PROCEEDINGS OF SPIE

Optical Pattern Recognition XXII

David P. Casasent Tien-Hsin Chao Editors

28–29 April 2011 Orlando, Florida, United States

Sponsored and Published by SPIE

Volume 8055

Proceedings of SPIE, 0277-786X, v. 8055

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

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 *Optical Pattern Recognition XXII*, edited by David P. Casasent, Tien-Hsin Chao, Proceedings of SPIE Vol. 8055 (SPIE, Bellingham, WA, 2011) Article CID Number.

ISSN 0277-786X ISBN 9780819486295

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 © 2011, 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/11/\$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 INVITED SESSION

8055 02 Autonomous learning approach for automatic target recognition processor (Invited Paper) [8055-01]

T.-H. Chao, T.-T. Lu, Jet Propulsion Lab. (United States)

- 8055 03 Tracking illegally parked vehicles using correlation of multi-scale difference of Gaussian filtered patches (Invited Paper) [8055-02]
 B. Mitra, W. Hassan, N. Bangalore, P. Birch, R. Young, C. Chatwin, Univ. of Sussex (United Kingdom)
- 8055 04 Empirical mode decomposition of the ECG signal for noise removal (Invited Paper) [8055-03] J. Khan, S. Bhuiyan, G. Murphy, Tuskegee Univ. (United States); M. Alam, Univ. of South Alabama (United States)

SESSION 2 OPTICAL SPECTRAL PROCESSING AND HARDWARE

- Monolithic liquid crystal waveguide Fourier transform spectrometer for gas species sensing [8055-05]
 T.-H. Chao, T. T. Lu, Jet Propulsion Lab. (United States); S. R. Davis, S. D. Rommel, G. Farca, B. Luey, A. Martin, M. H. Anderson, Vescent Photonics Inc. (United States)
- Feasibility breadboard demonstration of an imaging Fourier transform spectrometer using solid state time delay [8055-06]
 T.-H. Chao, T. T. Lu, Jet Propulsion Lab. (United States)

SESSION 3 NOVEL CORRELATION AND DISTORTION INVARIANT PATTERN RECOGNITION FILTERS

- 8055 08 Parameter optimization of the optimal trade-off maximum average correlation height filter for FLIR imaging in high clutter environments [8055-07]
 A. Alkandri, A. Gardezi, P. Birch, R. Young, C. Chatwin, Univ. of Sussex (United Kingdom)
- 8055 09 Enhancement of the speed of space-variant correlation filter implementations by using low-pass pre-filtering for kernel placement and applications to real-time security monitoring [8055-08]
 A. Gardezi, A. Al-Kandri, P. Birch, R. Young, C. Chatwin, Univ. of Sussex (United Kingdom)
- 8055 0A **Distortion-insensitive correlation constellation detection** [8055-09] C. Casey, L. G. Hassebrook, E. Crane, A. Davidson, Univ. of Kentucky (United States)

- 8055 0B **Distortion-invariant color pattern recognition using multiple phase-shifted-reference-based** joint transform correlation incorporating synthetic discriminant function [8055-10] M. N. Islam, Farmingdale State College (United States); M. A. Karim, Old Dominion Univ. (United States)
- 8055 0C Automatic angle measurement of a 2D object using optical correlator-neural networks hybrid system [8055-11]
 N. Manivannan, Brunel Univ. (United Kingdom); M. A. A. Neil, Imperial College London (United Kingdom)
- 8055 0D Wide-area surveillance with multiple cameras using distributed compressive imaging [8055-30]
 C. Huff, Univ. of Central Florida (United States); R. Muise, Lockheed Martin Missiles and Fire Control (United States)

SESSION 4 FEATURE EXTRACTION AND TRACKING FOR PATTERN RECOGNITION

8055 OE Optimization of nonlinear kernel PCA feature extraction algorithms for automatic target recognition [8055-13]

S. Winger, Stanford Univ. (United States); T. Lu, T.-H. Chao, Jet Propulsion Lab. (United States)

8055 OF Moving object tracking by using a novel real-time 2D local-polar-edge-detection method [8055-14]

C. J. Hu, Southern Illinois Univ. Carbondale (United States)

8055 0G A compressed sensing method with analytical results for lidar feature classification [8055-15] J. D. Allen, Oak Ridge National Lab. (United States); J. Yuan, X. Liu, The Florida State Univ. (United States); M. Rahmes, Harris Corp. (United States)

SESSION 5 PHOTOREFRACTIVE OPTICAL PATTERN RECOGNITION

8055 0H Optical correlation via dynamic range compression using organic photorefractive materials [8055-16]
 B. Haji-saeed, J. Khoury, C. L. Woods, Air Force Research Lab. (United States); J. Kierstead, Solid State Scientific Corp. (United States); N. Peyghambarian, Univ. of Arizona (United States); M. Yamamoto, Nitto Denko Technical Corp. (United States)

8055 01 Optical dynamic range compression deconvolution and correlation using organic photorefractive materials [8055-17]
 J. Khoury, B. Haji-saeed, C. L. Woods, Air Force Research Lab. (United States); J. Kierstead, Solid State Scientific Corp. (United States); N. Peyghambarian, Univ. of Arizona (United States); M. Yamamoto, Nitto Denko Technical Corp (United States)

SESSION 6 PATTERN RECOGNITION APPLICATIONS I

- Robust human intrusion detection technique using hue-saturation histograms [8055-18]
 W. Hassan, B. Mitra, N. Bangalore, P. Birch, R. Young, C. Chatwin, Univ. of Sussex (United Kingdom)
- 8055 0K Accurate, fast, and secure biometric fingerprint recognition system utilizing sensor fusion of fingerprint patterns [8055-19]
 A. El-Saba, S. Alsharif, R. Jagapathi, Univ. of South Alabama (United States)
- 8055 OL **Optical character recognition of handwritten Arabic using hidden Markov models** [8055-20] M. M. Aulama, A. M. Natsheh, G. A. Abandah, The Univ. of Jordan (Jordan); M. M. Olama, Oak Ridge National Lab. (United States)

SESSION 7 PATTERN RECOGNITION APPLICATIONS II

- 8055 0M Non-intrusive human fatigue monitoring in command centers [8055-31] A. Alsamman, T. Ratecki, The Univ. of New Orleans (United States)
- 8055 0N Sampling-balanced system for point target detection [8055-23] Y. Danziger, Rafael Advanced Defense Systems Ltd. (Israel)
- 8055 00 **A novel bag-of-visual-words approach for geospatial object detection** [8055-24] Ç. Aytekin, A. A. Alatan, Middle East Technical Univ. (Turkey)

POSTER SESSION

- 8055 OP Error correction in image registration using POCS [8055-22]
 P. Duraisamy, Univ. of North Texas (United States); M. S. Alam, Univ. of South Alabama (United States); S. C. Jackson, Univ. of North Texas (United States)
- 8055 0Q Kernel and stochastic expectation maximization fusion for target detection in hyperspectral imagery [8055-25]
 M. I. Elbakary, M. S. Alam, Univ. of South Alabama (United States)
- 8055 OR Spectral pattern recognition of controlled substances in street samples using artificial neural network system [8055-26]
 L. Poryvkina, Nartest AS (Estonia); V. Aleksejev, S. M. Babichenko, Laser Diagnostic Instruments AS (Estonia); T. Ivkina, NarTest (United States)
- 8055 0S The relationship study between image features and detection probability based on psychology experiments [8055-27]
 W. Lin, Beijing Institute of Technology (China) and Beijing Canbao Architecture Design Institution (China); Y. Chen, J. Wang, H. Gao, J. Wang, R. Su, W. Mao, Beijing Canbao Architecture Design Institution (China)

8055 0T The concept models and implementations of multiport neural net associative memory for 2D patterns [8055-28]

V. G. Krasilenko, Open International Univ. of Human Development (Ukraine); A. I. Nikolskyy, Vinnitsa National Technical Univ. (Ukraine); R. A. Yatskovskaya, V. I. Yatskovsky, Vinnitsa State Agrarian Univ. (Ukraine)

8055 0U **Text encryption via double-random phase-encoding** [8055-29] J. Sang, S. Ling, Chongqing Univ. (China); M. S. Alam, Univ. of South Alabama (United States)

Author Index

Conference Committee

Symposium Chair

William Jeffrey, HRL Laboratories, LLC (United States)

Symposium Cochair

Kevin P. Meiners, Office of the Secretary of Defense (United States)

Conference Chairs

David P. Casasent, Carnegie Mellon University (United States) Tien-Hsin Chao, Jet Propulsion Laboratory (United States)

Program Committee

Mohammad S. Alam, University of South Alabama (United States)
Don A. Gregory, The University of Alabama in Huntsville (United States)
Bahram Javidi, University of Connecticut (United States)
B. V. K. Vijaya Kumar, Carnegie Mellon University (United States)
Yunlong Sheng, Université Laval (Canada)
Robert C. Stirbl, Jet Propulsion Laboratory (United States)
Ashit Talukder, Jet Propulsion Laboratory (United States)
Shizhuo Yin, The Pennsylvania State University (United States)
Rupert C. D. Young, University of Sussex (United Kingdom)

Session Chairs

- Invited Session
 David P. Casasent, Carnegie Mellon University (United States)
- Optical Spectral Processing and Hardware
 Tien-Hsin Chao, Jet Propulsion Laboratory (United States)
- 3 Novel Correlation and Distortion Invariant Pattern Recognition Filters **Rupert C. D. Young**, University of Sussex (United Kingdom)
- 4 Feature Extraction and Tracking for Pattern Recognition Mohammad S. Alam, University of South Alabama (United States) Tien-Hsin Chao, Jet Propulsion Laboratory (United States)

- 5 Photorefractive Optical Pattern Recognition **Mohammad S. Alam**, University of South Alabama (United States) **Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)
- 6 Pattern Recognition Applications I **Rupert C. D. Young**, University of Sussex (United Kingdom)
- 7 Pattern Recognition Applications II **Rupert C. D. Young**, University of Sussex (United Kingdom)