

PROCEEDINGS OF SPIE

# ***Automatic Target Recognition XXVI***

**Firooz A. Sadjadi**  
**Abhijit Mahalanobis**  
*Editors*

**18–19 April 2016**  
**Baltimore, Maryland, United States**

*Sponsored and Published by*  
SPIE

**Volume 9844**

Proceedings of SPIE 0277-786X, V. 9844

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

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Automatic Target Recognition XXVI*, edited by Firooz A. Sadjadi, Abhijit Mahalanobis, Proceedings of SPIE Vol. 9844 (SPIE, Bellingham, WA, 2016) Six-digit Article CID Number.

ISSN: 0277-786X  
ISSN: 1996-756X (electronic)  
ISBN: 9781510600850

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](http://SPIE.org)

Copyright © 2016, 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/16/\$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. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- 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.

# Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>

---

## SESSION 1    **ADVANCED ALGORITHMS I**

---

9844 02	<b>Restoration of randomly sampled blurred images</b> [9844-2]
9844 03	<b>A robust close-range photogrammetric target extraction algorithm for size and type variant targets</b> [9844-3]
9844 04	<b>A fast automatic target detection method for detecting ships in infrared scenes (Best Paper Award)</b> [9844-4]
9844 05	<b>Evaluation of pre-processing, thresholding and post-processing steps for very small target detection in infrared images</b> [9844-5]

---

## SESSION 2    **ADVANCED ALGORITHMS II**

---

9844 06	<b>Uniform smooth filtering approach for fast template matching</b> [9844-6]
9844 08	<b>Deep transfer learning for automatic target classification: MWIR to LWIR (Best Paper Award)</b> [9844-8]
9844 09	<b>Convolution neural networks for ship type recognition</b> [9844-9]

---

## SESSION 3    **ADVANCED ALGORITHMS III**

---

9844 0A	<b>An improved watershed segmentation algorithm with thermal markers for multispectral image analysis</b> [9844-10]
9844 0B	<b>Building occupant and asset localization and tracking using visible light communication</b> [9844-12]
9844 0C	<b>Automatic seagrass pattern identification on sonar images</b> [9844-13]
9844 0D	<b>Evaluation schemes for video and image anomaly detection algorithms (Best Paper Award)</b> [9844-14]

---

## SESSION 4    **ADVANCED ALGORITHMS IV**

---

9844 0F	<b>Learned filters for object detection in multi-object visual tracking</b> [9844-16]
---------	---

- 9844 OG **Efficient pedestrian detection from aerial vehicles with object proposals and deep convolutional neural networks** [9844-17]
- 9844 OH **Tracker-aided adaptive multi-frame recognition of a specific target** [9844-39]
- 9844 OI **Target representation and classification using random graphs** [9844-40]

---

**SESSION 5    ADVANCED SENSOR PROCESSING**

---

- 9844 OJ **Transformation of distributions into heavy tailed** [9844-18]
- 9844 OK **Pulse propagation in wavelet phase space** [9844-19]
- 9844 OL **Radar target identification using probabilistic classification vector machines** [9844-20]
- 9844 OM **Multi-class open set recognition for SAR imagery (Best Student Paper Award)** [9844-21]
- 9844 ON **Multispectral image analysis for object recognition and classification** [9844-22]
- 9844 OO **Hyperspectral anomaly detection using enhanced global factors** [9844-23]

---

**SESSION 6    ADVANCED METHODS I**

---

- 9844 OQ **Fast tracking based on local histogram of oriented gradient and dual detection** [9844-25]
- 9844 OR **Estimation of direction of arrival of a moving target using subspace based approaches** [9844-26]
- 9844 OS **Outlier and target detection in aerial hyperspectral imagery: a comparison of traditional and percentage occupancy hit or miss transform techniques** [9844-27]

---

**SESSION 7    ADVANCED METHODS II**

---

- 9844 OT **Moving human full body and body parts detection, tracking, and applications on human activity estimation, walking pattern and face recognition (Best Paper Award)** [9844-29]
- 9844 OU **Ontology-based improvement to human activity recognition** [9844-30]
- 9844 OV **Truncated feature representation for automatic target detection using transformed data-based decomposition** [9844-31]

---

**SESSION 8    ADVANCED DEVELOPMENT I**

---

- 9844 OW **Spatial tuning of a RF frequency selective surface through origami (Invited Paper)** [9844-32]

9844 0X **Infrared photodetector with wavelength extension beyond the spectral limit (Invited Paper)** [9844-33]

**SESSION 9    ADVANCED DEVELOPMENT II**

---

9844 0Y **Real life identification of partially occluded weapons in video frames (Invited Paper)** [9844-34]

9844 0Z **Image disparity in cross-spectral face recognition: mitigating camera and atmospheric effects (Invited Paper)** [9844-35]

9844 10 **A closed form solution to the one-ball geolocation problem (Invited Paper)** [9844-36]

9844 11 **A software module for implementing auditory and visual feedback on a video-based eye tracking system** [9844-37]

9844 12 **Content-based vessel image retrieval (Best Student Paper Award)** [9844-38]