PROCEEDINGS OF SPIE

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2014

Jerome J. Braun Chair

6–7 May 2014 Baltimore, Maryland, United States

Sponsored and Published by SPIE

Volume 9121

Proceedings of SPIE 0277-786X, V. 9121

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 Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2014, Proceedings of SPIE Vol. 9121 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 0277-786X ISBN: 9781628410587

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 © 2014, 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/14/\$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	INFORMATION FUSION APPROACHES AND ALGORITHMS I
9121 02	MTS in false positive reduction for multi-sensor fusion [9121-1] R. Woodley, M. Gosnell, E. Cudney, 21st Century Systems, Inc. (United States)
9121 03	Embedding the results of focussed Bayesian fusion into a global context [9121-2] J. Sander, M. Heizmann, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)
9121 04	New results in semi-supervised learning using adaptive classifier fusion [9121-3] R. Lynch, Analytic Information Fusion Systems, LLC (United States); P. Willett, Univ. of Connecticut (United States)
9121 05	Probabilistic multi-source multi-INT intel fusion benefit analysis [9121-4] D. Wisniewski, P. Hershey, Raytheon Co. (United States)
9121 06	Multisensor fusion with non-optimal decision rules: the challenges of open world sensing [9121-5] C. Minor, Nova Research, Inc. (United States); K. Johnson, U.S. Naval Research Lab. (United States)
SESSION 2	INFORMATION FUSION APPROACHES AND ALGORITHMS II
9121 07	Characterization of computer network events through simultaneous feature selection and clustering of intrusion alerts [9121-7] S. Chen, H. Leung, Univ. of Calgary (Canada); M. Dondo, Defence Research and Development Canada (Canada)
9121 08	Space-based detection of spoofing AIS signals using Doppler frequency [9121-8] S. Guo, Defence Research and Development Canada (Canada)
9121 09	A metamaterial-inspired combined inductive-capacitive sensor [9121-9] J. Long, Mitsubishi Electric Research Labs. (United States) and Univ. of California, San Diego (United States); B. Wang, Mitsubishi Electric Research Labs. (United States)

SESSION 3	INFORMATION FUSION APPROACHES AND ALGORITHMS III
9121 0A	Synchronous radiation sensing and 3D urban mapping for improved source identification [9121-10] G. Christie, L. Stiltner, K. Kochersberger, Virginia Polytechnic Institute and State Univ. (United States); M. McLean, Remote Sensing Lab. (United States); W. Czaja, Univ. of Maryland, College Park (United States)
9121 OB	On an efficient and effective Intelligent Transportation System (ITS) using field and simulation data [9121-11] N. Ekedebe, Z. Chen, G. Xu, C. Lu, W. Yu, Towson Univ. (United States)
9121 0C	LIDAR image recovery by incorporating heterogeneous imaging modalities [9121-12] A. Cloninger, W. Czaja, Univ. of Maryland, College Park (United States)
9121 0D	Detection of oil pollution along the pipeline routes in tropical ecosystem from multi- spectral data [9121-14] B. Adamu, K. Tansey, B. Ogutu, Univ. of Leicester (United Kingdom)
SESSION 4	IMAGE FUSION
9121 OF	Enhancing thermal video using a public database of images [9121-15] H. Qadir, S. P. Kozaitis, E. A. Ali, Florida Institute of Technology (United States)
9121 0G	Low-cost, high-performance and efficiency computational photometer design [9121-16] S. B. Siewert, Univ. of Alaska Anchorage (United States); J. Shihadeh, Univ. of Colorado at Boulder (United States); R. Myers, Mentor Graphics, Inc. (United States); J. Khandhar, Univ. of Colorado at Boulder (United States); V. Ivanov, Univ. of Alaska Anchorage (United States)
9121 OH	Forensic prescreening system using coded aperture snapshot spectral imager [9121-17] S. Lim, D. C. Berends, C. Cho, A. K. Das, M. Isnardi, S. Chai, SRI International (United States)
9121 01	True and false symmetries in the classification of optical scatterers [9121-18] G. F. Crosta, Univ. degli Studi di Milano-Bicocca (Italy); G. Videen, U.S. Army Research Lab. (United States)
9121 OJ	Hybrid fusion and demosaicing algorithm with near-infrared image [9121-19] X. Y. Luo, J. Zhang, BeiHang Univ. (China); Q. H. Dai, Tsinghua Univ. (China)
SESSION 5	INFORMATION FUSION AND ROBOTICS I
9121 OK	Improving object detection in 2D images using a 3D world model [9121-20] H. E. M. Viggh, P. L. Cho, N. L. Armstrong-Crews, M. Nam, D. C. Shah, G. E. Brown, MIT Lincoln Lab. (United States)

9121 OL Eliminating mutual views in fusion of ranging and RGB-D data from robot teams operating in confined areas [9121-21] D. M. Lyons, K. Shrestha, Fordham Univ. (United States) 9121 0M Building animats: neurobiomimetic approach for cognitive systems [9121-22] J. J. Braun, M. A. De Angelus, K. D. Fischl, A. R. Hess, D. C. Shah, MIT Lincoln Lab. (United States) **SESSION 6 INFORMATION FUSION AND ROBOTICS II** 9121 00 Integrated multi-sensor fusion for mapping and localization in outdoor environments for mobile robots [9121-24] T. Emter, J. Petereit, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) 9121 OP Control fusion for safe multi-robot coordination [9121-25] R. Bostelman, J. Marvel, National Institute of Standards and Technology (United States) **Author Index**

Conference Committee

Symposium Chair

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

Symposium Co-chair

Wolfgang Schade, Technische Universität Clausthal (Germany) and Fraunhofer Heinrich-Hertz-Institut (Germany)

Conference Chair

Jerome J. Braun, MIT Lincoln Laboratory (United States)

Conference Program Committee

Sheela V. Belur, The Van Dyke Technology Group, Inc. (United States)

David P. Benjamin, Pace University (United States)

Belur V. Dasarathy, Information Fusion Technologies (United States)

Michael Heizmann, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

Charles F. Hester, U.S. Army Research, Development and Engineering Command (United States)

Mieczyslaw M. Kokar, Northeastern University (United States)

Damian M. Lyons, Fordham University (United States)

Mirela Popa, Chemring Detection Systems, Inc. (United States)

Firooz A. Sadjadi, Lockheed Martin Maritime Systems & Sensors (United States)

Pierre Valin, Defence Research and Development Canada, Valcartier (Canada)

Pramod Kumar Varshney, Syracuse University (United States) **Shanchieh Jay Yang**, Rochester Institute of Technology

(United States)

Session Chairs

- Information Fusion Approaches and Algorithms I Jerome J. Braun, MIT Lincoln Laboratory (United States) Damian M. Lyons, Fordham University (United States)
- Information Fusion Approaches and Algorithms II Mirela Popa, Chemring Detection Systems, Inc. (United States) Charles F. Hester, U.S. Army Research, Development and Engineering Command (United States)

- Information Fusion Approaches and Algorithms III
 David P. Benjamin, Pace University (United States)
 Mirela Popa, Chemring Detection Systems, Inc. (United States)
- 4 Image Fusion Jerome J. Braun, MIT Lincoln Laboratory (United States) Michael J. DeWeert, BAE Systems (United States)
- Information Fusion and Robotics I
 Damian M. Lyons, Fordham University (United States)
 David P. Benjamin, Pace University (United States)
- 6 Information Fusion and Robotics II Damian M. Lyons, Fordham University (United States) Jerome J. Braun, MIT Lincoln Laboratory (United States)