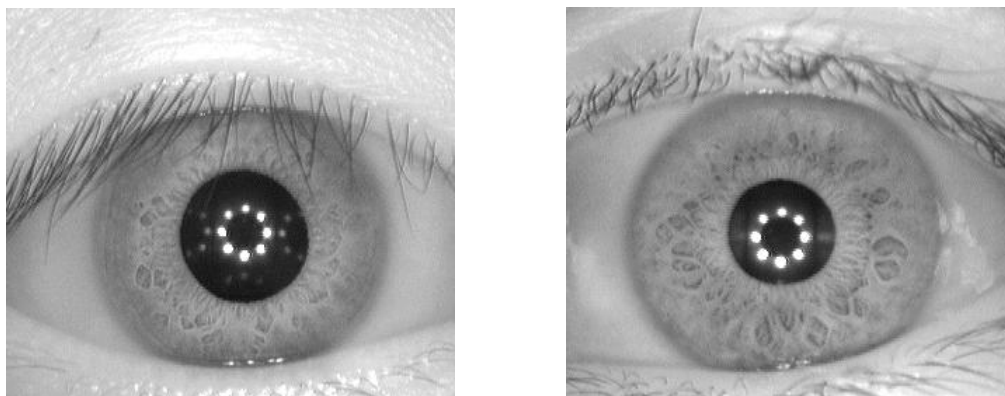


Fig.2 Example iris images in CASIA-Iris-Interval

## 2.2 CASIA-Iris-Lamp

CASIA-Iris-Lamp was collected using a hand-held iris sensor produced by OKI (Fig.3). A lamp was turned on/off close to the subject to introduce more intra-class variations when we collected CASIA-Iris-Lamp. Elastic deformation of iris texture (Fig.4) due to pupil expansion and contraction under different illumination conditions

is one of the most common and challenging issues in iris recognition. So CASIA-Iris-Lamp is good for studying problems of non-linear iris normalization and robust iris feature representation.



Fig.3 The hand-held iris camera used for collection of CASIA-Iris-Lamp

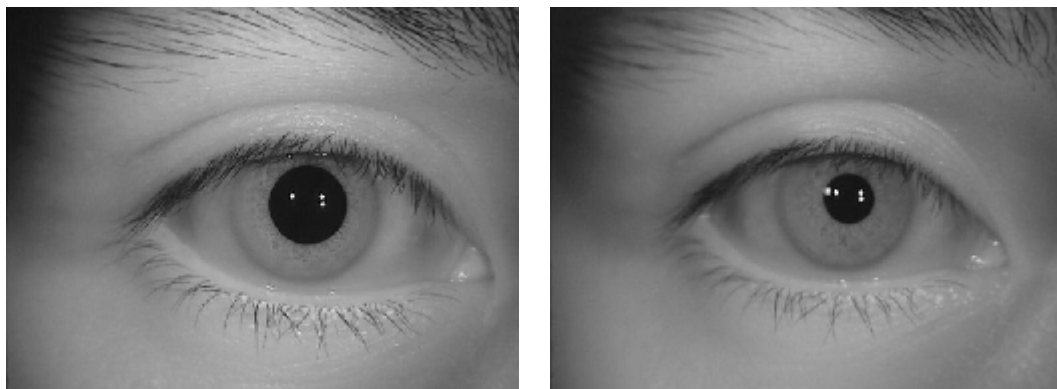


Fig.4 Example iris images in CASIA-Iris-Lamp

## 2.3 CASIA-Iris-Twins

CASIA-Iris-Twins contains iris images of 100 pairs of twins, which were collected during Annual Twins Festival in Beijing using OKI's IRISPASS-h camera (Fig.5). Although iris is usually regarded as a kind of phenotypic biometric characteristics and even twins have their unique iris patterns, it is interesting to study the dissimilarity and similarity between iris images of twins.

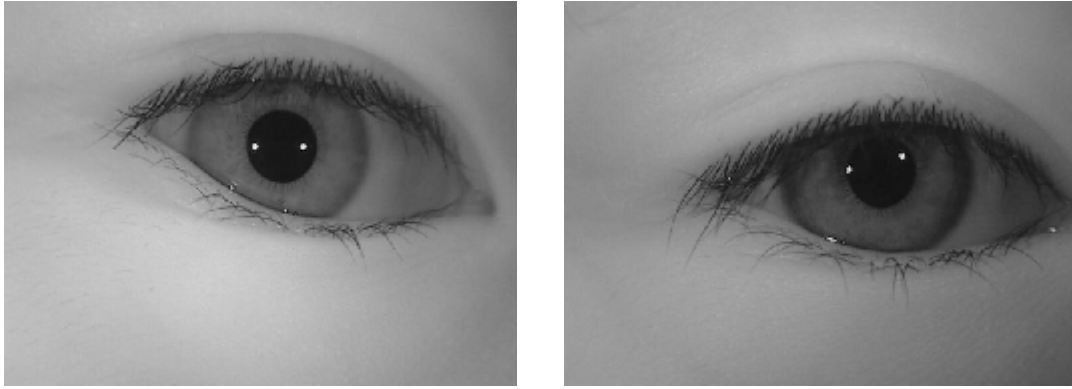


Fig.5 Example iris images in CASIA-Iris-Twins

Table 1 Statistics of CASIA-IrisV3

Subset \ Characteristics	CASIA-Iris -Interval	CASIA-Iris -Lamp	CASIA-Iris -Twins
Sensor	CASIA close-up iris camera	OKI IRISPASS-h	OKI IRISPASS-h
Environment	Indoor	Indoor with lamp on/off	Outdoor
Session	Two sessions for most iris images	one	one
Attributes of subjects	Most are graduate students of CASIA	Most are graduate students of CASIA	Most are children participating Beijing Twins Festival
No. of subjects	249	411	200
No. of classes	395	819	400
No. of images	2,639	16,212	3,183
Resolution	320*280	640*480	640*480
Features	Cross-session iris images with extremely clear iris texture details	Nonlinear deformation due to variations of visible illumination	The first publicly available iris image dataset of twins
Total	A total of 22,034 iris images from more than 700 subjects and 1500 eyes.		

### 3. Database Organization

The file name of each image in CASIA-IrisV3 is unique to each other and denotes some useful properties associated with the image such as subset category, left/right/double, subject ID, class ID, image ID etc. The file naming rules of all Three subsets are listed as follows:

- I The images of CASIA-Iris-Interval are stored as:  
\$root path\$/CASIA-Iris-Interval/YYY/S1YYYENN.jpg  
YYY: the unique identifier of the subject in the subset  
E: 'L' denotes left eye and 'R' denotes right eye  
NN: the index of the image in the class
- I The images of CASIA-Iris-Lamp are stored as:  
\$root path\$/CASIA-Iris-Lamp/YYY/E/S2YYYENN.jpg  
YYY: the unique identifier of the subject in the subset  
E: 'L' denotes left eye and 'R' denotes right eye  
NN: the index of the image in the class
- I The images of CASIA-Iris-Twins are stored as:  
\$root path\$/CASIA-Iris-Twins\XX\YE\S3XXYENN.jpg  
XX: the index of family  
Y: the identifier to one of the twins  
E: 'L' denotes left eye and 'R' denotes right eye  
NN: the index of the image in the class

#### **4. Copyright Note and Contacts**

The database is released for research and educational purposes. We hold no liability for any undesirable consequences of using the database. All rights of the CASIA database are reserved. Any person or organization is not permitted to distribute, publish, copy, or disseminate this database. In all documents and papers that report experimental results based on this database, our efforts in constructing the database should be acknowledged such as “Portions of the research in this paper use the CASIA-IrisV3 collected by the Chinese Academy of Sciences' Institute of Automation (CASIA)” and a reference to “CASIA Iris Image Database, <http://biometrics.idealtest.org/>” should be included. A copy of all reports and papers that are for public or general release that use the CASIA-IrisV3 should be forwarded upon release or publication to:

Professor Tieniu Tan  
Center for Biometrics and Security Research  
National Laboratory of Pattern Recognition  
Institute of Automation, Chinese Academy of Sciences  
P.O.Box 2728

Beijing 100190

China

or send electronic copies to [znsun@nlpr.ia.ac.cn](mailto:znsun@nlpr.ia.ac.cn).

Questions regarding this database can be addressed to Dr. Zhenan Sun at

Dr. Zhenan Sun

Center for Biometrics and Security Research

National Laboratory of Pattern Recognition

Institute of Automation, Chinese Academy of Sciences

P.O.Box 2728

Beijing 100190

China

Tel: +86 10 8261 0278

Fax: +86 10 6255 1993

Email: [znsun@nlpr.ia.ac.cn](mailto:znsun@nlpr.ia.ac.cn)

## Publications

1. Tieniu Tan, Zhaofeng He, Zhenan Sun, "Efficient and robust segmentation of noisy iris images for non-cooperative iris recognition", *Image and Vision Computing*, Vol.28, No. 2, 2010, pp.223-230.
2. T. Tan and L. Ma, "Iris Recognition: Recent Progress and Remaining Challenges", *Proc. of SPIE*, Vol. 5404, pp. 183-194, 12-13 Apr 2004, Orlando, USA.
3. Zhenan Sun, Tieniu Tan, "Ordinal Measures for Iris Recognition," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 31, No. 12, 2009, pp. 2211 - 2226.
4. Zhaofeng He, Tieniu Tan, Zhenan Sun and Xianchao Qiu, "Towards Accurate and Fast Iris Segmentation for Iris Biometrics", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 31, No. 9, 2009, pp.1670 - 1684.
5. L. Ma, T. Tan, Y. Wang and D. Zhang, "Personal Identification Based on Iris Texture Analysis", *IEEE Trans. on Pattern Analysis and Machine Intelligence (PAMI)*, Vol. 25, No. 12, pp.1519-1533, 2003.
6. Li Ma, Tieniu Tan, Yunhong Wang and Dexin Zhang, "Efficient Iris Recognition

- by Characterizing Key Local Variations”, IEEE Trans. on Image Processing, Vol. 13, No.6, pp. 739- 750, 2004.
7. L. Ma, T. Tan, D. Zhang and Y. Wang, “Local Intensity Variation Analysis for Iris Recognition, Pattern Recognition”, Vol.37, No.6, pp. 1287-1298, 2004.
  8. Zhenan Sun, Yunhong Wang, Tieniu Tan, Jiali Cui, “Improving Iris Recognition Accuracy via Cascaded Classifiers” , IEEE Transactions on Systems, Man, and Cybernetics-Part C, Volume 35, Issue 3, 2005, pp.435 - 441.
  9. Zhenan Sun, Tieniu Tan, Yunhong Wang, “Robust Encoding of Local Ordinal Measures: A General Framework of Iris Recognition”, Proceedings of International Workshop on Biometric Authentication (BioAW), Lecture Notes in Computer Science, Vol.3087, 2004, pp. 270-282.
  10. Zhenan Sun, Yunhong Wang, Tieniu Tan, Jiali Cui, “Improving Iris Recognition Accuracy via Cascaded Classifiers”, Proceedings of the 1st International Conference on Biometric Authentication, Lecture Notes in Computer Science, Vol.3072, 2004, pp. 418-425.
  11. Zhenan Sun, Yunhong Wang, Tieniu Tan, Jiali Cui, “Robust Direction Estimation of Gradient Vector Field for Iris Recognition”, Proceedings of the 17th International Conference on Pattern Recognition, Vol.2, 2004, pp.783-786.
  12. Zhenan Sun, Yunhong Wang, Tieniu Tan, Jiali Cui, “Cascading Statistical And Structural Classifiers For Iris Recognition”, Proceedings of IEEE International Conference on Image Processing, 2004, pp.1261-1264.
  13. Zhenan Sun, Tieniu Tan, Yunhong Wang, “Iris Recognition Based on Non-local Comparisons”, Proceedings of the 5th Chinese Conference on Biometric Recognition, Lecture Notes in Computer Science, Vol.3338, 2004, pp. 67-77.
  14. Zhenan Sun, Tieniu Tan, and Xianchao Qiu, "Graph Matching Iris Image Blocks with Local Binary Pattern", Proceedings of International Conference on Biometrics, Lecture Notes in Computer Sciences, Vol. 3832, 2005, pp. 366-372.
  15. Xianchao Qiu, Zhenan Sun, Tieniu Tan, “Global Texture Analysis of Iris Images for Ethnic Classification”, Proceedings of International Conference on Biometrics, Lecture Notes in Computer Sciences, Vol. 3832, 2005, pp. 411 - 418.
  16. Zhuoshi Wei, Tieniu Tan, Zhenan Sun, Jiali Cui, “Robust and Fast Assessment of Iris Image Quality”, Proceedings of International Conference on Biometrics, Lecture Notes in Computer Sciences, Vol. 3832, 2005, pp. 464 - 471.

17. Jiali Cui, Li Ma, Yunhong Wang, Tieniu Tan and Zhenan Sun, "An Appearance-Based Method for Iris Detection", Proc. of the 6th Asian Conference on Computer Vision (ACCV), Vol.2, pp.1091-1096, 2004, Korea.
18. Jiali Cui, Yunhong Wang, Junzhou Huang, Tieniu Tan, Zhenan Sun and Li Ma, "An Iris Image Synthesis Method Based on PCA and Super-Resolution", Proc. of the 17th IAPR International Conference on Pattern Recognition (ICPR), Vol. 4, pp. 471-474, 23-26 August 2004, Cambridge, UK.
19. Jiali Cui, Li Ma, Yunhong Wang, Tieniu Tan and Zhenan Sun, "A Fast and Robust Iris Localization Method Based on Texture Segmentation", Proc. of SPIE, Vol. 5404, pp. 401-408, 2004, USA.
20. Jiali Cui, Yunhong Wang, Li Ma, Tieniu Tan and Zhenan Sun, "An Iris Recognition Algorithm Using Local Extreme Points", Proceedings of the 1st International Conference on Biometric Authentication, Lecture Notes in Computer Science, Vol.3072, 2004, pp. 442-449.
21. Jiali Cui, Yunhong Wang, Tieniu Tan and Zhenan Sun, "Fast Recursive Mathematical Morphological Transforms", Proc. of the 3rd International Conference on Image and Graphics (ICIG), pp. 422-425, 2004, Hong Kong.
22. Junzhou Huang, Tieniu Tan, Li Ma, and Yunhong Wang, Phase Correlation Based Iris Image Registration Model, Journal of Computer Science and Technology, Vol.20, No.3, pp.419-425, May 2005.
23. L. Ma, Y. Wang and T. Tan, "Iris Recognition Based on Multichannel Gabor Filtering", Proc. of the 5th Asian Conference on Computer Vision (ACCV), Vol. I, pp.279-283, Jan 22-25, 2002, Melbourne, Australia.
24. L. Ma, Y. Wang and T. Tan, "Iris Recognition Using Circular Symmetric Filters", Proc. of IAPR International Conference on Pattern Recognition (ICPR), Vol. II, pp. 414-417, August 11-15, 2002, Quebec, Canada.
25. J. Z. Huang, L. Ma, T. N. Tan and Y. H. Wang, "Learning-Based Enhancement Model of Iris", Proc. of British Machine Vision Conference (BMVC), pp. 153-162, 2003.
26. J. Z. Huang, L. Ma, and Y. H. Wang and T. N. Tan, "Iris Model Based on Local Orientation Description", Proc. of the 6th Asian Conference on Computer Vision (ACCV), Vol.2, pp. 954-959, 2004, Korea.
27. J. Z. Huang, Y. H. Wang, T. N. Tan and J. L. Cui, "A New Iris Segmentation



- Model”, Proc. of the 17th IAPR International Conference on Pattern Recognition (ICPR), Vol. 3, pp. 554-557, 23-26 August 2004, Cambridge, UK.
28. J. Z. Huang, Y. H. Wang, J. L. Cui and T. N. Tan, “Noise Removal and Impainting Model for Iris Image”, Proc. of IEEE International Conference on Image Processing (ICIP), pp. 869-872, 2004, Singapore.
  29. Yuqing He, Yangsheng Wang and Tieniu Tan, “Iris Image Capture System Design For Personal Identification”, Proceedings of the 5th Chinese Conference on Biometric Recognition, Lecture Notes in Computer Science, Vol.3338, 2004, pp. 546-552.
  30. Zhuoshi Wei, Tieniu Tan, Zhenan Sun, Jiali Cui, "Robust and Fast Assessment of Iris Image quality", Proc. of International Conference of Biometrics, pp. 464-471, 2006.
  31. Zhuoshi Wei, Tieniu Tan and Zhenan Sun, "Nonlinear Iris Deformation Correction Based on Gaussian Model", International Conference of Biometrics, pp 780-789, 2007.
  32. Zhuoshi Wei, Yufei Han, Zhenan Sun and Tieniu Tan, Palmprint Image Synthesis: A Preliminary Study, Proc. of IEEE International Conference on Image Processing, 2008.
  33. Zhuoshi Wei, Tieniu Tan and Zhenan Sun, Synthesis of Large Realistic Iris Databases Using Patch-based Sampling, Proc. of IEEE International Conference on Pattern Recognition (ICPR), 2008.
  34. Zhuoshi Wei, Xianchao Qiu, Zhenan Sun and Tieniu Tan, Counterfeit Iris Detection Based on Texture Analysis, Proc. of IEEE International Conference on Pattern Recognition (ICPR), 2008.
  35. Zhaofeng He, Tieniu Tan and Zhenan Sun, “Iris Localization via Pulling and Pushing”, Proc. of the 18th IEEE International Conference on Pattern Recognition (ICPR'06), Vol.4, pp. 366-369, 2006, Hongkong.
  36. Zhaofeng He, Tieniu Tan, Zhenan Sun, Xianchao Qiu, Cheng Zhong and Wenbo Dong, Boosting Ordinal Features for Iris Recognition, Proc. of the 26th IEEE International Conference on Computer Vision and Pattern Recognition (CVPR'08) , pp. 1-8, June 23-28, Alaska, USA
  37. Zhaofeng He, Zhenan Sun, Tieniu Tan and Xianchao Qiu, Enhanced Usability of Iris Recognition via Efficient User Interface and Iris Image Restoration, Proc. of the 15th IEEE International Conference on Image Processing (ICIP'08), 2008,

San Diego, California Accepted.

38. Zhaofeng He, Tieniu Tan, Zhenan Sun and Xianchao Qiu, "Robust Eyelid, Eyelash and Shadow Localization for Iris Recognition", Proc. of the 15th IEEE International Conference on Image Processing (ICIP'08), 2008, San Diego, California, Accepted.
39. Zhaofeng He, Tieniu Tan, Zhenan Sun and Zhuoshi Wei, "Efficient Iris Spoof Detection via Boosted Local Binary Patterns", Proc. of the Third International Conference on Biometrics, Lecture Notes in Computer Science, Vol.5558, pp.1080-1090, 2009.
40. Xianchao Qiu, Zhenan Sun, Tieniu Tan, "Global Texture Analysis of Iris Images for Ethnic Classification", Proceedings of International Conference on Biometrics, Lecture Notes in Computer Sciences, Vol. 3832, 2005, pp. 411 - 418.
41. Xianchao Qiu, Zhenan Sun, and Tieniu Tan, "Coarse Iris Classification by Learned Visual Dictionary", In Proc. of The 2nd International Conference on Biometrics, pp. 770–779, Seoul, Korea, Aug. 2007.
42. Xianchao Qiu, Zhenan Sun, and Tieniu Tan, "Global Texture Analysis of Iris Images for Ethnic Classification", In Proc. of The 1st International Conference on Biometrics, pp. 411–418, Hong Kong, China. Jan. 2006.
43. Wenbo Dong, Zhenan Sun, Tieniu Tan, Xianchao Qiu, Self-adaptive iris image acquisition system, Proc. SPIE vol. 6944, 1-9, 2008.
44. Wenbo Dong, Zhenan Sun, Tieniu Tan, How to make iris recognition easier?, Proc. of the 19th International Conference on Pattern Recognition, pp.1-4, 2008.
45. Wenbo Dong, Zhenan Sun, Tieniu Tan, Zhuoshi Wei, "Quality-based dynamic threshold for iris matching", In Proceedings of IEEE International Conference on Image Processing, 2009.
46. Long Zhang, Zhenan Sun, Tieniu Tan and Shungeng Hu, "Robust Biometric Key Extraction Based on Iris Cryptosystem", Proc. of the Third International Conference on Biometrics, Lecture Notes in Computer Science, Vol.5558, pp.1060-1069, 2009.
47. Hui Zhang, Zhenan Sun, and Tieniu Tan, Contact lens detection based on weighted LBP, The 20th IEEE International Conference on Pattern Recognition (ICPR2010), Istanbul, Turkey, 2010.
48. Hui Zhang, Zhenan Sun, and Tieniu Tan, Statistics of Local Surface Curvatures for Mis-Localized Iris Detection, The 17th IEEE International Conference on

Image Processing (ICIP2010), Hong Kong, China, 2010.

49. Xiaobo Zhang, Zhenan Sun, and Tieniu Tan, "Texture Removal for Adaptive Level Set based Iris Segmentation", The 17th IEEE International Conference on Image Processing (ICIP2010), Hong Kong, China, 2010.
50. Xiaobo Zhang, Zhenan Sun, and Tieniu Tan, "Hierarchical Fusion of Face and Iris for Personal Identification", The 20th IEEE International Conference on Pattern Recognition (ICPR2010), Istanbul, Turkey, 2010.