## PROCEEDINGS OF SPIE

## Real-time Processing of Image, Depth, and Video Information 2025

Gian Domenico Licciardo Matthias F. Carlsohn Viktor J. Schneider Editors

7–10 April 2025 Prague, Czech Republic

Sponsored by SPIE

Cosponsored by
The Imaging Source Europe GmbH (Germany)
ELI Beamlines, ELI-ELRIC (Czech Republic)
Inprentus, Inc. (United States)
CeramOptec® (Latvia)

Cooperating Organisations
HiLASE (Czech Republic)
AWE (United Kingdom)
Czech and Slovak Optical Society (Czech Republic)

Published by SPIE

**Volume 13526** 

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 SPIEDigitalLibrary.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 *Real-time Processing of Image, Depth, and Video Information 2025*, edited by Gian Domenico Licciardo, Matthias F. Carlsohn, Viktor J. Schneider, Proc. of SPIE 13526, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510688483

ISBN: 9781510688490 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

Copyright © 2025 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. 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.



**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**

v Conference Committee vii Introduction

## LOW-POWER EDGE DEVICES AND RISC-V PLATFORMS

13526 02	Self-supervised event representations: towards accurate, real-time perception on SoC FPGAs [13526-1]
13526 03	Towards real-time LiDAR processing on RISC-V-based ASIPs: fast trigonometric approximations via parabolic synthesis [13526-2]
13526 04	In-memory computing accelerator for real-time image processing on the edge [13526-3]
13526 05	Beyond von Neumann: fundamental limitations of current compute architectures for real-time image processing (Best Paper Award) [13526-4]
13526 06	Implementation of a despeckling in SAR and OCT images using lightweight CNN [13526-5]
	APPLICATIONS OF ARTIFICIAL INTELLIGENCE AND DEEP LEARNING
13526 07	Intelligent video surveillance for early drowning detection using deep learning [13526-6]
13526 08	Vision for the blind: a deep learning approach to object recognition and accessibility [13526-7]
13526 09	Automatic classification of skin lesions based on semantic segmentation [13526-8]
13526 0A	Deepfakes image detection using a SVM algorithm based on texture features analysis [13526-9]
	INNOVATIONS IN IMAGING TECHNOLOGIES AND SENSORS
13526 OB	Bird protection at wind turbines using 3D tracking [13526-10]
13526 OC	A handheld multisensory scanner system with real-time mapping and data processing for building survey applications [13526-11]
13526 0D	Real-time crosstalk compensation in multizone Time-of-Flight sensors [13526-12]

	13526 OE	Simultaneous measurement of color and depth images at 1,000 fps based on a parallel-bus pattern [13526-13]
	13526 OF	Research on UV image processing technology for high voltage line inspection [13526-14]
	13526 0G	Artificial intelligence for real-time processing of high-contrast images for exoplanet detection during active wavefront sensing and control [13526-15]
_		HYBRID AND MULTI-MODAL DATA PROCESSING
	13526 OH	Hybrid deep learning with optical 4f correlator: simulation and performance analysis (Best Student Paper Award) [13526-16]
	13526 OI	Comparative analysis of real-time surface image texture reconstruction for avatars in virtual scenes development [13526-18]
	13526 OJ	A photoluminescence-based defect detection system for solar cell in wide illumination ranges [13526-19]
		PROCESSING FOR EXTREME AND ADVERSE CONDITIONS
	13526 OL	Satellite material segmentation using multispectral imaging for space domain awareness [13526-21]
	13526 OM	The image fusion algorithm of single-photon LiDAR and medium wave infrared thermal imager for far weak small target $[13526\text{-}22]$
_		POSTER SESSION
_	13526 ON	Chaotic system-based image watermarking for medical data protection [13526-23]
	13526 00	Enhancing lung cancer detection with hybrid CNN models [13526-24]