PROCEEDINGS OF SPIE

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX

Sylvia S. Shen Paul E. Lewis Editors

29 April–2 May 2013
Baltimore, Maryland, United States

Sponsored and Published by SPIE

Volume 8743

Proceedings of SPIE 0277-786X, V. 8743

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

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX, edited by Sylvia S. Shen, Paul E. Lewis, Proc. of SPIE Vol. 8743, 874301 ⋅ © 2013 SPIE CCC code: 0277-786X/13/\$18 ⋅ doi: 10.1117/12.2031940

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 Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX, edited by Sylvia S. Shen, Paul E. Lewis, Proceedings of SPIE Vol. 8743 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X ISBN: 9780819495341

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.



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

xi Conference Committee

SESSION 1	DETECTION, IDENTIFICATION, AND QUANTIFICATION I
8743 02	The remarkable success of adaptive cosine estimator in hyperspectral target detection (Invited Paper) [8743-1] D. Manolakis, M. Pieper, E. Truslow, MIT Lincoln Lab. (United States); T. Cooley, M. Brueggeman, S. Lipson, Air Force Research Lab. (United States)
8743 03	A hyperspectral anomaly detector based on partitioning pixel into adjacent components [8743-3] E. Lo, Susquehanna Univ. (United States)
8743 04	False alarm mitigation techniques for hyperspectral target detection [8743-4] M. L. Pieper, D. Manolakis, E. Truslow, MIT Lincoln Lab. (United States); T. Cooley, M. Brueggeman, Air Force Research Lab. (United States)
8743 05	Image change detection via ensemble learning [8743-5] B. W. Martin, The Univ. of Tennessee, Knoxville (United States); R. R. Vatsavai, Oak Ridge National Lab. (United States)
8743 06	LWIR hyperspectral change detection for target acquisition and situation awareness in urban areas [8743-14] R. J. Dekker, P. B. W. Schwering, K. W. Benoist, TNO Defence, Security and Safety (Netherlands); S. Pignatti, F. Santini, CNR, Istituto di Metodologie per l'Analisi Ambientale (Italy); O. Friman, FOI, Swedish Defence Research Agency (Sweden)
SESSION 2	SPECTRAL METHODOLOGIES AND APPLICATIONS I
8743 OA	Hyperspectral imaging of the crime scene for detection and identification of blood stains [8743-85] G. J. Edelman, T. G. van Leeuwen, M. C. G. Aalders, Academisch Medisch Ctr. (Netherlands)
SESSION 3	SPECTRAL METHODOLOGIES AND APPLICATIONS II
8743 OB	Undercomplete learned dictionaries for land cover classification in multispectral imagery of Arctic landscapes using CoSA: clustering of sparse approximations [8743-11] D. I. Moody, S. P. Brumby, J. C. Rowland, C. Gangodagamage, Los Alamos National Lab. (United States)

8743 OC	Security inspection in ports by anomaly detection using hyperspectral imaging technolog [8743-12] J. Rivera, F. Valverde, M. Saldaña, V. Manian, Univ. de Puerto Rico Mayagüez (United States)
8743 0D	Extending continuum fusion to create unbeatable detectors [8743-2] A. Schaum, U.S. Naval Research Lab. (United States)
8743 OE	A multistage framework for dismount spectral verification in the VNIR [8743-13] D. Rosario, U.S. Army Research Lab. (United States)
SESSION 4	SPECTRAL DATA COLLECTIONS AND EXPERIMENTS
8743 OF	The SHARE 2012 data campaign [8743-15] A. Giannandrea, N. Raqueno, D. W. Messinger, J. Faulring, J. P. Kerekes, J. van Aardt, K. Canham, S. Hagstrom, E. Ontiveros, A. Gerace, Rochester Institute of Technology (Unite States); J. Kaufman, K. M. Vongsy, Air Force Research Lab. (United States); H. Griffith, UTC Aerospace Systems (United States); B. D. Bartlett, The MITRE Corp. (United States); E. Ientilucci, Rochester Institute of Technology (United States); J. Meola, Air Force Research Lab. (United States); L. Scarff, UTC Aerospace Systems (United States); B. Daniel, U.S. Naval Research Lab. (United States)
8743 OG	SHARE 2012: large edge targets for hyperspectral imaging applications [8743-16] K. Canham, D. Goldberg, J. Kerekes, N. Raqueno, D. Messinger, Rochester Institute of Technology (United States)
8743 OH	SHARE 2012: subpixel detection and unmixing experiments [8743-17] J. P. Kerekes, K. Ludgate, A. Giannandrea, N. G. Raqueno, D. S. Goldberg, Rochester Institute of Technology (United States)
8743 01	SHARE 2012: analysis of illumination differences on targets in hyperspectral imagery [8743-18] E. J. Ientilucci, Rochester Institute of Technology (United States)
SESSION 5	SPECTRAL DATA ANALYSIS METHODOLOGIES I
8743 OJ	Detection and tracking of gas plumes in LWIR hyperspectral video sequence data [8743-19] T. Gerhart, J. Sunu, California State Univ., Long Beach (United States); L. Lieu, Harvey Mudo College (United States); E. Merkurjev, Univ. of California, Los Angeles (United States); JM. Chang, California State Univ., Long Beach (United States); J. Gilles, A. L. Bertozzi, Univ of California, Los Angeles (United States)
8743 OK	Geometrical interpretation of the adaptive coherence estimator for hyperspectral target detection [8743-20]

8743 OL	A novel automated object identification approach using key spectral components [8743-21] B. Kahler, T. Noble, SAIC (United States)
8743 OM	Target detection using the background model from the topological anomaly detection algorithm [8743-22] L. P. Dorado Munoz, D. W. Messinger, A. K. Ziemann, Rochester Institute of Technology (United States)
8743 ON	Low-rank decomposition-based anomaly detection [8743-23] SY. Chen, S. Yang, K. Kalpakis, CI Chang, Univ. of Maryland, Baltimore County (United States)
8743 00	Improved target recognition with live atmospheric correction [8743-24] C. Archer, J. Morgenstern, Vision4ce LLC (United States)
SESSION 6	MULTISENSOR DATA FUSION
8743 OP	Multimodal detection of man-made objects in simulated aerial images [8743-25] M. S. Baran, R. L. Tutwiler, D. J. Natale, The Pennsylvania State Univ. (United States); M. S. Bassett, M. P. Harner, The SI Organization, Inc. (United States)
8743 OQ	A method to generate sub-pixel classification maps for use in DIRSIG three-dimensional models [8743-26] R. N. Givens, K. C. Walli, Air Force Institute of Technology (United States); M. T. Eismann, Air Force Research Lab. (United States)
8743 OR	Snapshot spectral and polarimetric imaging; target identification with multispectral video [8743-27] B. D. Bartlett, M. D. Rodriguez, The MITRE Corp. (United States)
8743 OT	Blind analysis of multispectral and polarimetric data via canonical correlation analysis [8743-29] Ö. M. Polat, ASELSAN Inc. (Turkey); Y. Özkazanç, Hacettepe Univ. (Turkey)
SESSION 7	SPECTRAL DATA ANALYSIS METHODOLOGIES II
8743 OU	Lossless to lossy compression for hyperspectral imagery based on wavelet and integer KLT transforms with 3D binary EZW [8743-30] K. Cheng, J. Dill, Ohio Univ. (United States)
8743 OV	Analytical and comparative analysis of lossy ultraspectral image compression [8743-31] R. Herrero, V. K. Ingle, Northeastern Univ. (United States)
8743 OW	Supervised method for optimum hyperspectral band selection [8743-32] R. K. McConnell, WAY-2C (United States)
8743 0X	Second order statistics target-specified virtual dimensionality [8743-33] D. Paylor, CI Chang, Univ. of Maryland, Baltimore County (United States)

8743 OY	Hyperspectral image unmixing via bilinear generalized approximate message passing [8743-34]
	J. Vila, P. Schniter, The Ohio State Univ. (United States); J. Meola, Air Force Research Lab. (United States)
8743 OZ	Comparing quadtree region partitioning metrics for hyperspectral unmixing [8743-35] M. A. Goenaga-Jimenez, Univ. de Puerto Rico Mayagüez (United States); M. Vélez-Reyes, The Univ. of Texas at El Paso (United States)
SESSION 8	SPECTRAL METHODOLOGIES AND APPLICATIONS III
8743 10	Impact of specular reflection on bottom type retrieved from WorldView-2 images [8743-36] K. W. Patterson, G. Lamela, U.S. Naval Research Lab. (United States)
8743 11	Using multi-angle WorldView-2 imagery to determine bathymetry near Oahu, Hawaii [8743-37]
	K. R. Lee, R. C. Olsen, F. A. Kruse, A. M. Kim, Naval Postgraduate School (United States)
8743 12	Automatic ship detection from commercial multispectral satellite imagery [8743-38] B. J. Daniel, A. P. Schaum, E. C. Allman, R. A. Leathers, T. V. Downes, U.S. Naval Research Lab. (United States)
8743 13	A decade of measured greenhouse forcings from AIRS [8743-39] D. Chapman, Columbia Univ. (United States); P. Nguyen, M. Halem, Univ. of Maryland, Baltimore County (United States)
8743 14	Initial validation of atmospheric compensation for a Landsat land surface temperature product [8743-40]
	M. J. Cook, J. R. Schott, Rochester Institute of Technology (United States)
SESSION 9	DETECTION, IDENTIFICATION, AND QUANTIFICATION II
8743 15	Detection of unknown gas-phase chemical plumes in hyperspectral imagery [8743-41] J. Theiler, B. Wohlberg, Los Alamos National Lab. (United States)
8743 16	Hyperspectral chemical plume quantification via background radiance estimation [8743-42]
	S. Niu, Northeastern Univ. (United States); S. E. Golowich, MIT Lincoln Lab. (United States); V. K. Ingle, Northeastern Univ. (United States); D. G. Manolakis, MIT Lincoln Lab. (United States)
8743 17	Detection and tracking of gas clouds in an urban area by imaging infrared spectroscopy [8743-43]
	S. Sabbah, P. Rusch, JH. Gerhard, R. Harig, Bruker Optik GmbH (Germany)
8743 18	Spectral target detection using a physical model and a manifold learning technique [8743-44]
	J. A. Albano, D. W. Messinger, E. lentilucci, Rochester Institute of Technology (United States)

8743 19 Target detection performed on manifold approximations recovered from hyperspectral data [8743-45]

A. K. Ziemann, D. W. Messinger, J. A. Albano, Rochester Institute of Technology (United States)

8743 1A Target detection in inhomogeneous non-Gaussian hyperspectral data based on nonparametric density estimation [8743-46]

G. A. Tidhar, S. R. Rotman, Ben-Gurion Univ. of the Negev (Israel)

SESSION 10 SPECTRAL SENSOR DEVELOPMENT AND CHARACTERIZATION

8743 1B On super-resolved coded aperture spectral imaging [8743-48]

H. F. Rueda, Univ. of Delaware (United States); H. Arguello, Univ. of Delaware (United States) and Univ. Industrial de Santander (Colombia); G. R. Arce, Univ. of Delaware (United States)

8743 1D Modeling, development, and testing of a shortwave infrared supercontinuum laser source for use in active hyperspectral imaging [8743-50]

J. Meola, A. Absi, J. D. Leonard, Air Force Research Lab. (United States); A. I. Ifarraguerri, SAIC (United States); M. N. Islam, Univ. of Michigan (United States) and Omni Sciences, Inc. (United States); V. V. Alexander, Univ. of Michigan (United States); J. A. Zadnik, EOIR Technologies (United States)

8743 1E Low-complexity image processing for a high-throughput low-latency snapshot multispectral imager with integrated tiled filters [8743-51]

B. Geelen, M. Jayapala, N. Tack, A. Lambrechts, IMEC (Belgium)

SESSION 11 SPECTRAL DATA ANALYSIS METHODOLOGIES III

8743 1F Learning to merge: a new tool for interactive mapping [8743-52]

R. B. Porter, S. Lundquist, C. Ruggiero, Los Alamos National Lab. (United States)

8743 1G Enhancement of hyperspectral imagery using spectrally weighted tensor anisotropic nonlinear diffusion for classification [8743-53]

M. Marin-Mcgee, Univ. de Puerto Rico Mayagüez (United States); M. Velez-Reyes, Univ. of Texas at El Paso (United States)

8743 1H Pan-sharpening of spectral image with anisotropic diffusion for fine feature extraction using GPU [8743-54]

W. Sun, B. Chen, D. W. Messinger, Rochester Institute of Technology (United States)

8743 11 An analysis of the probability distribution of spectral angle and Euclidean distance in hyperspectral remote sensing using microspectroscopy [8743-55]

R. G. Resmini, C. J. Deloye, The MITRE Corp. (United States); D. W. Allen, National Institute of Standards and Technology (United States)

8743 1J Advanced spectral signature discrimination algorithm [8743-56]

S. Chakravarty, New York Institute of Technology (United States); W. Cao, New York Institute of Technology (China) and Nanjing Univ. of Post and Telecommunications, (China); A. Samat, Nanjing Univ. (China)

8743 1K Blind source separation of the HyMap hyperspectral data via canonical correlation analysis [8743-57]

Ö. M. Polat, ASELSAN Inc. (Turkey); Y. Özkazanç, Hacettepe Univ. (Turkey)

SESSION 12 SPECTRAL SIGNATURE MEASUREMENTS AND APPLICATIONS

8743 1L Intensity offset and correction of solid spectral library samples measured behind glass [8743-58]

B. E. Bernacki, R. L. Redding, Y.-F. Su, C. S. Brauer, T. J. Johnson, Pacific Northwest National Lab. (United States)

8743 1M A microscene approach to the evaluation of hyperspectral system level performance [8743-59]

D. W. Allen, National Institute of Standards and Technology (United States); R. G. Resmini, C. J. Deloye, The MITRE Corp. (United States); J. R. Stevens, George Mason Univ. (United States)

8743 10 Spectral variability constraints on multispectral and hyperspectral mapping performance [8743-61]

F. A. Kruse, K. G. Fairbarn, Naval Postgraduate School (United States)

8743 1P Multispectral and hyperspectral advanced characterization of soldier's camouflage equipment [8743-62]

V. Farley, Telops (Canada); M. Kastek, Military Univ. of Technology (Poland); M. Chamberland, Telops (Canada); T. Piątkowski, Military Univ. of Technology (Poland); P. Lagueux, Telops (Canada); R. Dulski, P. Trzaskawka, Military Univ. of Technology (Poland)

SESSION 13 SPECTRAL DATA ENHANCEMENT TECHNOLOGIES AND TECHNIQUES

8743 1Q Spectral image destriping using a low-dimensional model [8743-63]

S. Adler-Golden, S. Richtsmeier, P. Conforti, L. Bernstein, Spectral Sciences, Inc. (United States)

8743 1R Fully automatic destriping of Hyperion hyperspectral satellite imagery using local window statistics [8743-64]

J. B. Lunzer, S. D. Hunt, Univ. de Puerto Rico Mayagüez (United States)

8743 1S Accurate accommodation of scan-mirror distortion in the registration of hyperspectral image cubes [8743-65]

D. M. Conover, The George Washington Univ. (United States); J. K. Delaney, The George Washington Univ. (United States) and National Gallery of Art (United States); M. H. Loew, The George Washington Univ. (United States)

8743 1T	Automated geo/ortho registered aerial imagery product generation using the mapping system interface card (MSIC) [8743-66]
	T. Bratcher, Ionetrics, Inc. (United States); R. Kroutil, Kalman Corp. (United States); A. Lanouette, LR Tec Inc. (Canada); P. E. Lewis, National Geospatial-Intelligence Agency (United States); D. Miller, Kalman Corp. (United States); S. Shen, The Aerospace Corp. (United States); M. Thomas, U.S. Environmental Protection Agency (United States)
8743 1U	Estimating the pixel footprint distribution for image fusion by ray tracing lines of sight in a Monte Carlo scheme [8743-67] T. Opsahl, T. V. Haavardsholm, Norwegian Defense Research Establishment (Norway)
8743 1V	Evaluation of the CASSI-DD hyperspectral compressive sensing imaging system [8743-68] M. Busuioceanu, D. W. Messinger, Rochester Institute of Technology (United States); J. B. Greer, J. C. Flake, National Geospatial-Intelligence Agency (United States)
8743 1W	Modeling satellite imaging sensors over optically complex bodies of water [8743-69] R. Nevins, St. Olaf College (United States); A. Gerace, Rochester Institute of Technology (United States)
SESSION 14	CLUSTERING AND CLASSIFICATION
-	
8743 1X	Spectral dependence of texture features integrated with hyperspectral data for area target classification improvement [8743-70] C. F. Bangs, F. A. Kruse, C. R. Olsen, Naval Postgraduate School (United States)
8743 1Y	A semi-supervised classification algorithm using the TAD-derived background as training data [8743-72]
	L. Fan, B. Ambeau, D. W. Messinger, Rochester Institute of Technology (United States)
8743 1Z	Scale profile as feature for quick satellite image object-based classification [8743-73] D. Dubois, R. Lepage, École de Technologie Supérieure (Canada)
8743 20	Multi-scale vector tunnel classification algorithm for hyperspectral images [8743-74] S. Demirci, Turkish Air Force Academy (Turkey); I. Erer, Istanbul Technical Univ. (Turkey); N. Unaldi, Turkish Air Force Academy (Turkey)
	POSTER SESSION
8743 21	Progressive constrained energy minimization for subpixel detection [8743-75] Y. Wang, Harbin Engineering Univ. (China) and Univ. of Maryland, Baltimore County (United States); R. Schultz, Univ. of Maryland, Baltimore County (United States) and U.S. Naval Academy (United States); SY. Chen, Univ. of Maryland, Baltimore County (United States); C. Liu, Univ. of Maryland, Baltimore County (United States) and China Agricultural Univ. (China); CI Chang, Univ. of Maryland, Baltimore County (United States)
8743 22	GPUs for parallel on-board hyperspectral image radiometric normalization [8743-76] Y. Wu, B. Zhang, Ctr. for Earth Observation and Digital Earth (China); H. Zhao, J. Gao, L. Ni, W. Yang, Ctr. for Earth Observation and Digital Earth (China) and Univ. of Chinese Academy of Sciences (China)

8743 23	Impact of spatial complexity preprocessing on hyperspectral data unmixing [8743-77]
	S. A. Robila, K. Pirate, Montclair State Univ. (United States); T. Hall, Lincoln Univ. (United
	States)

- 8743 25 Concealed target detection using hyperspectral imagers based on intersection kernel of SVM [8743-79]
 M.-S. Shim, S. Kim, Yeungnam Univ. (Korea, Republic of)
- Fusion and quality analysis for remote sensing images using contourlet transform [8743-80] Y. Choi, E. Sharifahmadian, S. Latifi, Univ. of Nevada, Las Vegas (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

Sylvia S. Shen, The Aerospace Corporation (United States)
Paul E. Lewis, National Geospatial-Intelligence Agency
(United States)

Conference Program Committee

Gail P. Anderson, Air Force Research Laboratory (United States) **Chein-I Chang**, University of Maryland, Baltimore County United States)

Eustace L. Dereniak, College of Optical Sciences, The University of Arizona (United States)

Michael T. Eismann, Air Force Research Laboratory (United States)

Glenn E. Healey, University of California, Irvine (United States)

Fred A. Kruse, Naval Postgraduate School (United States)

Jacqueline J. Le Moigne, NASA Goddard Space Flight Center (United States)

David W. Messinger, Rochester Institute of Technology (United States)

Alan P. Schaum, U.S. Naval Research Laboratory (United States) **James Theiler**, Los Alamos National Laboratory (United States)

Grady Tuell, Georgia Tech Research Institute (United States)

Miguel Vélez-Reyes, The University of Texas at El Paso (United States)

Session Chairs

- Detection, Identification, and Quantification I
 Sylvia S. Shen, The Aerospace Corporation (United States)
- Spectral Methodologies and Applications I Paul E. Lewis, National Geospatial-Intelligence Agency (United States)

- 3 Spectral Methodologies and Applications II Scott D. Brown, Rochester Institute of Technology (United States)
- 4 Spectral Data Collections and Experiments
 David W. Messinger, Rochester Institute of Technology (United States)
- Spectral Data Analysis Methodologies I
 Scott D. Brown, Rochester Institute of Technology (United States)
- Multisensor Data Fusion
 Grady Tuell, Georgia Tech Research Institute (United States)
- Spectral Data Analysis Methodologies II
 Miguel Vélez-Reyes, The University of Texas at El Paso (United States)
- Spectral Methodologies and Applications III
 Fred A. Kruse, Naval Postgraduate School (United States)
- 9 Detection, Identification, and Quantification II Miguel Vélez-Reyes, The University of Texas at El Paso (United States)
- Spectral Sensor Development and Characterization Eustace L. Dereniak, College of Optical Sciences, The University of Arizona (United States)
- Spectral Data Analysis Methodologies IIIDavid W. Messinger, Rochester Institute of Technology (United States)
- 12 Spectral Signature Measurements and Applications

 Fred A. Kruse, Naval Postgraduate School (United States)
- Spectral Data Enhancement Technologies and Techniques Paul E. Lewis, National Geospatial-Intelligence Agency (United States)
- 14 Clustering and Classification **Sylvia S. Shen**, The Aerospace Corporation (United States)