

PROCEEDINGS OF SPIE

Next-Generation Analyst

Barbara D. Broome
David L. Hall
James Llinas
Editors

29–30 April 2013
Baltimore, Maryland, United States

Sponsored and Published by
SPIE

Volume 8758

Proceedings of SPIE 0277-786X, V. 8758

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

Next-Generation Analyst, edited by Barbara D. Broome, David L. Hall, James Llinas,
Proc. of SPIE Vol. 8758, 875801 · © 2013 SPIE · CCC code: 0277-786X/13/\$18
doi: 10.1117/12.2032139

Proc. of SPIE Vol. 8758 875801-1

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 *Next-Generation Analyst*, edited by Barbara D. Broome, David L. Hall, James Llinas, Proceedings of SPIE Vol. 8758 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819495495

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

BIG DATA

8758 04	Adaptive context exploitation [8758-9] A. N. Steinberg, Georgia Tech Research Institute (United States); C. L. Bowman, Data Fusion & Neural Networks, LLC (United States)
8758 05	Concept of operations for knowledge discovery from Big Data across enterprise data warehouses [8758-10] S. R. Sukumar, M. M. Olama, A. W. McNair, J. J. Nutaro, Oak Ridge National Lab. (United States)
8758 06	GOOSE: semantic search on internet connected sensors [8758-11] K. Schutte, F. Bomhof, G. Burghouts, J. van Diggelen, P. Hiemstra, J. van 't Hof, W. Kraaij, H. Pasman, A. Smith, C. Versloot, J. de Wit, TNO (Netherlands)

SOFT DATA PROCESSING, VALUE, AND TRUST

8758 08	Controlled English to facilitate human/machine analytical processing [8758-13] D. Braines, D. Mott, S. Laws, IBM Hursley Lab. (United Kingdom); G. de Mel, IBM Thomas J. Watson Research Ctr. (United States) and U.S. Army Research Lab. (United States); T. Pham, U.S. Army Research Lab. (United States)
8758 09	MIPS: a service-based aid for intelligence analysis [8758-14] D. Braines, J. B. Ibbotson, G. White, IBM Hursley Lab. (United Kingdom)
8758 0A	A decision support system for fusion of hard and soft sensor information based on probabilistic latent semantic analysis technique [8758-24] A. Shirkhodaie, V. Elangovan, A. Alkilani, M. Habibi, Tennessee State Univ. (United States)
8758 0B	Reusing information for high-level fusion: characterizing bias and uncertainty in human-generated intelligence [8758-16] D. Burke, A. Carlin, P. Picciano, G. Levchuk, B. Riordan, Aptima, Inc. (United States)

- 8758 0C **Reasoning with uncertain information and trust** [8758-17]
M. Sensoy, Ozyegin Univ. (Turkey) and Univ. of Aberdeen (United Kingdom); G. de Mel, IBM Thomas J. Watson Research Ctr. (United States) and U.S. Army Research Lab. (United States); A. Fokoue, IBM Thomas J. Watson Research Ctr. (United States); T. J. Norman, J. Z. Pan, Univ. of Aberdeen (United Kingdom); Y. Tang, Carnegie Mellon Univ. (United States); N. Oren, Univ. of Aberdeen (United Kingdom); K. Sycara, Carnegie Mellon Univ. (United States); L. Kaplan, T. Pham, U.S. Army Research Lab. (United States)

ANALYST TOOLS AND INTERFACES

- 8758 0D **Crowded: a crowd-sourced perspective of events as they happen** [8758-1]
R. Brantingham, A. Hossain, Defence Science and Technology Lab. (United Kingdom)
- 8758 0E **Supporting tactical intelligence using collaborative environments and social networking** [8758-2]
A. B. Wollocko, M. P. Farry, R. F. Stark, Charles River Analytics, Inc. (United States)
- 8758 0F **Using the living laboratory framework as a basis for understanding next-generation analyst work** [8758-3]
M. D. McNeese, V. Mancuso, N. McNeese, T. Endsley, P. Forster, The Pennsylvania State Univ. (United States)
- 8758 0G **Exploring client logs towards characterizing the user behavior on web applications** [8758-4]
L. Guarino de Vasconcelos, R. D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil); L. A. Baldochi Jr., Univ. Federal de Itajubá (Brazil)
- 8758 0H **Exploring the dynamics of collective cognition using a computational model of cognitive dissonance** [8758-5]
P. R. Smart, Univ. of Southampton (United Kingdom); K. Sycara, Carnegie Mellon Univ. (United States); D. P. Richardson, Univ. of Southampton (United Kingdom)
- 8758 0I **CE-SAM: a conversational interface for ISR mission support** [8758-6]
D. Pizzocaro, C. Parizas, A. Preece, Cardiff Univ. (United Kingdom); D. Braines, D. Mott, IBM Hursley Lab. (United Kingdom); J. Z. Bakdash, U.S. Army Research Lab. (United States)

POSTER SESSION

- 8758 0J **Characterization of gain-aware routing in delay tolerant networks** [8758-23]
F. Hajiaghajani, Y. Piolet Thulasidharan, M. Taghizadeh, S. Biswas, Michigan State Univ. (United States)
- 8758 0K **Beyond visualization of big data: a multi-stage data exploration approach using visualization, sonification, and storification** [8758-22]
J. Rimland, M. Ballora, W. Shumaker, The Pennsylvania State Univ. (United States)
- 8758 0L **Visualization and characterization of users in a citizen science project** [8758-21]
A. M. M. Morais, Instituto Nacional de Pesquisas Espaciais (Brazil); J. Raddick, Johns Hopkins Univ. (United States); R. D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil)

- 8758 OM **Representation of potential information gain to measure the price of anarchy on ISR activities** [8758-20]
H. J. Ortiz-Peña, CUBRC, Inc. (United States); M. Hirsch, Raytheon, Co. (United States);
M. Karwan, R. Nagi, Univ. at Buffalo (SUNY) (United States); M. Sudit, CUBRC, Inc. (United States)
- 8758 ON **Conserving analyst attention units: use of multi-agent software and CEP methods to assist information analysis** [8758-19]
J. Rimland, M. McNeese, D. Hall, The Pennsylvania State Univ. (United States)
- 8758 OO **Participatory telerobotics** [8758-18]
A. D. Wissner-Gross, Harvard Univ. (United States), Massachusetts Institute of Technology (United States), and Gemedi, Inc. (United States); T. M. Sullivan, Gemedi, Inc. (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

Barbara D. Broome, U.S. Army Research Laboratory (United States)

David L. Hall, The Pennsylvania State University (United States)

James Llinas, University at Buffalo (United States)

Conference Program Committee

Nina M. Berry, Sandia National Laboratories, California (United States)

John S. Eicke, U.S. Army Research Laboratory (United States)

James Fink, U. S. Army Intelligence Center of Excellence
(United States)

Timothy P. Hanratty, U.S. Army Research Laboratory (United States)

James Hendler, Rensselaer Polytechnic Institute (United States)

John E. Lavery, U.S. Army Research Laboratory (United States)

Bob Madahar, Defence Science and Technology Laboratory
(United Kingdom)

Paul Sajda, Columbia University (United States)

Alan Steinberg, Georgia Tech Research Institute (United States)

Edward L. Waltz, BAE Systems (United States)

Session Chairs

- 1 Data-to-Decisions: Joint Session with Conferences 8742 and 8758

David L. Hall, The Pennsylvania State University (United States)

James Llinas, University at Buffalo (United States)

Tien Pham, Consultant (United States)

- 2 Big Data

James Llinas, University at Buffalo (United States)

- 3 Soft Data Processing, Value, and Trust
David L. Hall, The Pennsylvania State University (United States)
- 4 Analyst Tools and Interfaces
Michael D. McNeese, The Pennsylvania State University
(United States)

Introduction

A new generation of intelligence analysts and intelligence information users is emerging. These *next-generation* analysts and users are thoroughly familiar with Open Source information, participate in social networks and “hive mind” collaboration, and generally utilize all of the emerging capabilities of hand-held computer/sensor systems (a k a “smartphones”). The new environment includes ubiquitous sensing and human reporting (participatory sensing), access to Cloud computing for advanced modeling, and dynamic collaboration via social networks and virtual world technologies.

This conference brought together researchers and practitioners to discuss these emerging changes including; perspectives on the evolution of tools and technology for accessing and processing data, collaboration methods, implications for new analysis methods, opportunities, threats (e.g., “the commoditization of Information, Surveillance and Reconnaissance (ISR)”), and implications for operations. Specific DOD and industry applications were of particular interest.

This proceedings volume provides the SPIE community with new perspectives on this emerging field. Papers contained here span the range from general overviews of advances in data visualization, decision support, mathematical techniques, and examples of test beds and prototype systems. A wide range of organizations are represented in this collection including universities, small and large companies, government organizations, and research laboratories.

Because of the high interest in these papers it is anticipated that this represents the inauguration of several years of focus on this topic area. We are grateful to the efforts of our distinguished invited speakers, authors, and associates in the program committee.

Barbara Broome
David L. Hall
James Llinas