

PROCEEDINGS OF SPIE

# ***Optical Pattern Recognition XX***

**David P. Casasent**  
**Tien-Hsin Chao**  
*Editors*

**16–17 April 2009**  
**Orlando, Florida, United States**

*Sponsored and Published by*  
SPIE

**Volume 7340**

Proceedings of SPIE, 0277-786X, v. 7340

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 XX*, edited by David P. Casasent, Tien-Hsin Chao, Proceedings of SPIE Vol. 7340 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X  
ISBN 9780819476067

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 © 2009, 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](http://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/09/\$18.00.

Printed in the United States of America.

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

The logo for SPIE Digital Library features the word "SPIE" in a bold, sans-serif font above the words "Digital Library" in a smaller, regular sans-serif font. To the right of the text is a stylized graphic consisting of three vertical bars of increasing height from left to right, with a curved line arching over them.

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**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 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 PATTERN RECOGNITION INVITED PAPERS

---

- 7340 02 **Automatic target recognition using 3D passive sensing and imaging with independent component analysis (Keynote Paper)** [7340-01]  
C. M. Do, Univ. of Connecticut (United States); R. Martínez-Cuenca, Univ. of Valencia (Spain); B. Javidi, Univ. of Connecticut (United States)
- 7340 03 **Automatic target recognition (ATR) performance improvement using integrated grayscale optical correlator and neural network (Invited Paper)** [7340-02]  
T.-H. Chao, T. Lu, Jet Propulsion Lab. (United States)
- 7340 04 **An optical space domain volume holographic correlator (Invited Paper)** [7340-03]  
P. Birch, A. Gardezi, B. Mitra, R. Young, C. Chatwin, Univ. of Sussex (United Kingdom)
- 7340 06 **Kernel synthetic discriminant function (SDF) filters for fast object recognition** [7340-31]  
R. Patnaik, D. Casasent, Carnegie Mellon Univ. (United States)

---

## SESSION 2 DISTORTION INVARIANT FILTERS

---

- 7340 07 **Composite correlation filter for O-ring detection in stationary colored noise (Invited Paper)** [7340-05]  
L. G. Hasebrook, Univ. of Kentucky (United States)
- 7340 08 **Optimization of OT-MACH filter generation for target recognition** [7340-06]  
O. C. Johnson, Harvey Mudd College (United States); W. Edens, Butler Univ., Purdue Univ. (United States); T. T. Lu, T.-H. Chao, Jet Propulsion Lab. (United States)
- 7340 09 **Distortion invariant pattern recognition using neural network based shifted phase-encoded joint transform correlation** [7340-07]  
M. N. Islam, Old Dominion Univ. (United States); M. H. Islam, Bangladesh Univ. of Engineering and Technology (Bangladesh); K. V. Asari, M. A. Karim, Old Dominion Univ. (United States); M. S. Alam, Univ. of South Alabama (United States)
- 7340 0A **Nonlinear Fourier correlation** [7340-08]  
K. Heidary, Alabama A&M Univ. (United States); H. J. Caulfield, Alabama A&M Univ. Research Institute (United States)
- 7340 0B **Linear methods for input scenes restoration from signals of optical-digital pattern recognition correlator** [7340-27]  
S. N. Starikov, M. V. Konnik, E. A. Manykin, V. G. Rodin, Moscow Engineering Physics Institute (Russian Federation)

- 7340 0C **LPCC filters realization as binary amplitude hologram in 4-f correlator: range limitation of hologram pixels representation** [7340-28]  
N. N. Evtikhiev, S. N. Starikov, R. S. Starikov, E. Yu. Zlokazov, Moscow Engineering Physics Institute (Russian Federation)

---

**SESSION 3 NEW TRACKING TECHNIQUES AND RESULTS**

---

- 7340 0D **Remote event detection and tracking using multiple heterogeneous satellite data fusion (Invited Paper)** [7340-09]  
A. Talukder, S.-S. Ho, Jet Propulsion Lab. (United States)
- 7340 0E **Data fusion based target tracking in FLIR imagery (Invited Paper)** [7340-10]  
M. S. Alam, Univ. of South Alabama (United States)
- 7340 0F **Visual target tracking in the presence of unknown observer motion** [7340-11]  
S. Williams, Georgia Institute of Technology (United States); T. Lu, Jet Propulsion Lab. (United States)
- 7340 0G **Correlation based swarm trackers for 3-dimensional manifold mesh formation** [7340-12]  
C. Casey, L. G. Hassebrook, P. Chaudhary, Univ. of Kentucky (United States)
- 7340 0H **Enhancing the accuracy of a recognition system using two fused patterns of same classifier** [7340-13]  
S. Alsharif, A. El-Saba, Univ. of South Alabama (United States)

---

**SESSION 4 NOVEL IMAGE PROCESSING TECHNIQUES**

---

- 7340 0I **An improved multi-frame super-resolution technique (Invited Paper)** [7340-15]  
P. Lakshmi Narasimha, Z. Yue, P. Topiwala, FastVDO Inc. (United States)
- 7340 0J **Nonlinear optical dynamic range compression with thin-film organic photorefractive material** [7340-16]  
B. Haji-saeed, J. Khoury, C. L. Woods, Air Force Research Lab. (United States); J. Kierstead, Solid State Scientific Corp. (United States); N. Peyghambarian, College of Optical Sciences, The Univ. of Arizona (United States)
- 7340 0K **Neural network target identification system for false alarm reduction** [7340-17]  
D. Ye, California Institute of Technology (United States); W. Edens, Butler Univ., Purdue Univ. (United States); T. T. Lu, T.-H. Chao, Jet Propulsion Lab. (United States)

---

**SESSION 5 IMAGE PROCESSING APPLICATIONS**

---

- 7340 0L **Detecting people in IR border surveillance video using scale invariant image moments** [7340-18]  
S. O'Hara, A. Fischer, 21st Century Systems, Inc. (United States)
- 7340 0M **Analytical feature filter used in an analytically preprocessed picture image** [7340-19]  
C. J. Hu, Univ. of Colorado at Boulder (United States)

7340 ON **Logarithmic  $r$ - $\theta$  mapping for hybrid optical neural network filter for multiple objects recognition within cluttered scenes** [7340-21]  
I. Kypraios, R. C. D. Young, C. R. Chatwin, P. M. Birch, Univ. of Sussex (United Kingdom)

7340 OO **Image complexity matrix for pattern and target recognition based on Fourier spectrum analysis** [7340-30]  
V. Perju, Technical Univ. of Moldova (Moldova) and Free International Univ. of Moldova (Moldova); D. Casasent, Carnegie Mellon Univ. (United States); I. Mardare, Technical Univ. of Moldova (Moldova)

---

**SESSION 6 PATTERN RECOGNITION APPLICATIONS**

---

7340 OP **Joint transform correlator fingerprint verification using complementary-reference and complementary-scene images** [7340-22]  
H. A. Kamal, A. K. Cherri, Kuwait Univ. (Kuwait)

7340 OQ **High performance and fast face recognition technique based on components of phases of face images** [7340-23]  
N. Zaeri, A. Cherri, Kuwait Univ. (Kuwait)

7340 OS **Digital images inpainting using modified convolution based method** [7340-25]  
M. M. Hadhoud, K. A. Moustafa, S. Z. Shenoda, Menofyia Univ. (Egypt)

7340 OT **A novel clustering method using weighted sub-sampling for an infrared search and track system** [7340-26]  
B. Choi, S. Nam, J. Youn, Samsung Thales Co., Ltd. (Korea, Republic of); Y. Yang, S. Kim, J. Lee, Y. Park, Agency for Defense Development (Korea, Republic of)

7340 OU **The comparative analysis of image restoration represented as a matrix and as a vector using feed forward neural networks** [7340-29]  
I. Mardare, Technical Univ. of Moldova (Moldova); V. Perju, Technical Univ. of Moldova (Moldova) and Free International Univ. of Moldova (Moldova); D. Casasent, Carnegie Mellon Univ. (United States); O. Ghincul, Technical Univ. of Moldova (Moldova)

*Author Index*



# Conference Committee

## *Symposium Chair*

**Ray O. Johnson**, Lockheed Martin Corporation (United States)

## *Symposium Cochair*

**Michael T. Eismann**, Air Force Research Laboratory (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)

**Richard D. Juday**, NASA Johnson Space Center (United States)

**B.V.K. Vijaya Kumar**, Carnegie Mellon University (United States)

**Dennis R. Pape**, AlphaLaunch (United States)

**Yunlong Sheng**, Université Laval (Canada)

**Joseph L. Stufflebeam**, NewTec (United States)

**Ashit Talukder**, University of Southern California (United States)

**Rupert C. D. Young**, University of Sussex at Brighton (United Kingdom)

## *Session Chairs*

- 1 Pattern Recognition Invited Papers  
**David P. Casasent**, Carnegie Mellon University (United States)
- 2 Distortion Invariant Filters  
**Mohammad S. Alam**, University of South Alabama (United States)  
**Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)
- 3 New Tracking Techniques and Results  
**Ashit Talukder**, Jet Propulsion Laboratory (United States)  
**Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)
- 4 Novel Image Processing Techniques  
**Rupert C. D. Young**, University of Sussex (United Kingdom)  
**Mohammad S. Alam**, University of South Alabama (United States)

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