

PROCEEDINGS OF SPIE

***Algorithms, Technologies, and  
Applications for Multispectral  
and Hyperspectral Imaging XXIX***

**Miguel Velez-Reyes**

**David W. Messinger**

*Editors*

**2–4 May 2023**

**Orlando, Florida, United States**

*Sponsored and Published by*

**SPIE**

**Volume 12519**

Proceedings of SPIE 0277-786X, V. 12519

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](http://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, Technologies, and Applications for Multispectral and Hyperspectral Imaging XXIX*, edited by Miguel Velez-Reyes, David W. Messinger, Proc. of SPIE 12519, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510661523

ISBN: 9781510661530 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://SPIE.org)

Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at [copyright.com](http://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.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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

vii *Conference Committee*

---

## CALIBRATION AND CHARACTERIZATION

---

- 12519 02 **Selection of optimal performance parameters in industrial hyperspectral camera design** [12519-2]
- 12519 03 **Calibration method for high-resolution single mode fiber optic spectrometers for optical coherence tomography** [12519-6]
- 12519 04 **Comparison of methods to derive infrared optical constants for organic materials for optical modeling** [12519-5]

---

## SPECTRAL REMOTE SENSING FOR SPACE SITUATIONAL AWARENESS I: JOINT SESSION WITH CONFERENCES 12519 AND 12546

---

- 12519 05 **Advanced statistical characterization of multispectral infrared properties of the GEO belt debris population** [12519-7]
- 12519 06 **Preliminary study of the characterization of a geosynchronous satellite with glint season observations from a small aperture telescope and synthetic imagery** [12519-8]
- 12519 07 **Multi-geosynchronous satellite classification with spectroscopic signatures** [12519-9]

---

## SPECTRAL REMOTE SENSING FOR SPACE SITUATIONAL AWARENESS II: JOINT SESSION WITH CONFERENCES 12519 AND 12546

---

- 12519 08 **Simulating ground-based measurements of spectral signatures of resident space objects** [12519-10]
- 12519 09 **Model validity dynamics in learned spectroscopic recognition of satellites** [12519-11]
- 12519 0A **The potential for satellite recognition from ground-based filter photometry** [12519-12]

---

## APPLICATIONS OF MACHINE LEARNING IN SPECTRAL IMAGING I

---

- 12519 0B **A comparison of traditional and machine learning corn yield models using hyperspectral UAS and Landsat imagery** [12519-13]

12519 0C **Machine learning algorithms for standoff detection of threat chemicals by active infrared backscatter hyperspectral imaging** [12519-14]

---

#### **MSI AND HSI ALGORITHMS**

---

12519 0D **Leveraging spatial content of images to enhance hyperspectral-multispectral fusion performance** [12519-19]

12519 0E **A neural differential equation formulation for modeling atmospheric effects in hyperspectral images** [12519-21]

12519 0F **In-situ water quality monitoring in oil and gas operations** [12519-26]

---

#### **APPLICATIONS OF SPECTRAL SENSING**

---

12519 0G **Flight testing and characterization of THIA: a terrestrial hyperspectral imaging apparatus for ecological, agricultural, and mining applications** [12519-23]

12519 0H **Sentinel-2 data classification for land use land cover mapping in northern Algeria** [12519-25]

12519 0I **Development of a particle analysis system for the process water of the petrochemical industry using hyperspectral imaging, white-light imaging, and fluorescence imaging** [12519-27]

---

#### **SPECTRAL SENSING SYSTEMS**

---

12519 0J **Performance assessment of the new Telops hyper-cam airborne mini** [12519-32]

12519 0K **Sharjah-Sat-2: a low-cost high-resolution Earth observation microsatellite** [12519-29]

---

#### **APPLICATIONS OF MACHINE LEARNING IN SPECTRAL IMAGING II**

---

12519 0L **Impact of model architecture on robustness and interpretability of multispectral deep learning models** [12519-34]

12519 0M **Quantifying the robustness of deep multispectral segmentation models against natural perturbations and data poisoning** [12519-35]

12519 0N **Spectral variability modeling with variational autoencoders for hyperspectral target analysis** [12519-37]

---

#### TARGET AND CHANGE DETECTION

---

- 12519 OO **Effective segmentation for point target detection** [12519-38]
- 12519 OP **Experiments in anomalous change detection: improving detector discrimination through feature layers** [12519-41]
- 12519 OQ **Evaluation of aerial real-time RX anomaly detection** [12519-40]
- 12519 OR **Anisotropic background models for spectral target detection** [12519-39]

---

#### POSTER SESSION

---

- 12519 OS **Contribution of hyperspectral imaging in interventional environment: application to orthopedic surgery** [12519-45]
- 12519 OT **Using hyperspectral unmixing for the analysis of very high spatial resolution hyperspectral imagery** [12519-46]