

PROCEEDINGS OF SPIE

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013

Jerome J. Braun
Chair

30 April –1 May 2013
Baltimore, Maryland, United States

Sponsored and Published by
SPIE

Volume 8756

Proceedings of SPIE 0277-786X, V. 8756

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

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013,
Proc. of SPIE Vol. 8756, 875601 · © 2013 SPIE · CCC code: 0277-786X/13/\$18
doi: 10.1117/12.2032133

Proc. of SPIE Vol. 8756 875601-1

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 *Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013*, Proceedings of SPIE Vol. 8756 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819495471

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 © 2013, 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/13/\$18.00.

Printed in the United States of America.

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



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 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

- 8756 03 **Affordable non-traditional source data mining for context assessment to improve distributed fusion system robustness** [8756-3]
C. Bowman, G. Haith, Data Fusion & Neural Networks, LLC (United States); A. Steinberg, Georgia Tech Research Institute (United States); C. Morefield, M. Morefield, Arctan Group LLC (United States)
- 8756 04 **Considerations for multiple hypothesis correlation on tactical platforms** [8756-4]
A. M. Thomas, J. E. Turpen, Georgia Tech Research Institute (United States)
- 8756 05 **Scalable sensor management for automated fusion and tactical reconnaissance** [8756-2]
T. J. Walls, M. L. Wilson, U.S. Naval Research Lab. (United States); D. C. Partridge, J. R. Haws, M. D. Jensen, T. R. Johnson, B. D. Petersen, S. W. Sullivan, Space Dynamics Lab. (United States)

SESSION 2 INFORMATION FUSION APPROACHES AND ALGORITHMS II

- 8756 06 **Efficiently applying uncertain implication rules to the transferable belief model** [8756-5]
W. J. Farrell, A. M. Knapp, Lakota Technical Solutions, Inc. (United States)
- 8756 07 **A methodology for hard/soft information fusion in the condition monitoring of aircraft** [8756-6]
J. T. Bernardo, The Pennsylvania State Univ. (United States)
- 8756 08 **Using classifier fusion to improve the performance of multiclass classification problems** [8756-7]
R. Lynch, Consultant (United States); P. Willett, Univ. of Connecticut (United States)

SESSION 3 INFORMATION FUSION APPROACHES AND ALGORITHMS III

- 8756 09 **Generalized information fusion and visualization using spatial voting and data modeling** [8756-10]
H. M. Jaenisch, Licht Strahl Engineering, Inc. (United States) and Johns Hopkins Univ. (United States); J. W. Handley, Licht Strahl Engineering, Inc. (United States)
- 8756 0A **Real-time tracking and fast retrieval of persons in multiple surveillance cameras of a shopping mall** [8756-11]
H. Bouma, J. Baan, S. Landsmeer, C. Kruszynski, G. van Antwerpen, J. Dijk, TNO (Netherlands)

- 8756 OB **Spatial voting for automatic feature selection, fusion, and visualization** [8756-12]
H. Jaenisch, Licht Strahl Engineering, Inc. (United States), Johns Hopkins Univ. (United States), and Alabama A&M Univ. (United States); J. Handley, Licht Strahl Engineering, Inc. (United States)

SESSION 4 IMAGE FUSION

- 8756 OF **Fusion of data from multiple sensors with model-based data analysis** [8756-15]
J. Straub, Univ. of North Dakota (United States)
- 8756 OG **Performance analysis of image fusion methods in transform domain** [8756-16]
Y. Choi, E. Sharifahmadian, S. Latifi, Univ. of Nevada, Las Vegas (United States)
- 8756 OH **An approach to DSM refinement with fusion of airborne lidar point cloud data and optical imagery** [8756-17]
X. Hao, W. Zhang, L. Jiang, Zhengzhou Institute of Surveying and Mapping (China)

SESSION 5 INFORMATION FUSION AND ROBOTICS I

- 8756 OI **A cognitive approach to vision for a mobile robot** [8756-18]
D. P. Benjamin, C. Funk, Pace Univ. (United States); D. Lyons, Fordham Univ. (United States)
- 8756 OJ **Persistent unmanned airborne network support for cooperative sensors** [8756-19]
A. Verma, R. Fernandes, Knowledge Based Systems, Inc. (United States)
- 8756 OK **Fusion of ranging data from robot teams operating in confined areas** [8756-20]
D. M. Lyons, K. Shrestha, T.-M. Liu, Fordham Univ. (United States)
- 8756 OL **Combining metric episodes with semantic event concepts within the Symbolic and Sub-Symbolic Robotics Intelligence Control System (SS-RICS)** [8756-21]
T. D. Kelley, U.S. Army Research Lab. (United States); S. M. McGhee, STG International (United States)

SESSION 6 INFORMATION FUSION AND ROBOTICS II

- 8756 OM **Primate-inspired vehicle navigation using optic flow and mental rotations** [8756-22]
R. C. Arkin, F. Dellaert, N. Srinivasan, R. Kerwin, Georgia Institute of Technology (United States)
- 8756 ON **Multi-brain fusion and applications to intelligence analysis** [8756-23]
A. Stoica, Jet Propulsion Lab. (United States); A. Matran-Fernandez, D. Andreou, R. Poli, C. Cinel, Univ. of Essex (United Kingdom); Y. Iwashita, C. Padgett, Jet Propulsion Lab. (United States)

8756 0O **Spatial cognition: robot target localization in open arenas based on rat studies** [8756-24]
G. Tejera, Univ. de la República Uruguay (Uruguay); A. Barrera, Instituto Tecnológico
Autónomo De México (Mexico); J.-M. Fellous, Univ. of Arizona (United States); M. Llofriu,
Univ. de la República Uruguay (Uruguay) and Univ. of South Florida (United States);
A. Weitzenfeld, Univ. of South Florida (United States)

8756 0P **Development of standard test methods for unmanned and manned industrial vehicles used
near humans** [8756-25]
R. Bostelman, R. Norcross, J. Falco, J. Marvel, National Institute of Standards and
Technology (United States)

SESSION 7 INFORMATION FUSION SYSTEMS AND EVALUATION MEASURES

8756 0R **Measuring knowledge: investigative research into the quantification of performance within
a contextual multi-source PED fusion process** [8756-27]
L. A. Scarff, UTC Aerospace Systems (United States); D. Burke, E. Jones, Aptima, Inc. (United
States); L. Gilfillan, Rhumblin Consultants (United States); S. Pratt, C. Jackson, S. Weil,
Aptima, Inc. (United States); S. Fiore, Univ. of Central Florida (United States)

8756 0S **Enhancing situational awareness by means of visualization and information integration of
sensor networks** [8756-28]
J. Timonen, J. Vankka, Finnish National Defence Univ. (Finland)

Author Index

Conference Committee

Symposium Chair

Kenneth R. Israel, Major General (USAF Retired) (United States)

Symposium Cochair

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

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

- 1 Information Fusion Approaches and Algorithms I
Jerome J. Braun, MIT Lincoln Laboratory (United States)
Damian M. Lyons, Fordham University (United States)
- 2 Information Fusion Approaches and Algorithms II
Mirela Popa, Chemring Detection Systems, Inc. (United States)
David P. Benjamin, Pace University (United States)

- 3 Information Fusion Approaches and Algorithms III
David P. Benjamin, Pace University (United States)
 - 4 Image Fusion
Mirela Popa, Chemring Detection Systems, Inc. (United States)
 - 5 Information Fusion and Robotics I
Damian M. Lyons, Fordham University (United States)
Jerome J. Braun, MIT Lincoln Laboratory (United States)
 - 6 Information Fusion and Robotics II
Damian M. Lyons, Fordham University (United States)
David P. Benjamin, Pace University (United States)
 - 7 Information Fusion Systems and Evaluation Measures
Damian M. Lyons, Fordham University (United States)
- Panel Discussion: Information Fusion and Robotics II:
Jerome J. Braun, (*Moderator*) MIT Lincoln Laboratory (United States)