

# PROCEEDINGS OF SPIE

## ***Optical Pattern Recognition XXVI***

**David Casasent**  
**Mohammad S. Alam**  
*Editors*

**22–23 April 2015**  
**Baltimore, Maryland, United States**

*Sponsored and Published by*  
SPIE

**Volume 9477**

Proceedings of SPIE 0277-786X, V. 9477

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

Optical Pattern Recognition XXVI, edited by David Casasent, Mohammad S. Alam,  
Proc. of SPIE Vol. 9477, 947701 · © 2015 SPIE · CCC code: 0277-786X/15/\$18  
doi: 10.1117/12.2186690

Proc. of SPIE Vol. 9477 947701-1

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 *Optical Pattern Recognition XXVI*, edited by David Casasent, Mohammad S. Alam, Proceedings of SPIE Vol. 9477 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 0277-786X

ISBN: 9781628415933

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 © 2015, 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/15/\$18.00.

Printed in the United States of America.

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

**SPIE**   
**Digital Library**

[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. Papers are published as they are submitted and meet publication criteria. A unique 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.

# Contents

v *Authors*  
vii *Conference Committee*

<b>SESSION 1</b>	<b>INVITED SESSION</b>
9477 02	<b>Holographic 3D tracking of microscopic tools (Invited Paper) [9477-1]</b>
9477 03	<b>Efficient live face detection to counter spoof attack in face recognition systems (Invited Paper) [9477-2]</b>
<b>SESSION 2</b>	<b>DISTORTION INVARIANT FILTERS: TECHNIQUES AND APPLICATIONS</b>
9477 06	<b>Comparison of spatial domain optimal trade-off maximum average correlation height (OT-MACH) filter with scale invariant feature transform (SIFT) using images with poor contrast and large illumination gradient (Invited Paper) [9477-5]</b>
9477 07	<b>A robust fringe-adjusted joint transform correlator for efficient object detection [9477-6]</b>
9477 08	<b>Human detection in sensitive security areas through recognition of Omega shapes using MACH filters [9477-7]</b>
9477 0A	<b>Invariant correlation filters with peak stability parameter in problem of scaled objects recognition [9477-29]</b>
<b>SESSION 3</b>	<b>NOVEL DETECTION TECHNIQUES</b>
9477 0B	<b>Simulation of pattern and defect detection in periodic amplitude and phase structures using photorefractive four-wave mixing [9477-9]</b>
9477 0C	<b>Efficient thermal image segmentation through integration of nonlinear enhancement with unsupervised active contour model [9477-10]</b>
9477 0D	<b>An improved algorithm for pedestrian detection [9477-11]</b>
<b>SESSION 4</b>	<b>CLASSIFICATION AND RECOGNITION TECHNIQUES</b>
9477 0F	<b>Volume component analysis for classification of LiDAR data [9477-13]</b>
9477 0G	<b>Machine vision for airport runway identification [9477-14]</b>
9477 0H	<b>Road sign recognition using Viapix module and correlation [9477-15]</b>

9477 0I **Fourier transform-based method for pattern matching: affine invariance and beyond**  
[9477-16]

9477 0K **Pose estimation of non-cooperative targets without feature tracking** [9477-26]

9477 0L **Pose estimation of non-cooperative targets based on docking surface** [9477-27]

---

**SESSION 5 APPLICATIONS**

---

9477 0M **Numerical implementation of the multiple image optical compression and encryption technique** [9477-18]

9477 0O **Adaptive threshold and error-correction coding for robust data retrieval in optical media**  
[9477-21]

9477 0Q **Real-time holographic heterodyne spatial filtering** [9477-30]

---

**SESSION 6 NOVEL OPTICAL MEMORY SYSTEMS AND NEW SPATIAL LIGHT MODULATORS**

---

9477 0S **Holographic content addressable storage** [9477-23]

## Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Alam, Mohammad S., 03, 07  
Albalooshi, Fatema A., 0C  
Aldossari, M., 0M  
Alfalou, A., 0H, 0M  
Alkandri, A., 06  
Asari, Vijayan K., 07, 0C, 0F  
Bañas, Andrew, 02  
Banerjee, Partha, 0B  
Birch, P. M., 06  
Biswas, Bikram Kumar, 03  
Brosseau, C., 0M  
Cao, Shuqing, 0L  
Chao, Tien-Hsin, 0O, 0S  
Charalampidis, Dimitrios, 0I  
Chatwin, C. R., 06  
Costello, Colin, 0O  
Desthieux, M., 0H  
Dolph, Chester, 0G  
Du, Wenkai, 0L  
Duraisamy, Prakash, 0D  
Gardezi, A., 06  
Ginley-Hidinger, Matthew, 0O  
Glückstad, Jesper, 02  
Gundam, Madhuri, 0I  
Hassan, Ali, 08  
Ivanov, Petr A., 0A  
Karim, Mohammad, 0D  
Khoury, Jed, 0B, 0Q  
Krieger, Evan, 0C  
Liaquat, Muwahida, 08  
Liu, Jie, 0K  
Liu, Zongming, 0K, 0L  
Lu, Shan, 0K  
Lu, Thomas, 0O, 0S  
Moore, Andrew J., 0G  
Nehmetallah, Georges, 0B  
Ouerhani, Y., 0H, 0M  
Palima, Darwin, 02  
Qureshi, T., 06  
Rehman, Saad, 08  
Reyes, George, 0S  
Riaz, Farhan, 08  
Sang, Nong, 0K, 0L  
Schubert, Matthew, 0G  
Sidike, Paheding, 07, 0C  
Varney, Nina M., 0F  
Villangca, Mark, 02  
Woodell, Glenn, 0G  
Young, Rupert C. D., 06, 08  
Yousef, Amr, 0D  
Zhang, Yu, 0L

# Conference Committee

## *Symposium Chair*

**Nils R. Sandell Jr.**, Defense Advanced Research Projects Agency  
(United States)

## *Symposium Co-chair*

**David A. Logan**, BAE Systems (United States)

## *Conference Chairs*

**David Casasent**, Carnegie Mellon University (United States)  
**Mohammad S. Alam**, University of South Alabama (United States)

## *Conference Program Committee*

**Vijayan K. Asari**, University of Dayton (United States)  
**Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)  
**Katsushi Ikeuchi**, The University of Tokyo (Japan)  
**Bahram Javidi**, University of Connecticut (United States)  
**Jed Khoury**, Lardec Inc. (United States)  
**Wesam A. Sakla**, Air Force Research Laboratory (United States)  
**Yunlong Sheng**, Université Laval (Canada)  
**Robert C. Stirbl**, Jet Propulsion Laboratory (United States)  
**Ashit Talukder**, National Institute of Standards and Technology  
(United States)  
**B. V. K. Vijaya Kumar**, Carnegie Mellon University (United States)  
**Rupert C. Young**, University of Sussex (United Kingdom)

## *Session Chairs*

- 1 Invited Session  
**David Casasent**, Carnegie Mellon University (United States)
- 2 Distortion Invariant Filters: Techniques and Applications  
**Rupert C. Young**, University of Sussex (United Kingdom)
- 3 Novel Detection Techniques  
**Jed Khoury**, Lartec, Inc. (United States)
- 4 Classification and Recognition Techniques  
**Wesam A. Sakla**, Air Force Research Laboratory (United States)

- 5 Applications  
**Mohammad S. Alam**, University of South Alabama (United States)  
**Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)
- 6 Novel Optical Memory Systems and New Spatial Light Modulators  
**Tien-Hsin Chao**, Jet Propulsion Laboratory (United States)  
**Jed Khoury**, Lartec, Inc. (United States)