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:


ISSN 0277-786X
ISBN 9780819488077

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 © 2011, 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/11/$18.00.

Printed in the United States of America.

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

SPIE Digital Library
SPIEDigitalLibrary.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 The evolution of airborne chemical and radiological remote sensing for emergency and natural disaster response (Plenary Summary)
P. E. Lewis, National Geospatial-Intelligence Agency (United States)

SESSION 1 ANALYSIS OF VHR IMAGES AND PANSHARPENING

8180 02 Multispectral pansharpening based on pixel modulation: state of the art and new results [8180-01]
B. Aiazzi, Istituto di Fisica Applicata Nello Carrara, CNR (Italy); L. Alparone, Univ. of Florence (Italy); S. Baronti, Istituto di Fisica Applicata Nello Carrara, CNR (Italy); A. Garzelli, Univ. of Siena (Italy); M. Selva, Istituto di Fisica Applicata Nello Carrara, CNR (Italy)

8180 03 A new geometric invariant to match regions within remote sensing images of different modalities [8180-02]
C. Palmann, S. Mavromatis, J. Sequeira, Univ. de la Méditerranée (France)

8180 04 An automated procedure for detection of IDP’s dwellings using VHR satellite imagery [8180-03]
M. Jenerowicz, Space Research Ctr. (Poland); T. Kemper, P. Soille, European Commission Joint Research Ctr. (Italy)

8180 05 Application of modulation transfer function in high-resolution image fusion [8180-04]
X. Zhang, Wuhan Univ. (China) and The Second Institute of Oceanography, SOA (China); Y. Jia, Wuhan Univ. (China); X. Chen, The Second Institute of Oceanography, SOA (China); D. Pan, Wuhan Univ. (China) and The Second Institute of Oceanography, SOA (China); J. Chen, Z. Hao, The Second Institute of Oceanography, SOA (China)

SESSION 2 IMAGE ANALYSIS AND SENSORS

8180 06 Application of multispectral color enhancement for remote sensing [8180-05]
N. Hashimoto, Y. Murakami, M. Yamaguchi, N. Ohyama, K. Uto, Y. Kosugi, Tokyo Institute of Technology (Japan)

8180 07 Automated texture registration on 3D models [8180-06]
A. Pelagotti, Istituto Nazionale di Ottica, CNR (Italy); F. Uccheddu, F. Picchioni, Univ. of Florence (Italy)

8180 08 Radiometric correction of RapidEye imagery using the on-orbit side-slither method [8180-07]
C. Anderson, D. Naughton, A. Brunn, M. Thiele, RapidEye AG (Germany)
SESSION 3  CLASSIFICATION TECHNIQUES I

8180 0B  Support vector machines in remote sensing: the tricks of the trade (Invited Paper) [8180-10]
G. Camps-Valls, Univ. de València (Spain)

8180 0C  Active versus semi-supervised learning paradigm for the classification of remote sensing images [8180-11]
C. Persello, L. Bruzzone, Univ. of Trento (Italy)

8180 0D  Selection of samples for active labeling in semi-supervised hyperspectral pixel classification [8180-12]
O. Rajadell, P. García-Sevilla, Univ. Jaume I (Spain); C. V. Dinh, R. P. W. Duin, Delft Univ. of Technology (Netherlands)

8180 0E  A change-detection-driven approach to active transfer learning for classification of image time series [8180-13]
B. Demir, F. Bovolo, L. Bruzzone, Univ. of Trento (Italy)

SESSION 4  CLASSIFICATION TECHNIQUES II

8180 0F  Transfer component analysis for domain adaptation in image classification [8180-14]
G. Matasci, M. Volpi, Univ. de Lausanne (Switzerland); D. Tuia, Univ de València (Spain) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); M. Kanevski, Univ. de Lausanne (Switzerland)

8180 0I  Evaluation of textural features for multispectral images [8180-18]
U. Bayram, ODTU Teknokent (Turkey); G. Can, S. Duzgun, Middle East Technical Univ. (Turkey); N. Yalabik, ODTU Teknokent (Turkey)

SESSION 5  CLASSIFICATION TECHNIQUES III

8180 0J  An efficient approach for multi-temporal hyperspectral images interpretation based on high-order tensor [8180-21]
S. Hemissi, I.R. Farah, K. Saheb Ettabaa, Ecole Nationale des Sciences de l'Informatique (Tunisia) and TELECOM Bretagne (France); B. Solaiman, TELECOM Bretagne (France)

8180 0K  Spectral-spatial classification of polarimetric SAR data using morphological attribute profiles [8180-19]
P. R. Marpu, Univ. of Iceland (Iceland); K.-S. Chen, National Central Univ. (Taiwan); J. A. Benediktsson, Univ. of Iceland (Iceland)

SESSION 6  ANALYSIS OF HYPERSPECTRAL DATA

8180 0N  An endmember extraction strategy for geometrical methods based on spectral-spatial information [8180-23]
M. Beauchemin, Natural Resources Canada (Canada)

8180 0O  Content-based hyperspectral image retrieval using spectral unmixing [8180-24]
A. J. Plaza, Univ. of Extremadura (Spain)
Endmember detection in marine environment with oil spill event [8180-25]
C. Andreou, V. Karathanassi, National Technical Univ. of Athens (Greece)

Illumination and shadow compensation of hyperspectral images using a digital surface model and non-linear least squares estimation [8180-26]
O. Friman, G. Tolt, Swedish Defence Research Agency (Sweden); J. Ahlberg, Termisk Systemteknik (Sweden)

Spatial/spectral area-wise analysis for the classification of hyperspectral data [8180-27]
G. Roussel, V. Achard, A. Alakian, ONERA (France); J.-C. Fort, Univ. Paris Descartes (France)

Sparse principal component analysis in hyperspectral change detection [8180-28]
A. A. Nielsen, R. Larsen, J. S. Vestergaard, Technical Univ. of Denmark (Denmark)

Change detection over Sokolov open-pit mining area, Czech Republic, using multi-temporal HyMAP data (2009-2010) [8180-29]
S. Adar, G. Nofesco, A. Brook, I. Livne, Tel Aviv Univ. (Israel); P. Rojik, Sokolovská uhelná a.s. (Czech Republic); V. Kopacková, K. Zelenkova, J. Mišurec, Czech Geological Survey (Czech Republic); A. Bourguignon, S. Chevrel, BRGM (France); C. Ehler, C. Fisher, German Aerospace Ctr. (Germany); J. Hanuš, Academy of Sciences of the Czech Republic (Czech Republic); Y. Shkolnisky, E. Ben Dor, Tel Aviv Univ. (Israel)

Lidar-based measurement of surface roughness features of single tree crowns [8180-32]
M. Kolditz, P. M. Krahwinkler, J. Roßmann, RWTH Aachen Univ. (Germany)

Dynamic and data-driven classification for polarimetric SAR images [8180-33]
S. Uhlmann, S. Kiranyaz, Tampere Univ. of Technology (Finland); T. Ince, Izmir Univ. of Economics (Turkey); M. Gabbouj, Tampere Univ. of Technology (Finland)

Performance evaluation for blind methods of noise characteristic estimation for TerraSAR-X images [8180-35]
V. V. Lukin, S. K. Abramov, D. V. Fevralayev, N. N. Ponomarenko, National Aerospace Univ. (Ukraine); K. O. Egiazarian, J. T. Astola, Tampere Univ. of Technology (Finland); B. Vozel, K. Chehdi, Univ. de Rennes 1 (France)

An experimental study on ship detection based on the fixed-point polarimetric whitening filter [8180-36]
D. Tao, C. Brekke, S. N. Anfinsen, Univ. of Tromsø (Norway)

A radar target DB construction method using 3D scattering centers [8180-37]
Comparison of using single- or multi-polarimetric TerraSAR-X images for segmentation and classification of man-made maritime objects [8180-38]
M. Teutsch, G. Saur, Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (Germany)

Characteristic analyses of the reflected components of IR signals due to multiple reflection on object surfaces [8180-48]
D.-G. Kim, J.-H. Choi, T.-K. Kim, Chung-Ang Univ. (Korea, Republic of)

Lossless compression of images from China-Brazil Earth Resources Satellite [8180-52]
M. S. Pinho, Instituto Tecnológico de Aeronáutica (Brazil)

Impact of informative band selection on target detection performance [8180-54]
H. Gholizadeh, M. J. Valadan Zoej, K.N. Toosi Univ. of Technology (Iran, Islamic Republic of); B. Majaradi, Iran Univ. of Science and Technology (Iran, Islamic Republic of)

Comparison of supervised classification methods applied on high-resolution satellite images [8180-55]
A. Ozturk, Yalova Univ. (Turkey)

Joint high dynamic range imaging and color demosaicing [8180-56]
J. Herwig, J. Pauli, Univ. of Duisburg-Essen (Germany)

Fusion of hyperspectral and lidar data using morphological attribute profiles [8180-58]
M. Pedergnana, Univ. of Iceland (Iceland) and Univ of Trento (Italy); P. R. Marpu, Univ. of Iceland (Iceland); M. Dalla Mura, Univ of Trento (Italy); J. A. Benediktsson, Univ. of Iceland (Iceland); L. Bruzzone, Univ of Trento (Italy)

Spectral dimensionality reduction based on integrated bispectrum phase for hyperspectral image analysis [8180-59]
K. M. Saipullah, Univ. Teknikal Malaysia Melaka (Malaysia); D.-H. Kim, Inha Univ. (Korea, Republic of)
Conference Committee

Symposium Chair

Karin Stein, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

Symposium Cochair

Charles R. Bostater, Florida Institute of Technology (United States)

Conference Chair

Lorenzo Bruzzone, Università degli Studi di Trento (Italy)

Conference Cochairs

Jon Atli Benediktsson, University of Iceland (Iceland)
Sebastiano B. Serpico, Università degli Studi di Genova (Italy)

Programme Committee

Luciano Alparone, Università degli Studi di Firenze (Italy)
Selim Aksoy, Bilkent University (Turkey)
José M. Bioucas-Dias, Universidade Técnica de Lisboa (Portugal)
Francesca Bovolo, Università degli Studi di Trento (Italy)
Gustavo Camps-Valls, Universitat de València (Spain)
Jocelyn Chanussot, Laboratoire des Images et des Signaux (France)
Chi Hau Chen, University of Massachusetts Dartmouth (United States)
David A. Clausi, University of Waterloo (Canada)
Melba M. Crawford, Purdue University (United States)
Fabio Dell’Acqua, Università degli Studi di Pavia (Italy)
Giles M. Foody, The University of Nottingham (United Kingdom)
Jordi Inglada, Centre d’Etudes Spatiales de la Biosphère (France)
Gabriele Moser, Università degli Studi di Genova (Italy)
Allan A. Nielsen, Technical University of Denmark (Denmark)
Ryuei Nishii, Kyushu University (Japan)
Antonio J. Plaza, Universitat de Extremadura (Spain)
John A. Richards, The Australian National University (Australia)
Anne S. Solberg, University of Oslo (Norway)
Josiane B. Zerubia, INRIA Sophia Antipolis - Méditerranée (France)
Session Chairs

1. Analysis of VHR Images and Pansharpening
   Lorenzo Bruzzone, Università degli Studi di Trento (Italy)

2. Image Analysis and Sensors
   Luciano Alparone, Università degli Studi di Firenze (Italy)

3. Classification Techniques I
   Lorenzo Bruzzone, Università degli Studi di Trento (Italy)

4. Classification Techniques II
   Gustavo Camps-Valls, Universitat de València (Spain)

5. Classification Techniques III
   Jordi Inglada, Centre d'Etudes Spatiales de la Biosphère (France)

6. Analysis of Hyperspectral Data
   Antonio J. Plaza, Universitat de Extremadura (Spain)

7. Change Detection and Analysis of Multitemporal Images
   Allan A. Nielsen, Technical University of Denmark (Denmark)

8. Lidar and SAR Processing
   Jordi Inglada, Centre d'Etudes Spatiales de la Biosphère (France)

9. Joint Session with Conference 8179: SAR Data Analysis I
   Claudia Notarnicola, EURAC research (Italy)

10. Joint Session with Conference 8179: SAR Data Analysis II
    Lorenzo Bruzzone, Università degli Studi di Trento (Italy)
First responders, joint operations centers, and recovery and remediation personnel consider timely and affordable airborne chemical, radiological, imagery analysis, and related mapping products essential in the formulation of a complete understanding of an incident and its potential impact on adjacent communities, and for recovery and remediation. Airborne remote sensing provides the flexibility to produce incident specific products and conduct over-flights at the frequencies needed to provide timely and relevant information for recovery and remediation operations, optimization of resources during an event, and for the safety of emergency response personnel.

The utility of airborne chemical remote sensing became apparent to the EPA during a chemical plant explosion, which occurred in Sioux City, Iowa in December of 1994. The facility produced ammonium nitrate fertilizer, and also produced its own ammonia for use in the process. In late December an explosion occurred rupturing the main storage tank and spilling three million gallons of ammonia. This resulted in lethal vapor levels in and around the plant and created a plume of ammonia vapors estimated to be 35 miles long. Approximately 3,500 people were evacuated over a 50 square mile area. The EPA sent in vehicles with ground sampling crews dressed in Level A hazmat suits with 30 minute air packs to monitor the site. Due to heavy snow coverage on the ground and saturated soil conditions underneath the snow, all of the EPA vehicles became stuck. Ground sampling crews had to be rescued before air supplies ran out. Consequently, no monitoring of vapor levels was accomplished.

The lessons learned from responding to the chemical explosion in Sioux City, Iowa in 1994 prompted the EPA to begin evaluating the application of airborne remote sensing infrared and gamma ray spectroscopy for emergency responses involving chemical and radiological incidents. Concurrently, with the evaluation process to determine the performance and feasibility of implementing infrared and gamma ray spectroscopy in an airborne platform came the evolution of a set of core requirements for an airborne operational capability: Standoff chemical and gamma ray detection and identification with low false alarm rates; High resolution ortho-rectified day-night imagery; Airborne data collection under cloud ceilings; Rapid dispatch-wheels up in under one hour after activation; Automated data processing – real or near-real-time chemical data analysis; Direct integration of data and information to local incident commanders-local and federal joint operations centers; Data telemetry to and from the aircraft.

According to the EPA, in the United States there are approximately 123 facilities where a release of chemicals could threaten more than one million people. There are approximately 750 additional facilities where a chemical release could threaten more than a hundred thousand people.

In 2001, the EPA implemented the United States only civilian operational airborne chemical detection and identification capability called the Airborne Spectral Photometric Environmental Collection Technology (ASPECT) Program. Subsequently in 2003, the EPA and NGA agreed to collaborate in a cooperative research and development program focused on evolving the capabilities of the ASPECT Program to produce near-real-time state of the art chemical, radiological and imagery mapping emergency response products.
The ASPECT model of operation combines an airborne operational remote sensing suite with a research and development support team to insure that analysis and products are validated and verified scientifically and are reviewed and checked before release. The research and development support team collaboration between the EPA and NGA to evolve the capabilities of the ASPECT Program has resulted in the following significant accomplishments: Near-real-time automated onboard chemical detection and identification of 78 chemical compounds with low false alarm rates; Near-real-time information on plume direction and concentrations; Automated software producing day/night ortho-rectified imagery rapid response maps; Automated software producing gamma ray survey information maps onboard the aircraft; Data and information telemetry to and from the aircraft facilitating turn-around times and seamless integration of vital situational awareness information from the aircraft to first responders or joint operation centers in 5 to 15 minutes.

Since 2001 the ASPECT Program has provided essential information during 115 emergency, disaster, and homeland security related incidents ranging from chemical plant explosions and train derailments to fires, floods, hurricanes, and special events. The ASPECT Program played key roles in providing essential information to first responders and joint operations centers in response to the following historical events: The Shuttle Columbia break up during re-entry over Texas in February of 2003; Hurricane Katrina in August of 2005; The Deepwater Horizon Oil Spill disaster in the Gulf of Mexico from April-August 2010.

Over the past decade in over 115 responses, the ASPECT program has demonstrated the utility of having timely, cost-effective operational airborne chemical and radiological remote sensing information integrated seamlessly into to the local, state and federal emergency response and disaster recovery and remediation communities. What is needed next is the implementation of multiple aircraft strategically located throughout the United States so that ASPECT capabilities can be on the scene of a disaster or event in less than three hours.