

PROCEEDINGS OF SPIE

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

**Miguel Velez-Reyes
David W. Messinger**
Editors

**17–19 April 2018
Orlando, Florida, United States**

Sponsored and Published by
SPIE

Volume 10644

Proceedings of SPIE 0277-786X, V. 10644

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

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XXIV*, edited by Miguel Velez-Reyes, David W. Messinger, Proceedings of SPIE Vol. 10644 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510617995

ISBN: 9781510618008 (electronic)

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 © 2018, 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/18/\$18.00.

Printed in the United States of America Vm7 i ffUb '5gg: WJUH g' bWzi bXYf`jW bgY Zca 'GD-9.

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

SPIE. DIGITAL LIBRARY

SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

Contents

ix	<i>Authors</i>
xi	<i>Conference Committee</i>
xiii	<i>Introduction</i>

TARGET AND ANOMALY DETECTION

10644 02	Target detection using artificial neural networks on LWIR hyperspectral imagery [10644-1]
10644 03	Impact of platform motion on hyperspectral imaging target detection and ground resolution distance [10644-3]
10644 04	A machine learning approach to hyperspectral detection of solid targets [10644-4]
10644 05	Onboard CubeSat data processing for hyperspectral detection of chemical plumes [10644-5]
10644 06	Closed-form solutions to replacement target models of sub-pixel spectral detection [10644-6]

DIMENSIONALITY REDUCTION AND FEATURE EXTRACTION

10644 07	Optimal sensor control for fast target detection in hyperspectral imagery [10644-7]
10644 08	Semi-supervised normalized embeddings for land-use classification from multiple view data [10644-8]
10644 09	Dimensionality reduction for spatial-spectral target detection on hyperspectral imagery [10644-9]
10644 0A	Using a column subset selection method for endmember extraction in hyperspectral unmixing [10644-10]

IMAGE FUSION

10644 0B	On the generation of high-spatial and high-spectral resolution images using THEMIS and TES for Mars exploration [10644-11]
10644 0C	Spectral-elevation data registration using visible-SWIR spatial correspondence [10644-12]

10644 OD **Landing zone identification for autonomous UAV applications using fused hyperspectral imagery and LIDAR point clouds** [10644-13]

MACHINE LEARNING IN SPECTRAL SENSING

10644 OF **A study of the effect of alternative similarity measures on the performance of graph-based anomaly detection algorithms (Invited Paper)** [10644-20]

10644 OG **Threat determination for radiation detection from the Remote Sensing Laboratory (Invited Paper)** [10644-16]

10644 OH **Scattering transforms and classification of hyperspectral images (Invited Paper)** [10644-17]

10644 OI **Diffusion geometric methods for fusion of remotely sensed data (Invited Paper)** [10644-18]

10644 OK **Semi-supervised deep autoencoder network for graph-based dimensionality reduction of hyperspectral imagery** [10644-15]

PERFORMANCE EVALUATION OF SENSORS AND SYSTEMS

10644 OL **Examining the impact of spectral uncertainty on hyperspectral data exploitation** [10644-21]

10644 ON **Evaluating calibration consistency of Terra and Aqua MODIS LWIR PV bands using Dome C** [10644-23]

10644 OO **Evaluating the long-term stability and response versus scan angle effect in the SNPP VIIRS SDR reflectance product using a deep convective cloud technique** [10644-24]

10644 OP **Simulation techniques for image utility analysis** [10644-25]

10644 OQ **A computational approach to hyperspectral imaging for long-range target identification** [10644-26]

ATMOSPHERIC MODELING AND COMPENSATION

10644 OR **Sensitivity of temperature and emissivity separation to atmospheric errors in LWIR hyperspectral imagery** [10644-27]

10644 OT **Seeing through heavily polluted satellite imagery using QUAC** [10644-29]

10644 OU **Atmospheric correction of commercial thermal infrared hyperspectral imagery using FLAASH-IR** [10644-30]

LWIR AND MWIR SPECTRAL SENSING

- 10644 0V **Comparison of bad pixel replacement techniques for LWIR hyperspectral imagery** [10644-31]
- 10644 0W **Infrared signature measurements of a jet turbine using a hyperspectral imager for combustion diagnostics** [10644-32]
- 10644 0X **Design, calibration and characterization of a low-cost spatial Fourier transform LWIR hyperspectral camera with spatial and temporal scanning modes** [10644-33]
- 10644 0Y **Infrared absorption bands measured with an uncooled interferometric LWIR hyperspectral camera** [10644-34]

CHANGE DETECTION AND IMAGE REGISTRATION

- 10644 0Z **High performance change detection in hyperspectral images using multiple references** [10644-35]
- 10644 10 **A new nonlinear change detection approach based on band ratioing** [10644-36]
- 10644 11 **Multi-spectral change detection methods: evaluation on simulated and real-world satellite imagery** [10644-37]
- 10644 12 **Temperature-robust longwave infrared hyperspectral change detection** [10644-38]
- 10644 13 **Image registration and change detection for artifact detection in remote sensing imagery** [10644-39]
- 10644 14 **Improvement of the Harris corner detector using an entropy-block-based strategy** [10644-40]

APPLICATIONS

- 10644 15 **Pigment diversity estimation for hyperspectral images of the Selden map of China** [10644-41]
- 10644 16 **Necessary steps for the systematic calibration of a multispectral imaging system to achieve a targetless workflow in reflectance estimation: a study of Parrot SEQUOIA for precision agriculture** [10644-42]
- 10644 18 **Multispectral imaging for improved liquid classification in security sensor systems** [10644-44]

SENSOR, DESIGN, DEVELOPMENT, AND CHARACTERIZATION

- 10644 1B **Three mirror off-axis optical system with an obscuration hole as a fore optics of the hyperspectral imager** [10644-47]
- 10644 1D **A compressive approach to imaging spectroscopy** [10644-49]
- 10644 1E **Agile optoelectronic fiber sources for hyperspectral chemical sensing from SWIR to LWIR** [10644-50]
- 10644 1F **Measurement of point spread function for characterization of coregistration and resolution: comparison of two commercial hyperspectral cameras** [10644-51]
- 10644 1G **Compact visible to extended-SWIR hyperspectral sensor for unmanned aircraft systems (UAS)** [10644-52]

SPECTRAL MODELING AND CHARACTERIZATION

- 10644 1I **Grazing angle experimental analysis of modification to microfacet BRDF model for improved accuracy** [10644-54]
- 10644 1J **Case-study analysis of apparent color for camouflage fabrics** [10644-55]
- 10644 1K **Influence of surface roughness, volume diffusion and particle size in reflectance infrared spectroscopy** [10644-56]
- 10644 1L **Measurement campaign for hyperspectral imaging in complex illumination environments** [10644-58]

POSTER SESSION

- 10644 1M **A new bandwidth selection criterion for using SVDD to analyze hyperspectral data** [10644-60]
- 10644 1N **Statistical evaluation of the periodically sampled method for efficient measurement of the distortions in hyperspectral imager** [10644-62]
- 10644 1O **Programmable system on chip implementation of a principal component analysis for preprocessing of multispectral image data acquired with filter wheel cameras** [10644-63]
- 10644 1Q **Noise reduction for improving the performance of gas detection algorithms in the FTIR spectrometer** [10644-65]
- 10644 1R **A wide dense architecture neural network for material classification based on spectral BTF** [10644-66]
- 10644 1S **Advanced imaging system with multiple optical sensing modes** [10644-67]

- 10644 1T **Parametric modeling of NIR and SWIR reflectance spectra for dye mixtures in fabrics using reference spectra** [10644-68]
- 10644 1U **Evaluation of MODIS and Sentinel-3 SLSTR thermal emissive bands calibration consistency using Dome C** [10644-69]
- 10644 1V **Comparative study of spectral matched filter, constrained energy minimization, and adaptive coherence estimator for subpixel target detection based on hyperspectral imaging** [10644-70]
- 10644 1W **Processes for conducting HSI and MSI pan-sharpening with 3D digital flattening** [10644-71]
- 10644 1X **Evaluation of the on-orbit response versus scan-angle (RVS) performance for the MODIS reflective solar bands using multiple ground targets** [10644-72]
- 10644 1Z **Underwater target detection with hyperspectral imagery for search and rescue missions** [10644-74]
- 10644 20 **Spectral phenomenology of historical parchments and inks to aid cultural heritage imaging system development** [10644-75]
- 10644 21 **Seeded Laplacian in sparse subspace for hyperspectral image classification** [10644-76]
- 10644 22 **Low-dimensional enhanced superpixel representation with homogeneity testing for unmixing of hyperspectral imagery** [10644-77]
- 10644 23 **Toward an AR multiperspective active imaging environment for application development** [10644-78]
- 10644 27 **Kernel PCA for anomaly detection in hyperspectral images using spectral-spatial fusion** [10644-83]
- 10644 28 **Modeling apparent camouflage patterns for visual evaluation** [10644-84]