

PROCEEDINGS OF SPIE

# ***Disruptive Technologies in Information Sciences VIII***

**Misty Blowers  
Bryant T. Wysocki**  
*Editors*

**22–25 April 2024  
National Harbor, Maryland, United States**

*Sponsored and Published by*  
SPIE

**Volume 13058**

Proceedings of SPIE 0277-786X, V. 13058

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

Disruptive Technologies in Information Sciences VIII, edited by Misty Blowers,  
Bryant T. Wysocki, Proc. of SPIE Vol. 13058, 1305801 · © 2024 SPIE  
0277-786X · doi: 10.1117/12.3036957

Proc. of SPIE Vol. 13058 1305801-1

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 *Disruptive Technologies in Information Sciences VIII*, edited by Misty Blowers, Bryant T. Wysocki, Proc. of SPIE 13058, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X  
ISSN: 1996-756X (electronic)

ISBN: 9781510674349  
ISBN: 9781510674356 (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 © 2024 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*

---

## AI METHODOLOGIES AND APPLICATIONS I

---

- 13058 02 **Bridging the AI/ML gap with explainable symbolic causal models using information theory**  
[13058-1]
- 13058 03 **Application specificity of data for pre-training in computer vision** [13058-2]
- 13058 04 **Modular, hierarchical machine learning for sequential goal completion** [13058-3]
- 13058 05 **Deep reinforcement learning to assess lower extremity movement intention and assist a rehabilitation exoskeleton** [13058-4]
- 13058 06 **Eye tracking in extreme environments: from invention to new frontiers of human-machine teaming** [13058-5]

---

## AI METHODOLOGIES AND APPLICATIONS II

---

- 13058 07 **Quantization to accelerate inference in multimodal 3D object detection** [13058-6]
- 13058 08 **A systems theoretic perspective on open architectures for learning systems** [13058-8]
- 13058 09 **Generative AI agile assistant** [13058-18]

---

## AI FOR DETECTION AND RECOGNITION

---

- 13058 0B **HALO: an ontology for representing and categorizing hallucinations in large language models**  
[13058-9]
- 13058 0C **Adaptive object detection algorithms for resource constrained autonomous robotic systems**  
[13058-10]
- 13058 0D **Methodology of soft partition for image classification** [13058-11]

---

#### AI SYSTEMS AND DECISION MAKING I

---

- 13058 OE **Circumventing broken neural networks, both real and imaginary, through SPSF-based neural decoding and interconnected associative memory matrices** [13058-12]
- 13058 OG **Latency-aware service placement for GenAI at the edge** [13058-14]
- 13058 OH **Risk considerations for the Department of Defense's fielding of large language models** [13058-15]

---

#### AI SYSTEMS AND DECISION MAKING II

---

- 13058 OI **Quantifying decision complexity in IADS operations** [13058-16]
- 13058 OJ **Combining AI control systems and human decision support via robustness and criticality** [13058-13]

---

#### DATA ANALYTICS AND FEDERATED SYSTEMS

---

- 13058 OL **Situational awareness on a graph: towards graph neural networks for spectrum analysis and battlefield management** [13058-27]
- 13058 ON **Aberdeen architecture: information flow monitoring and tracking** [13058-30]
- 13058 OO **Working MOG optimization via opportunistic delays** [13058-31]
- 13058 OP **Deep HoriXons: 3D virtual generative AI assisted campus for deep learning AI and cybersecurity** [13058-48]

---

#### CYBERSECURITY AND ENCRYPTION I

---

- 13058 OQ **A look inside of homomorphic encryption for federated learning** [13058-24]
- 13058 OR **Integration of blockchain in smart systems: problems and opportunities for real-time sensor data storage** [13058-25]
- 13058 OS **Neural cryptography: vulnerabilities and attack strategies** [13058-22]

---

#### CYBERSECURITY AND ENCRYPTION II

---

- 13058 OT **Integrated spacecraft autonomous attitude control testbed** [13058-21]

13058 0U **Zero trust decision analysis for next generation networks** [13058-26]

---

**SIGNAL PROCESSING AND SOFTWARE EXECUTION FLOW**

---

13058 0V **The game-changing memristive technology for next-gen AI/ML hardware** [13058-34]

13058 0W **OpenMutt: a low-cost quadruped for student education in research** [13058-35]

13058 0X **CubeSat reaction wheel attitude control platform** [13058-19]

---

**DECEIVER I**

---

13058 0Y **The impact of misinformation on the health of underrepresented youth during public health crises: a preliminary study (Invited Paper)** [13058-36]

13058 0Z **Uncovering deep-rooted cultural differences (UNCOVER) (Invited Paper)** [13058-37]

13058 10 **Debunking warfare narratives: the role of commercial satellites in the Russian-Ukrainian conflict (Invited Paper)** [13058-38]

13058 11 **A lightweight deep learning model for rapid detection of fabricated ENF signals from audio sources (Invited Paper)** [13058-39]

---

**DECEIVER II**

---

13058 12 **Generative adversarial networks-based AI-generated imagery authentication using frequency domain analysis (Invited Paper)** [13058-40]

13058 13 **Video modification in drone and satellite imagery (Invited Paper)** [13058-41]

13058 15 **Continuous time systems disruptive signal processing and accurate real time signal reconstruction** [13058-32]

---

**DIGITAL POSTER SESSION**

---

13058 17 **The convergence of control and cognition: a bibliometric overview of UKF in AI-infused robotics** [13058-43]

13058 18 **Load balancing algorithms in SDN networks with multiple servers** [13058-44]

13058 19 **Multi-interface mobile gateways for LPWAN-based air pollution monitoring** [13058-45]



# Conference Committee

## *Symposium Chairs*

**Tien Pham**, The MITRE Corporation (United States)  
**Douglas R. Droege**, L3Harris Technologies, Inc. (United States)

## *Symposium Co-chairs*

**Ann Marie Raynal**, Sandia National Laboratories (United States)  
**Ravi Ravichandran**, BAE Systems (United States)

## *Program Track Chair*

**Latasha Solomon**, DEVCOM Army Research Laboratory  
(United States)

## *Conference Chairs*

**Misty Blowers**, Datalytica (United States)  
**Bryant T. Wysocki**, Air Force Research Laboratory (United States)

## *Conference Co-Chair*

**Gaby Rossi**, Datalytica (United States)

## *Conference Program Committee*

**Yu Chen**, Binghamton University (United States)  
**Brian Crooks**, Datalytica (United States)  
**Michael L. Fanto**, Air Force Research Laboratory (United States)  
**Russell D. Hall**, Zel Technologies, LLC (United States)  
**Chin-tser Huang**, University of South Carolina (United States)  
**Nelson Jaimes**, The George Washington University (United States)  
**Raju Namburu**, DEVCOM Army Research Laboratory (United States)  
**Jon R. Williams**, Datalytica (United States)  
**Andrew Young**, Datalytica (United States)

