PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 8747

, "Front Matter: Volume 8747," Proc. SPIE 8747, Geospatial InfoFusion III, 874701 (14 June 2013); doi: 10.1117/12.2032424

SPIE.

Event: SPIE Defense, Security, and Sensing, 2013, Baltimore, Maryland, United States

PROCEEDINGS OF SPIE

Geospatial InfoFusion III

**Matthew F. Pellechia
Richard J. Sorensen
Kannappan Palaniappan**
Editors

**2–3 May 2013
Baltimore, Maryland, United States**

Sponsored and Published by
SPIE

Volume 8747

Proceedings of SPIE 0277-786X, V. 8747

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

Geospatial InfoFusion III, edited by Matthew F. Pellechia, Richard J. Sorensen,
Kannappan Palaniappan, Proc. of SPIE Vol. 8747, 874701 · © 2013 SPIE
CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2032424

Proc. of SPIE Vol. 8747 874701-1

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 *Geospatial InfoFusion III*, edited by Matthew F. Pellechia, Richard J. Sorensen, Kannappan Palaniappan, Proceedings of SPIE Vol. 8747 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819495389

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
ix	Introduction

SESSION 1 GEO-REGISTRATION AND UNCERTAINTY HANDLING IN GEOSPATIAL DATA

- 8747 02 **The full multi-state vector error covariance matrix: why needed and its practical representation** [8747-1]
J. T. Dolloff, National Geospatial-Intelligence Agency (United States)
- 8747 03 **Evaluating conflation methods using uncertainty modeling** [8747-2]
P. Doucette, J. Dolloff, R. Canavosio-Zuzelski, M. Lenihan, D. Motsko, National Geospatial-Intelligence Agency (United States)
- 8747 05 **Uncertainty quantification techniques for population density estimates derived from sparse open source data** [8747-4]
R. Stewart, D. White, Oak Ridge National Lab. (United States) and The Univ. of Tennessee (United States); M. Urban, A. Morton, C. Webster, M. Stoyanov, E. Bright, Oak Ridge National Lab. (United States); B. L. Bhaduri, Oak Ridge National Lab. (United States) and The Univ. of Tennessee (United States)
- 8747 06 **Geoaccurate three-dimensional reconstruction via image-based geometry** [8747-5]
D. J. Walvoord, A. J. Rossi, B. D. Paul, B. Brower, M. F. Pellechia, Exelis Inc. (United States)
- 8747 07 **Guidance in feature extraction to resolve uncertainty** [8747-6]
B. Kovalerchuk, Central Washington Univ. (United States) and BKF Systems (United States); M. Kovalerchuk, BKF Systems (United States); S. Streltsov, LongShort Way Inc. (United States); M. Best, U.S. Air Force (United States)
- 8747 08 **A fast, accurate, cross-modality image geo-registration and target/object detection algorithm** [8747-7]
T. McKay, CACI International, Inc. (United States); H. Hirsch, Hirsch Engineering and Communications, Inc. (United States)
- 8747 09 **Improved evaluation of geo-registration algorithms for airborne EO/IR imagery** [8747-8]
C. N. Taylor, Air Force Research Lab. (United States)

SESSION 2 GEOSPATIAL INFORMATION APPLICATION NEEDS AND CHALLENGES

- 8747 0A **Geodata fusion study by the Open Geospatial Consortium** [8747-9]
G. Percivall, Open Geospatial Consortium (United States)

- 8747 0B **Overview of contextual tracking approaches in information fusion** [8747-10]
E. Blasch, Air Force Research Lab. (United States); J. Garcia Herrero, Univ. Carlos III de Madrid (Spain); L. Snidaro, Univ. of Udine (Italy); J. Llinas, Univ. at Buffalo (United States); G. Seetharaman, Air Force Research Lab. (United States); K. Palaniappan, Univ. of Missouri-Columbia (United States)
- 8747 0C **Geometric exploration of virtual planes in a fusion-based 3D data registration framework** [8747-11]
H. Aliakbarpour, Univ. of Coimbra (Portugal) and Univ. of Missouri-Columbia (United States); K. Palaniappan, Univ. of Missouri-Columbia (United States); J. Dias, Univ. of Coimbra (Portugal) and Khalifa Univ. (United Arab Emirates)

SESSION 3 GEOSPATIAL DATA PROCESSING EXPLOITATION AND VISUALIZATION

- 8747 0D **Application of feature descriptors to low-pixel-count persistent surveillance tracking systems** [8747-12]
J. Edelberg, C. Miller, M. Wilson, Naval Research Lab. (United States)
- 8747 0F **A position-independent image complexity selector (PICSEL) for enhanced visualization and intuitive object detection in images** [8747-14]
T. McKay, CACI International, Inc. (United States); H. Hirsch, Hirsch Engineering and Communications, Inc. (United States)
- 8747 0G **Feature selection for appearance-based vehicle tracking in geospatial video** [8747-16]
M. Poostchi, F. Bunyak, K. Palaniappan, Univ. of Missouri-Columbia (United States); G. Seetharaman, Air Force Research Lab. (United States)
- 8747 0I **Vehicle detection and orientation estimation using the radon transform** [8747-18]
R. Pelapur, F. Bunyak, K. Palaniappan, Univ. of Missouri-Columbia (United States); G. Seetharaman, Air Force Research Lab. (United States)

SESSION 4 GEOSPATIAL PROCESSING EXPLOITATION AND VISUALIZATION

- 8747 0J **Evaluating fusion techniques for multisensor satellite image data** [8747-19]
B. W. Martin, The Univ. of Tennessee Knoxville (United States); R. R. Vatsavai, Oak Ridge National Lab. (United States)
- 8747 0K **Usage of data-encoded web maps with client side color rendering for combined data access, visualization, and modeling purposes** [8747-20]
D. Plutau, N. S. Prasad, NASA Langley Research Ctr. (United States)
- 8747 0L **Correlation of partial frames in video matching** [8747-21]
B. Kovalerchuk, Central Washington Univ. (United States) and BKF Systems (United States); M. Kovalerchuk, BKF Systems (United States)
- 8747 0M **Subdimensional geo-localization from finite set statistics** [8747-22]
F. Boyle, L-3 Communications Integrated Systems (United States)

- 8747 ON **KOLAM: a cross-platform architecture for scalable visualization and tracking in wide-area imagery** [8747-23]
J. Fraser, A. Haridas, Univ. of Missouri-Columbia (United States); G. Seetharaman, Air Force Research Lab. (United States); R. M. Rao, U.S. Army Research Lab. (United States); K. Palaniappan, Univ. of Missouri-Columbia (United States)
- 8747 OO **A Semi-Automated Building Outline Tool (SABOT)** [8747-24]
S. Simmons, M. Thompson, D. Lamb, T. McKay, CACI International, Inc. (United States); H. Hirsch, Hirsch Engineering and Communications, Inc. (United States)
- 8747 OP **Mining patterns in persistent surveillance systems with smart query and visual analytics** [8747-26]
M. S. Habibi, A. Shirkhodaie, Tennessee State Univ. (United States)

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 Chairs

Matthew F. Pellechia, ITT Exelis (United States)

Richard J. Sorensen, U.S. Air Force (United States)

Kannappan Palaniappan, University of Missouri-Columbia (United States)

Conference Cochairs

Shiloh L. Dockstader, ITT Exelis (United States)

Xuan Liu, IBM Thomas J. Watson Research Center (United States)

Peter Doucette, National Geospatial-Intelligence Agency (United States)

Paul B. Deignan, L-3 Communications Integrated Systems (United States)

Conference Program Committee

Selim Aksoy, Bilkent University (Turkey)

Erik P. Blasch, Air Force Research Laboratory (Canada)

Bernard V. Brower, ITT Exelis (United States)

Filiz Bunyak, University of Missouri-Columbia (United States)

Rama Chellappa, University of Maryland, College Park (United States)

Hui Cheng, SRI International Sarnoff (United States)

Brian J. Daniel, U.S. Naval Research Laboratory (United States)

Larry S. Davis, University of Maryland, College Park (United States)

Emmanuel Duflos, École Centrale de Lille (France)

Dan L. Edwards, National Geospatial-Intelligence Agency (United States)

Paul Fieguth, University of Waterloo (Canada)

Robert D. Fiete, ITT Exelis (United States)

Michael E. Gangl, MacAulay-Brown, Inc. (United States)

Robert J. Gillen, University of Dayton Research Institute (United States)

Adel Hafiane, Ecole Nationale Supérieure d'Ingénieurs (France)

Anthony J. Hoogs, Kitware, Inc. (United States)

Yan Huang, University of North Texas (United States)

Holger E. Jones, Lawrence Livermore National Laboratory (United States)

Simon J. Julier, University College London (United Kingdom)

Frederick W. Koehler IV, National Geospatial-Intelligence Agency (United States)

Boris Kovalerchuk, Central Washington University (United States)

Mohamed F. Mokbel, University of Minnesota, Twin Cities (United States)
Dennis Motsko, National Geospatial-Intelligence Agency (United States)
Raghuveer M. Rao, U.S. Army Research Laboratory (United States)
John A. Richards, Sandia National Laboratories (United States)
Carlo Regazzoni, Università degli Studi di Genova (Italy)
Larry A. Scarff, UTC Aerospace Systems (United States)
Gunasekaran Seetharaman, Air Force Research Laboratory (United States)
Philippe M. Vanheeghe, École Centrale de Lille (France)
Pramod Kumar Varshney, Syracuse University (United States)
Darrell L. Young, Raytheon Intelligence & Information Systems (United States)
Ranga R. Vatsavai, Oak Ridge National Laboratory (United States)
Karmon M. Vongsy, Air Force Research Laboratory (United States)
Lexing Xie, The Australian National University (Australia)
Chengyang Zhang, Terradata Corporation (United States)

Session Chairs

- 1 Geo-registration and Uncertainty Handling in Geospatial Data
Peter Doucette, National Geospatial-Intelligence Agency (United States)
 - 2 Geospatial Information Application Needs and Challenges
Paul B. Deignan, L-3 Communications Integrated Systems (United States)
 - 3 Geospatial Data Processing Exploitation and Visualization
Paul B. Deignan, L-3 Communications Integrated Systems (United States)
 - 4 Geospatial Processing Exploitation and Visualization
Kannappan Palaniappan, Univ. of Missouri-Columbia (United States)
- Panel on Synergistic Data Fusion through Multi-Sensing Enablement
Shiloh L. Dockstader, ITT Exelis (United States)

Introduction

A Geospatial Information System (GIS) describes any information system that collects, integrates, stores, edits, analyzes, shares, and displays geographic information. GIS systems are fundamental to today's information networks and inherently encompass techniques that transform "raw bits and bytes" into "actionable information", also termed InfoFusion. GIS applications incorporate tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data, maps, and present the results of all these operations. In the commercial sector, GIS systems are used in cartography, remote sensing, land surveying, utility management, geographical strategic natural resource planning, photogrammetric science, geography, urban planning, emergency management, navigation, and localized search engines. For example, defense and security applications, such as Unmanned Ariel Systems and Airport Security Systems, are rapidly transforming from basic sensor collection systems that "take pictures" to fully-capable GIS systems that incorporate multi-sensor collections, perform advanced processing and correlations in real-time, initiate sensor cross-cueing, and allow multiple users to instantly retrieve and disseminate information. GIS is critical to defense and security providers in order to enable satisfying emerging demands and rapid access to information for situational awareness and forensic back -tracking missions.

These proceedings provide the SPIE community with a collection of perspectives, advancements, learning, and new solutions from a range of global industry, government and academic authors. The motivation of this conference track is simple: to expand the awareness of advanced architectures and enabling technologies that address emerging and adaptive security threats. Technical and scientific papers related to advancements in Architectures for GIS Collection Sensors, Data Processing Algorithms and Techniques, Information Dissemination, Serving, Search, and Query Methodologies, and Information Visualization Solutions that push beyond the scope of the state-of-the-art in industry are solicited.

On behalf of the Conference Chairs, Dr. Kannappan Palaniappan, Mr. Matthew Pellechia, and Mr. Richard Sorensen, and our cochairs, we hope you find these proceedings useful in the advancement of GIS technologies.

Matthew F. Pellechia
Richard J. Sorensen
Kannappan Palaniappan