PROCEEDINGS OF SPIE

Biometric and Surveillance Technology for Human and Activity Identification X

Ioannis Kakadiaris Walter J. Scheirer Laurence G. Hassebrook Editors

2 May 2013 Baltimore, Maryland, United States

Sponsored and Published by SPIE

Volume 8712

Proceedings of SPIE 0277-786X, V. 8712

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Biometric and Surveillance Technology for Human and Activity Identification X, edited by Ioannis Kakadiaris, Walter J. Scheirer, Laurence G. Hassebrook, Proc. of SPIE Vol. 8712, 871201 · © 2013 SPIE CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2029719

Proc. of SPIE Vol. 8712 871201-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in Biometric and Surveillance Technology for Human and Activity Identification X, edited by Ioannis Kakadiaris, Walter J. Scheirer, Laurence G. Hassebrook, Proceedings of SPIE Vol. 8712 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X ISBN: 9780819495037

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445 SPIE.org

Copyright © 2013, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/13/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering
- system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

vii Conference Committee

SESSION 1 FINGERPRINTS

- 8712 03 A novel hand-type detection technique with fingerprint sensor [8712-2] N. Abe, T. Shinzaki, Fujitsu Labs., Ltd. (Japan)
- 8712 04 Security analysis for fingerprint fuzzy vaults [8712-3]
 J. Hartloff, M. Bileschi, S. Tulyakov, J. Dobler, A. Rudra, V. Govindaraju, Univ. at Buffalo, SUNY (United States)
- 8712 05 **Performance characterization of structured light-based fingerprint scanner** [8712-4] L. G. Hassebrook, M. Wang, R. C. Daley, Univ. of Kentucky (United States)

SESSION 2 BIOMETRIC SYSTEMS

- 8712 07 **Privacy information management for video surveillance** [8712-6] Y. Luo, S. S. Cheung, Univ. of Kentucky (United States)
- 8712 08 Eyebrow segmentation using active shape models [8712-7]
 K. Hollingsworth, S. Clark, J. Thompson, P. J. Flynn, K. W. Bowyer, Univ. of Notre Dame (United States)

SESSION 3 FACE RECOGNITION

- 8712 0A Encoding and selecting features for boosted multispectral face recognition: matching SWIR versus color [8712-9]
 S. Boothapati, N. A. Schmid, West Virginia Univ. (United States)
- 8712 OB Using crypts as iris minutiae [8712-10] F. Shen, P. J. Flynn, Univ. of Notre Dame (United States)
- 8712 OC Automatic detection of non-cosmetic soft contact lenses in ocular images [8712-11] G. Erdogan, West Virginia Univ. (United States); A. Ross, Michigan State Univ. (United States)

SESSION 4 NON-TRADITIONAL BIOMETRICS

8712 OE Securing iris recognition systems against masquerade attacks [8712-13]
 J. Galbally, M. Gomez-Barrero, Univ. Autónoma de Madrid (Spain); A. Ross, West Virginia Univ. (United States); J. Fierrez, J. Ortega-Garcia, Univ. Autónoma de Madrid (Spain)

8712 OF Gaze estimation for off-angle iris recognition based on the biometric eye model [8712-14] M. Karakaya, D. Barstow, H. Santos-Villalobos, J. Thompson, D. Bolme, C. Boehnen, Oak Ridge National Lab. (United States)

POSTER SESSION I

- 8712 0I The relationship between 2D static features and 2D dynamic features used in gait recognition [8712-22] H. M. Alawar, H. Ugail, M. Kamala, D. Connah, Univ. of Bradford (United Kingdom)
 8712 0J Investigating gait recognition in the short-wave infrared (SWIR) spectrum: dataset and challenges [8712-23] B. DeCann, West Virginia Univ. (United States); A. Ross, Michigan State Univ. (United States);
- 8712 0K Palm vein for efficient person recognition based on 2D Gabor filter [8712-24]
 J. Wang, Y. He, J. Zhu, X. Gao, Beijing Institute of Technology (China); Y. Cui, Zhejiang Univ. (China)
- 8712 OL Effects of mascara on iris recognition [8712-25] J. S. Doyle, P. J. Flynn, K. W. Bowyer, Univ. of Notre Dame (United States)

J. Dawson, West Virginia Univ. (United States)

- 8712 0M A red-eye detector for iris segmentation using shape context [8712-26]
 C. Ti, Univ. of Kentucky (United States); X. Huang, A. Tokuta, North Carolina Central Univ. (United States); R. Yang, Univ. of Kentucky (United States)
- 8712 0N Ear recognition: a complete system [8712-27]
 A. Abaza, West Virginia High Technology Consortium Foundation (United States) and Cairo Univ. (Egypt); M. F. Harrison, West Virginia High Technology Consortium Foundation (United States)
- 8712 00 An efficient visualization method for analyzing biometric data [8712-28] M. Rahmes, M. McGonagle, J. H. Yates, R. Henning, J. Hackett, Harris Corp. (United States)
- 8712 OP
 Secure voice-based authentication for mobile devices: vaulted voice verification [8712-29]
 R. C. Johnson, Securics, Inc. (United States) and Univ. of Colorado at Colorado Springs (United States); W. J. Scheirer, Securics, Inc. (United States) and Harvard Univ. (United States); T. E. Boult, Securics, Inc. (United States) and Univ. of Colorado at Colorado Springs (United States)

POSTER SESSION II

How reliable are your visual attributes? [8712-15]
 W. J. Scheirer, Harvard Univ. (United States); N. Kumar, Univ. of Washington (United States);
 V. N. Iyer, Securics, Inc. (United States); P. N. Belhumeur, Columbia Univ. (United States);
 T. E. Boult, Securics, Inc. (United States)

- 8712 OR Local gradient Gabor pattern (LGGP) with applications in face recognition, cross-spectral matching, and soft biometrics [8712-16]
 C. Chen, West Virginia Univ. (United States); A. Ross, Michigan State Univ. (United States)
- 8712 0S Color constancy in 3D-2D face recognition [8712-17]
 M. Meyer, C. Riess, E. Angelopoulou, Univ. of Erlangen-Nuremberg (Germany);
 G. Evangelopoulos, I. A. Kakadiaris, Univ. of Houston (United States)
- 8712 OT The impact of specular highlights on 3D-2D face recognition [8712-19]
 V. Christlein, C. Riess, E. Angelopoulou, Univ. of Erlangen-Nuremberg (Germany);
 G. Evangelopoulos, I. A. Kakadiaris, Univ. of Houston (United States)
- 8712 0U ASIE: application-specific image enhancement for face recognition [8712-21] E. Bilgazyev, U. Kurkure, S. K. Shah, I. A. Kakadiaris, Univ. of Houston (United States)

Author Index

Conference Committee

Symposium Chair

Kenneth R. Israel, Major General (USAF Retired) (United States)

Symposium Cochair

David A. Whelan, Boeing Defense, Space, and Security (United States)

Conference Chairs

Ioannis Kakadiaris, University of Houston (United States) Walter J. Scheirer, Harvard University (United States) Laurence G. Hassebrook, University of Kentucky (United States)

Conference Program Committee

Ross Beveridge, Colorado State University (United States) Jean-Francois Bonastre, Université d'Avignon et des Pays du Vaucluse (France) Terrance E. Boult, University of Colorado at Colorado Springs (United States) Rama Chellappa, University of Maryland, College Park (United States) Sen Ching Cheung, University of Kentucky (United States) Bernadette Dorizzi, TELECOM & Management SudParis (France) Julian Fierrez, Universidad Autónoma de Madrid (Spain) Patrick J. Flynn, University of Notre Dame (United States) Brian Heflin, University of Colorado at Colorado Springs (United States) Ajay Kumar, The Hong Kong Polytechnic University (Hong Kong, China) Daniel P. Lopresti, Lehigh University (United States) Norman Poh, University of Surrey (United Kingdom) Salil Prabhakar, Consultant (United States) Nalini K. Ratha, IBM Thomas J. Watson Research Center (United States) Anderson Rocha, Universidade Estadual de Campinas (Brazil) Arun A. Ross, West Virginia University (United States) Marios Savvides, Carnegie Mellon University (United States) Natalia A. Schmid, West Virginia University (United States) Stephanie Schuckers, Clarkson University (United States) William Robson Schwartz, Universidade Federal de Minas Gerais (Brazil)

Shishir Shah, University of Houston (United States)
Elham Tabassi, National Institute of Standards and Technology (United States)
Kar-Ann Toh, Yonsei University (Korea, Republic of)
Raymond N. J. Veldhuis, University of Twente (Netherlands)
Ruigang Yang, University of Kentucky (United States)

Session Chairs

- 1 Fingerprints Walter J. Scheirer, Harvard University (United States)
- 2 Biometric Systems Ioannis Kakadiaris, University of Houston (United States)
- 3 Face Recognition Walter J. Scheirer, Harvard University (United States)
- 4 Non-traditional Biometrics **Ioannis Kakadiaris**, University of Houston (United States)