IEEE Biometrics Council

Spotlight:

The Transportation Worker Identification Credential Program, TSA

The Transportation Worker Identification Credential (or TWIC) program is an initiative undertaken by the Transportation Security Administration (TSA) and the U.S. Coast Guard in the United States. The program provides a tamper-resistant biometric credential to maritime workers who are seeking unescorted access to secure areas of port facilities, outer continental shelf facilities, vessels regulated under the Maritime Transportation Security Act of 2002 (or MTSA), and all U.S. Coast Guard credentialed merchant mariners. TWIC is steadily enrolling transportation workers and with the completion of field trials in early 2012, it is expected that most US ports will require biometric based authentication of the transportation workers in near future.

INTERVIEW

Stephen Sadler
Assistant Administrator, Office of Intelligence & Analysis

TWIC is probably the largest project of its kind ever rolled out in the world. What are the biggest unexpected challenges that the Transportation Worker Identification Credential (TWIC) has faced? Would you mind sharing some of the lessons learned?

TSA has had to overcome a number of challenges implementing the TWIC program. We initially estimated a population of between 850,000 and 1 million workers would need a TWIC. To date, more than 2.4 million transportation workers have enrolled in the program that adds an additional workload to all aspects of the program from enrollment to credential issuance.

Federal smart card standards for credentials require insertion of the card into a slot in a contact card reader to conduct a biometric match. Maritime interests were concerned that the slot on contact readers would expose the reader's electronics to moisture, dust, dirt, grit, and vandalism. Developing the capability to exchange biometric information with a non-contact reader proved to be a challenge. Shortly after program initiation, TSA and industry successfully developed an application, which enabled the secure radio-frequency (RF) transmission of the TWIC's biometric template to a reader for biometric confirmation of identity.

Are the advantages of TWIC already visible at this stage? Can you give us specific examples?

Prior to TWIC, many workers, particularly truck drivers who had to enter multiple ports or facilities, were required to obtain a separate badge or credential for each port or facility entered. TWIC is now the only credential required by statute for access to secure areas of maritime facilities nationwide. This is a significant benefit for those workers who need to access multiple facilities and vessels (i.e., truck drivers, merchant mariners, dock workers, etc.). Maritime operators are relieved of the cost of issuing and managing identification cards for their workers. Also, they do not have to incur the cost of performing background screening of applicants.

The primary goal of the TWIC program is to ensure the security of our critical maritime infrastructure. Therefore, ensuring that all workers who have unescorted access to maritime secure areas have completed a satisfactory Security Threat Assessment (STA) (which includes a terrorism-related check, criminal history check and immigration status check) is a critical component of the program. Prior to TWIC, many facilities did not require background checks.

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The Transportation Worker Identification Credential Program, TSA

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There are open challenges concerning the security of biometric identification systems such as vulnerability to spoofing attacks, storage of templates, privacy, among others. Have there been attempts to address these issues or others? Have you detected security problems during the initial stages of this project?

The TWIC aligns with the highly secure Federal standards for smart card credentials (Federal Information Processing Standards Publication 201-1). The only personal information the card contains is the worker's name, photograph, and fingerprint template (an algorithm; not an image). The fingerprint template is protected by a PIN when used with a contact reader, or encryption when used with a contactless reader.

TSA has not encountered any security problems directly related to the compromise of fingerprint templates stored on TWIC cards.

TSA worked closely with the maritime and security technology industries to craft a comprehensive TWIC reader hardware and card application specification that addresses many of these issues and concerns.

The biometric technology employed in the TWIC is based on fingerprint. Many systems based on other human traits are available such as face, iris, palm print, among others. Did you consider other technologies at the time of the system choice?

Currently the only biometric standard specified by the Federal government is for the fingerprint, to which TWIC is aligned. TSA did test iris recognition in an early prototype of the TWIC program. However, it was determined that fingerprint technology was a more mature and reliable biometric modality which would function best in the weather exposed maritime environment. Further, fingerprint biometrics was supported by recognized interoperability standards at the template level, and there was extensive comparative performance testing results for the technology by the National Institute of Standards and Technology (NIST) and other independent testing organizations.
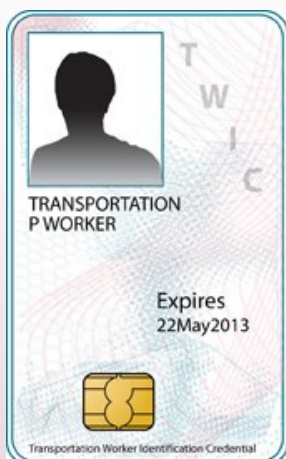
Many of the technological advances come from laboratories in which conditions are well known and far away from real scenarios. Have you spotted an issue that should be improved by the scientific community? Would you like to give any general advice?

Card durability has been an issue for the TWIC program's maritime population. The program uses the same GSA-approved card stock as is used for Federal employee credentials. The working conditions of mariners, truckers, longshoremen, and others often expose TWICs to heat, moisture, salt air, bending and twisting motions. These conditions have caused failures to the circuit chips and antennae of the cards making them unreadable to an electronic card reader. While more recent versions of the card stock appear to be more durable, replacing a failed card costs a worker time and money. TSA is working with DHS to examine more durable card stock options.

If another country wants to implement a similar project and asks you for advice, how would you tell them to begin?

We would make the following suggestions:
- *Make a risk-based assessment of which types of facilities or environments require a highly secure biometric credential for access;*
- *Determine if credentials should be produced centrally by the government, or locally after completion of a standardized or common STA;*
- *Determine the type and extent of the STA;*
- *Ensure that the card and reader technology is appropriate to the security level required and is durable in the often harsh maritime environment, and*
- *Plan for and develop a policy for the deployment of readers to coincide with the issuance of credentials.*

TRANSPORTATION P WORKER

Expires 22May2013

Transportation Worker Identification Credential

Content

The Transportation Worker Identification Credential Program, TSA

Are you planning any other large scale application of biometric technology in relationship to the TSA's needs in the future?

The TWIC system is capable of serving the identity and STA needs for other populations. The transition over the next year to Universal Enrollment Services (UES) contract and the Technology Infrastructure Modernization (TIM) system will further enhance TSA's ability to provide identity and STA services. TSA will evaluate these needs in conjunction with DHS and other Federal departments and agencies.

White Paper on Trends and Challenges in Forensic Science

The Netherlands Forensic Institute (NFI) has come up with a white paper on *Trends, Challenges and Strategy in Forensic Sector*. This white paper describes some of the trends and pressures that will affect the structure and governance of the sector today and in years to come. It underlines that the recent growth in forensics has resulted from the introduction of new technologies, most notably high-tech biometrics, like forensic DNA and forensic information technology. This white paper also suggests way forward to meet emerging challenges and can be downloaded from the following weblink: http://www.forensicinstitute.nl/Images/trends-challenges-and-strategy-in-the-forensic-science-sector-(march-2013)_tcm120-494231.pdf
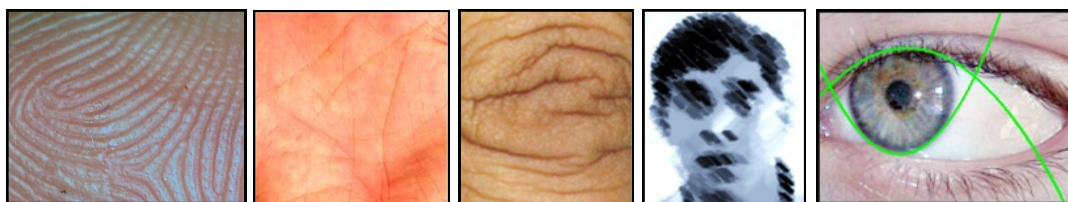
Ethics and Policy for Maximizing Profits from Face Recognition

Significant increase in the accuracy of face recognition technologies is increasingly attracting retail and commercial organizations to find new ways to deploy these technologies to drive them towards higher profitability. Commercial organizations are experimenting with new ways to categorize customers, identifying repeat spenders, analysing face images to reveal age group and much more. This article from *Carl Gohringer,* presents overview of such applications of face recognition technologies and analyses potential solutions for the emerging privacy issues. This article can be downloaded from the following weblink: http://allevate.com/index_files/Face_Recognition_in_Retail_Profit_Ethics_and_Privacy_v1.0_07_January_2013.pdf

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Ridge Based Palmprint Matching

Jifeng Dai, Jianjiang Feng, Jie Zhou
Department of Automation, Tsinghua University, Beijing

Content

Palmprint is an important biometric trait for the personal identification. Patterns formed by the friction ridges on the palm surface are believed to be highly unique among the individuals. The law enforcement agencies throughout the world have been collecting palmprints routinely, together with the fingerprints, from criminals since the early 20th century, and effectively using to establish identity of suspects.

There has been lot of research on automated palmprint matching schemes which exploit texture features from the palm images. Such texture features are easily revealed from the palm images, typically with 100 ppi resolution, which can be acquired using low-cost digital cameras. However the texture features, like the crease patterns, may not be as stable as the palm ridges ridges. An image resolution of about 500 ppi is required to resolve such friction ridges. Figure 1 shows some crease and ridge features in a 500 ppi palmprint image. Personal identification based solely on the ridge features (such as minutiae) is accepted in the courts of law. While the use of ridge-based fingerprint matching system is pervasive, there are several open problems relating to the ridge-based palmprint matching: 1) Skin distortion due to the flexible skin and bone structure in the palm; 2) Diverse quality and distinctiveness of different palm regions; 3) Demanding computation in matching such palm images, largely because of large number of minutiae.

In order to develop an accurate and efficient palmprint matching algorithm, intrinsic characteristics of palmprints need to be utilized. We conducted a quantitative and statistical study on various characteristics of palmprints to guide the design and parameter selection of the matching system. Based on our quantitative study of palmprint statistics as well as motivated by matching strategies of human palmprint
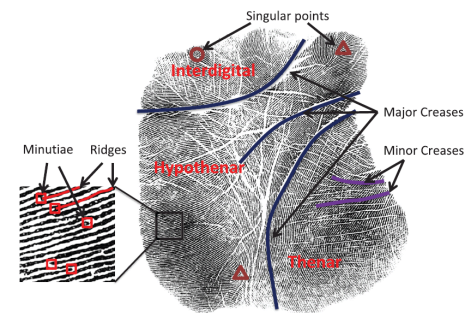

Figure 1. Crease and ridge features in a typical 500 ppi palmprint.

experts, a novel palmprint matching system for 1:N matching was designed. The outline of the proposed palmprint matching system is shown in Figure 2 where the proposed system is composed of three modules: palmprint registration, patch-based matching and fusion, and cascade filtering.
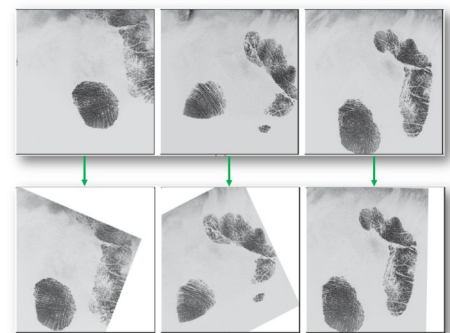

Figure 3. The developed palmprint registration algorithm can register poor quality palmprints into the same coordinate system, facilitating subsequent matching step. Since this registration is performed only once for each palmprint in the database, its computational time is negligible compared to the 1:N matching stage.
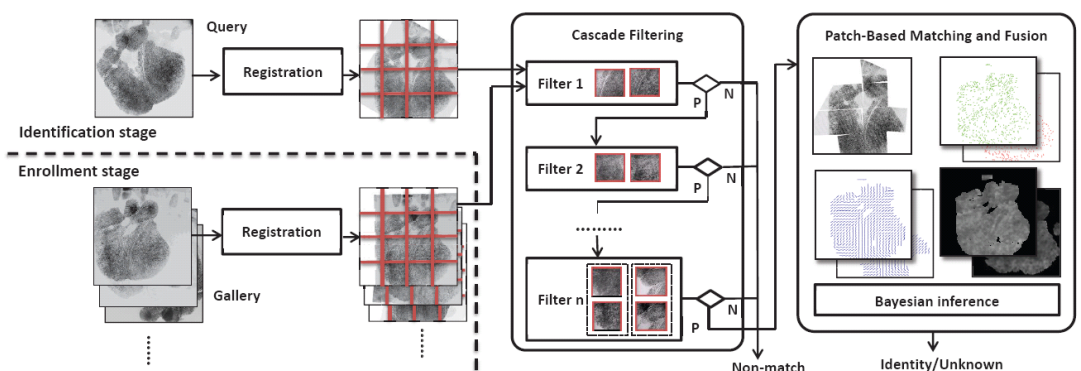

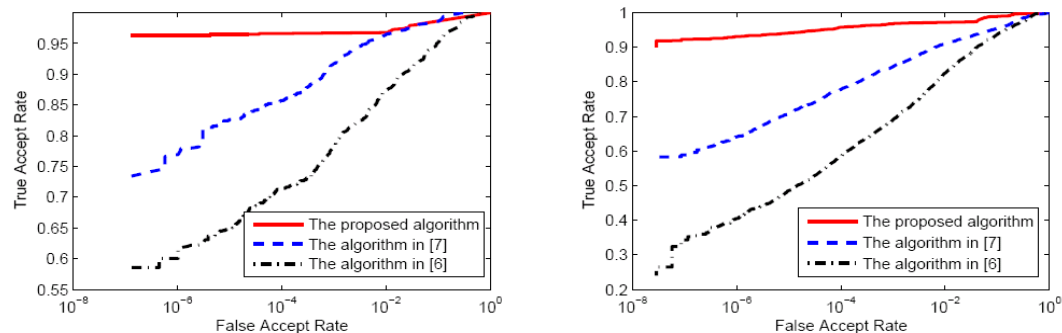**Figure 2.** Overview of the developed palmprint matching system.

Figure 4. The receiver operating characteristics from our algorithms in [6] and [7] on the THUPALMLAB database: (Left) full-to-full palmprint matching; (Right) partial-to-full palmprint matching.

Since different palmprints share a lot of common ridge flow patterns, the orientation field is used for palmprint registration. The registration transforms palmprints of different rotations and displacements into a common coordinate system. This automated registration step is carried out on each of the full palmprint images independently, and manual registration could be performed on partial latent palmprints. Please see Figure 3 for the registration of three different impressions of the same palm. In the following matching step, tight position constraints can be enforced to greatly improve the matching speed. A registered palmprint is divided into a set of patches. A patch-based matching and fusion algorithm is proposed to address the distortions and varying discrimination power of different regions. During palmprint matching, all the corresponding patches are finely aligned and compared. When distortion occurs, the patches are rotated and shifted to compensate for the distortion. In this way, the influence of distortion can be effectively reduced. The similarity score is calculated at each patch for each type of feature, respectively. Finally, the weights of various features at different patches are determined by learning. As some patches in palmprints are very distinctive, it is possible to discard many non-mated gallery palmprints by merely comparing those distinctive patches. The cascade filter is based on this idea. A detailed description of this algorithm can be found in [1].

Experimental results on the THUPALMLAB database [4] from the matching 840 query palmprints against a gallery set of 13,736 palmprints show that the proposed algorithm achieves large improvement in both matching accuracy and speed as compared to the previous works [2, 3]. The ROC curves of full-to-full and partial-to-full palmprint matching of the proposed algorithms are shown in Figure 4. The results also show that the proposed algorithm can improve the palmprint matching speed by a factor of 132 compared with the algorithm in [3]. The average time of matching a pair of full palmprints is 22.8 milliseconds on PC with a 3.3 GHz CPU. The executive version of the proposed algorithm is also available [4].

The current registration algorithm is designed for registering full palmprints. However, experienced latent examiners can determine the location of a small latent palmprints based on certain clues, including the latent shape, some fine orientation field and crease features. The issue regarding how to extend the current registration algorithm to partial and latent palmprints is an interesting and challenging problem for future research. This research was supported by the National Natural Science Foundation of China under Grants 61020106004, 61005023, and 61021063.

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4. Tsinghua 500 PPI Palmprint Database, THUPALMLAB, http://ivg.au.tsinghua.edu.cn

Please visit IEEE biometrics council website for more details on council activities. We welcome all your comments/suggestions and our mailing address is: bjteoh@ieee.org

NIST News on Biometrics

Content

Advances in Biometric Standardization

The National Institute of Standards and Technology (NIST) has released a report on the current status of biometric standards developments with the objective of addressing global market needs for biometric standards. This report addresses the status of published biometric standards, on-going biometric standards development activities and short-term standards development plans.

This report discusses work of the following major standards development bodies: Joint Technical Committee 1 of ISO and IEC Subcommittees 37 - Biometrics, 17 - Cards and personal identification, 27 - IT Security techniques, ISO Technical Committee 68 - Financial Services - SC 2 - Security, and the International Telecommunication Union - Study Group 17 - Security.

This report also addresses the development of the ANSI/NIST-ITL standards led by the Information Technology Laboratory of NIST and discusses a few examples of global and national biometric standards adoption for verification and identification applications. The report can be downloaded from the following web-link: http://www.nist.gov/customcf/get_pdf.cfm?pub_id=909998

Interoperability among Automated Fingerprint Identification Systems for Forensic Examiners

The National Institute of Standards and Technology (NIST) has released three new publications on facilitating cross-jurisdictional fingerprint matching for forensic examiners. To avoid having to re-encode the print's features before searching each automated fingerprint identification system (AFIS), these publications aim to maximize consistency among examiners. In general, they define data-exchange specifications for latent print interoperability based on the Extended Feature Set (EFS) proposed in the ANSI/NIST-ITL (2011) standard.

These publications include: NIST SP-1134 - Extended Feature Set Profile Specification; NIST SP-1151 - Markup Instructions for Extended Friction Ridge Features and NIST SP-1152 - Latent Interoperability Transmission Specification. In specific, the first publication defines EFS Profiles – sets of features to be used in latent friction ridge searches of AFIS; the second publication defines vendor-neutral latent transactions to be exchanged among different cross-jurisdictional automated friction ridge identification systems; and the third publication provides instructions for latent print examiners in marking friction ridge features. These three publications can be downloaded from the following web-link: http://www.nist.gov/oles/afis_interoperability.cfm

Use Case and Scenario Development for Mobile Identification

The National Institute of Standards and Technology (NIST) has released a white paper draft on mobile identification as a supplement to ANSI/NIST-ITL 1-2011. This white paper is intended to better define concepts for use in mobile handheld biometric devices. Issues addressed by these concepts include collecting data on the same person in different places and time, rapidly identifying individuals with limited bandwidth, capturing modules physically separated from the control unit using web services and enabling mobile modules communicating to different systems. This white paper contains a detailed description of a scenario for each concept and a general use case discussion of each scenario. The white paper can be downloaded from the following web-link: http://biometrics.nist.gov/cs_links/standard/ansi_2012/Supplement_Mobile%20ID%20Skeleton.pdf

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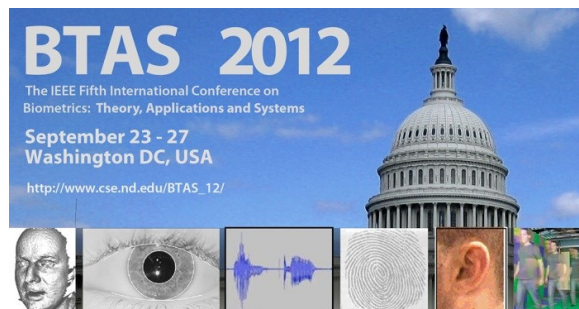**Please sign-up today at our IEEE Biometrics Council website!**

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Conference Report for BTAS 2012

Content

The Fifth IEEE International Conference on Biometrics: Theory, Applications and Systems (BTAS 2012) was successfully held in the Washington DA area between September 23 and 26, 2012. Patrick Flynn and Arun Ross served as the General Chairs for BTAS 2012. The conference featured a rich program consisting of three keynote talks, one banquet talk, two tutorials, 32 oral presentations, 30 poster presentations and a Doctoral Symposium. Delegates commented on the impressive scientific quality and the breadth of work discussed at the event. The reception, conference banquet and coffee breaks served as additional opportunities for networking with the attendees..

The Program Chairs – Davide Maltoni, BVK Vijayakumar, Pong C. Yuen – along with the Program Committee, selected 62 papers out of 144 submissions after a rigorous review process. The submissions covered various biometric topics including sensors, modalities, fusion, security, privacy, applications, usability and social impact. The oral presentations were organized into 8 sessions. The poster presenters had the opportunity to highlight their work at the poster spotlight session.

The keynote talks by Maja Pantic ("Machine Analysis of Facial Behavior"), Yi Ma ("Pursuit of Low-dimensional Structures in High-dimensional Data") and Jason Pelecanos ("Automatic Speaker Recognition Research: A Journey of Recent Trends, Forensics, and Toward Achieving Robustness"), fostered excellent discussions and gave researchers insight into several interesting problems. The banquet talk by Rama Chellappa ("Computational Vision Theories and Dictionaries for Face and Expression Recognition") was also well received.

BTAS 2012 featured a Doctoral Symposium, organized by Thirimachos Bourlai and Brendan Klare, in which PhD candidates and PostDocs discussed their work with senior researchers in the community and presented their research at the poster session. The Symposium also had a luncheon talk by Mark Nixon who offered career guidance to the participants.

The Tutorials Chair, Ajay Kumar, facilitated the organization of two tutorials: "Multiple Uses of Correlation Filters for Biometrics" by BVK Vijayakumar and "Video Based Face Recognition" by Rama Chellappa and Pavan Turaga.

The Honeywell Best Student Paper Awards went to "Matching Vein Patterns from Color Images for Forensic Investigation" by Hengyi Zhang, Chaoying Tang, Adams Wai-Kin Kong, and Noah Craft, and "Robust Feature Extraction in Fingerprint Images Using Ridge Model Tracking" by Nathaniel Short, Lynn Abbott, Michael Hsiao and Edward Fox. The Best Poster Awards, as voted by the attendees, went to "A Multi-Sample Standoff Multimodal Biometric System" by Christopher Boehnen, Del Barstow, Dilip Reddy and Chris Mann (Day 1), "Hallucinating Faces in the Dark" by Sasikanth Bendapudi, Khoa Luu and Marios Savvides (Day 2), and "On Iris Camera Interoperability" by Sunpreet Arora, Mayank Vatsa, Richa Singh and Anil Jain (Day 3).

BTAS 2012 was sponsored by the IEEE Biometrics Council and the IEEE Systems, Man and Cybernetics Society. Industrial sponsors included Progeny Systems, Honeywell, Neurotechnology, Lumidigm, Cross-Match and Safran Morpho. Plans are already underway for a BTAS 2013 meeting to be held in the Washington DC area in the fall of 2013.

Videos of all BTAS 2012 talks and the keynote slides can be accessed at https://sites.google.com/a/nd.edu/btas_2012/ .

Forthcoming Biometrics Conferences

Biometrics: Theory, Applications and Systems
BTAS 2013, Washington DC, USA, Sep 29 - Oct 2, 2013

The Sixth IEEE International Conference on Biometrics: Theory, Applications and Systems (BTAS 2013) is intended to have a broad scope, including advances in image processing, pattern recognition, statistical and mathematical techniques relevant to biometrics, new algorithms and/or technologies for biometrics, analysis of specific applications, and analysis of the social impact of biometrics technology. Submissions may be up to eight pages in IEEE conference format. Papers accepted and presented at BTAS 2013 will be available in the IEEE eXplore digital library. *Paper Submission Deadline: 2nd May 2013*.

International Conference of the Biometrics Special Interest Group
BIOSIG 2013, Darmstadt, Germany, 5-6 Sep 2013
http://fg-biosig.gi.de/biosig2013

The BIOSIG 2013 conference is devoted to addressing problems relating to the deployment of biometrics systems, emerging modalities, acquisition techniques, efficient fusion techniques for multimodality systems, security of the biometric system, security analysis and certification of security properties. The conference will present innovations and best practices that can be transferred into future applications. Stakeholders and technical experts are invited to submit original research papers. Industrial contributions presenting lessons learned from practical usage, case study, recent results of prototypes are also welcomed. Submissions should be full papers (max. 12 pages) in English. Each paper will be subjected to the *double blind peer review* process. *Paper Submission Deadline: 15th May 2013*.

IEEE Computer Society Workshop on Biometrics - in conjunction with CVPR 2013
Oregon Conventional Centre, Portland, USA, 23 June 2013
http://vislab.ucr.edu/Biometrics13

This workshop on biometrics is organized in conjunction with CVPR 2013. It is intended to be positioned at the frontier of biometrics research and disseminate the excellent and advanced research work underway at academic and private research organizations as well as government labs. The review process for the papers submitted for the workshop presentation was *double blind* and involved more than a dozen of external or invited reviewers who provided insightful comments. The technical program for the workshop includes presentation on *high quality* papers on research issues in face, fingerprint, periocular, palmprint, gait recognition, *antispoofing* techniques and new techniques to improve system performance. All the papers presented in the workshop will be included in the *CVPR 2013-DVD* and made available on IEEE eXplore.

International Conference on Biometrics
ICB 2013, Madrid, Spain, 4-7 June 2013
http://atvs.ii.uam.es/icb2013

The 6th IAPR International Conference on Biometrics (ICB 2013), technically co-sponsored by both IEEE (Biometrics Council) and IAPR (Technical Committee on Biometrics - TC4), ICB 2013 has attracted high number of quality paper submissions and after a rigorous review process, only 33.9% of the submitted papers have been accepted for presentation. Together with both oral and poster regular sessions, we have a set of keynote speakers, tutorials, panel sessions, competitions, doctoral consortium, related social events, and awards, that will make of ICB 2013 a unique event for all of the participates in the field of biometrics. Please visit conference website for further details and early registration for the conference attendance.

Content

Call for nominations for a new Biometrics Award

IAPR Young Biometrics Investigator Award

Content

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The Technical Committee on Biometrics (TC4) of IAPR has recently announced the establishment of a new biometrics investigator award. This new biometrics award has been named as "IAPR Young Biometrics Investigator Award" (YBIA) and has been established from the outcome of the International Conference on Biometrics (ICB 2012) held in New Delhi last year. The objectives and criteria of this award are similar to those for the IAPR's JK Aggarwal award, except that it will be given to outstanding scientists in the biometrics field. This award will be given out in the odd years. The recipients of the award will be announced at ICB or IJCB every year. At the conference, the winner will be asked to deliver a plenary talk.

The recipient of the award will be recommended by nomination by a special selection committee, appointed by the TC4, and composed of three active members of the TC4. One of the committee members will be the most recent past recipient of the award. The awards will be then be sent for the approval from the President of the IAPR.

Selection criteria and procedures

The recipient of the YBIA is expected to be a young scientist, under the age of 40 on the deadline date for nominations, who has made substantial contributions to the IAPR biometrics community and whose research work has had a major impact in advancing biometrics. The prize consists of a cash amount and a suitably inscribed certificate.

Nomination procedure

Each candidate must be supported by a nominator who is responsible for providing the names of at least three, and no more than five, endorsers supporting the respective nomination. The nomination and endorsement forms can be downloaded from the following weblink: http://http://www.cbsr.ia.ac.cn:8080/iapr_news_201301.jsp. The nomination and endorsement forms must reach the chairman of the YBIA committee, Prof. Anil K. Jain, no later than 1st May 2013.

ICB 2013 TABULA RASA Spoofing Challenge

Tabula Rasa Spoofing Challenge invites researchers to develop ingenious attack plans and deceive various biometric authentications systems of different modalities.

The goal of this challenge is to stimulate novel ideas to spoof state-of-the-art biometric authentication systems with four different modalities: 2D face in visible spectra, 2D face in infra-red spectra, Speech and Fingerprint. Each system is reinforced with countermeasures for numerous attack types and the participants are invited to find ways to break through the system using their imagination and creativity. The most brilliant attempt, which will be decided on its spoofing success and originality, will be awarded with the "**Best Spoofing Attack Award**", accompanied by an incentive prize.

For further information, please visit http://www.tabularasa-euproject.org/evaluations/tabula-rasa-spoofing-challenge-2013

First ICB Competition on Face Recognition

The first ICB *Competition on Face Recognition* is organized in conjunction with ICB 2013 and is open to participants from academia and industry. A training database of 2500 facial images from 500 subjects is made freely available to all participants. A test database of 4000 facial images from 1000 subjects, i.e., cropped images of only facial regions, will be used for evaluation during the competition. Each participant can submit maximum of three algorithms. The competition results and the detailed summary will be presented during the ICB 2013 in Madrid. Please visit http://face.idealtest.org/2013/ICFR2013.jsp for further details.

New Biometrics Databases in Public Domain

Content

New Databases

The OU-ISIR Gait Database, Large Population Dataset

This new dataset is meant to aid research efforts in the general area of developing, testing and evaluating algorithms for gait-based human identification. The data have been acquired by two cameras (camera 1 and 2) at 30 fps, 640 by 480 pixels. The data consists of walking image sequences from over 4,000 subjects with a wide range of ages are available. Samples of still color images from one of the cameras are shown in the figures below. The datasets are distributed in a form of silhouette sequences with a wide range of ages and registered and size-normalized to 88 by 128 pixels size, and currently silhouette image sequences from camera 1 are released. For further details, please visit: http://www.am.sanken.osaka-u.ac.jp/BiometricDB/index.html

Hong Kong Polytechnic University Finger Vein Database Version 1.0

The Hong Kong Polytechnic University finger image database consists of simultaneously acquired finger vein and finger surface texture images from both male and female volunteers. The database has 6264 images from 156 subjects where all the images are in bitmap (*.bmp) format. In this dataset about 93% of the subjects are younger than 30 years. The finger images were acquired in two separate sessions with a minimum interval of one month, a maximum interval of over six months and an average interval of 66.8 days. Within each session, each subject provided 6 image samples from his/her left index and middle finger, respectively, wherein each sample set consists of one finger vein image and one finger texture image. Detailed instruction regarding download and use of this database, can be found in http://www4.comp.polyu.edu.hk/~csajaykr/fvdatabase.htm

GREYC-Keystroke benchmark Database

Keystroke dynamics can be used to identify humans while they are typing using keyboard. Lack of publicly available keystroke dynamics database poses challenges for benchmarking algorithms. GREYC Keystroke database is released for researchers to help with such comparison of different protocols and algorithms. In this database, 133 individuals have participated to the capture process by typing between 5 and 107 times the password "greyc laboratory" between 03/18/2009 and 07/05/2009. There are 7555 available captures, and the average number of acquisitions per user is 51 with 100 of them having more than 60 templates. Most of the individuals participated in at least 5 sessions, with one week's interval between each consecutive session. Two keyboards (the original keyboard of the laptop, and an USB one plugged to the laptop) were used to verify if the model is only dependent on a user or if it is dependent on both user and keyboard. During the first session, the individuals were able to train themselves on the typing of the password on the two keyboards as long as they wanted. For the following sessions, they were not authorized to train, but have to directly register their typing events. Please visit: http://www.epaymentbiometrics.ensicaen.fr/index.php/app/resources/66 for further details of GREYC Keystroke database.

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