PROCEEDINGS OF SPIE

SPIE Future Sensing Technologies

Masafumi Kimata Joseph A. Shaw Christopher R. Valenta Editors

9–13 November 2020 Online Only, Japan

Sponsored and Published by SPIE

Volume 11525

Proceedings of SPIE 0277-786X, V. 11525

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 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 SPIE Future Sensing Technologies, edited by Masafumi Kimata, Joseph A. Shaw, Christopher R. Valenta, Proceedings of SPIE Vol. 11525 (SPIE, Bellingham, WA, 2020) Sevendigit Article CID Number.

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

ISBN: 9781510638617 ISBN: 9781510638624 (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 © 2020, 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 \$21.00 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/20/\$21.00.

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: 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

KEYNOTE SESSION

11525 03 High-responsivity graphene infrared photodetectors based on photogating (Keynote Paper) [11525-101]

SENSING FOR SAFETY/SECURITY

11525 04 Distance measurement based on two-photon absorption process in Si-avalanche photodiode with pulsed reference light [11525-2] 11525 05 Sensitivity enhancement of distributed Brillouin fiber optic sensing using two-frequency pump and probe [11525-3] 11525 06 Bridge monitoring and assessment by high-resolution satellite remote sensing technologies [11525-4] 11525 07 Receiver operating characteristics analysis of Surface Enhanced Raman Spectroscopy (SERS) sensors [11525-5] 11525 08 Real-time laser displacement measurement based on intensity correlation with phasemodulated signal and its measurement range extension [11525-6] 11525 0A Rapid quality assessment of food samples through biosensors [11525-8] 11525 OB FOTAS (Fiber Optic Based Acoustic Sensing System): requirements, design, implementation, tests and results [11525-9] 11525 OC Development of novel integrated in-line inspection techniques for pipeline inspection [11525-10]

NEXT GENERATION TECHNOLOGY

- 11525 OE GaN laser diodes for quantum sensing [11525-12]
- 11525 0F Manifestation of an ultra-high sensitive fiber optic microbend sensor realized by shining a Bessel-Gauss beam [11525-13]
- 11525 0G Two entangled electrons (photons) microscopy [11525-14]
- 11525 0I G-CoReCCD: a GPU-based simulator of the charge transport in fully-depleted CCDs [11525-16]

11525 0J Characterization of surface plasmon resonance detection based on the colocalization effect inside metallic nanogap [11525-97]

LIDAR AND ACTIVE ELECTRO-OPTICAL SYSTEMS

11525 0M	Self-calibration of sensors using point cloud feature extraction [11525-17]
11525 ON	A rail extraction algorithm based on the generalized neighborhood height difference from mobile laser scanning data [11525-18]
11525 0O	Building contour extraction from Airborne LIDAR point cloud for Digital Line Graphic [11525-19]
11525 OP	The use of statistical mixture models to reduce noise in SPAD images of fog-obscured environments [11525-20]
11525 OQ	Object ranging and sensing by temporal cross-correlation measurement [11525-21]
11525 OR	Automatic laser power suggestion algorithm for active range gating system using Matlab and Scilab [11525-22]
	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
11525 OS	Anomaly detection using 1D convolutional neural networks for surface enhanced raman scattering [11525-23]
11525 0V	SAMA-VTOL: a new unmanned aircraft system for remotely sensed data collection [11525-26]
11525 OW	AI based prediction of daily rainfall from satellite observation for disaster management [11525-27]
11525 OX	High-speed image-free target detection and classification in single-pixel imaging [11525-28]
11525 OY	Optical multi-band detection of unmanned aerial vehicles with YOLO v4 convolutional neural network [11525-85]
	HYPERSPECTRAL AND ENVIRONMENTAL SENSING
11525 OZ	Hyperspectral band selection for food fraud application using self-organizing maps (SOM) [11525-29]
11525 10	Hyperspectral imaging for VIS-SWIR classification of post-consumer plastic packaging products by polymer and color [11525-30]
11525 12	Probe-based hyperspectral imager for crop monitoring [11525-32]

11525 13	Standoff mid-infrared reflectance spectroscopy using quantum cascade laser for mineral identification [11525-33]

- 11525 14 Suggestion for fine and coarse particle size and total volumes extraction methods from the two extinctions and PM information [11525-34]
- 11525 15 Spatial water quality and plastic buoy of seaweed culture in coastal area, Indonesia [11525-35]
- 11525 16 Research of periodical and non-periodical features of electric field components near Nalchik [11525-87]

EO/IR SYSTEMS

- 11525 18 Design of passive athermalized objective lens in 1-5 µm wave band [11525-36]
- 11525 19 A solution for future single-electron-counting fast-readout Skipper-CCD experiments: high channel density front-end electronics design and noise performance analysis [11525-37]
- 11525 1A High performance Van der Waals heterostructure photodetectors based on black phosphorus [11525-38]
- 11525 1B The design of 3-mirror off-axis optical system with stray light analysis based on vector aberration theory [11525-39]
- 11525 1C AOTF transmission shaping for spectral polarimetric imaging [11525-40]
- 11525 1D Retrieval of the polarization ellipse of a THz-wave from precision measurements of lightshifts with cold trapped HD+ [11525-41]

SENSOR PROCESSING AND DATA FUSION

- 11525 1G Optical measurements with stereoscopic shadows [11525-43]
- 11525 1H Light field image restoration in low-light environment [11525-44]
- 11525 11 Fractional fourier transform based imaging algorithm for near-range radar and discretisation formats [11525-45]
- 11525 1J A frequency spectrum-based processing framework for the assessment of tree root systems [11525-46]
- 11525 1L A spatiotemporal framework for human indoor activity monitoring [11525-48]
- 11525 1M Clustering and visualization of long-term data on thunderstorms for the North Caucasus [11525-49]
- 11525 1N Spoof detection for fake biometric images using feature-based techniques [11525-50]

- 11525 10 Colour weight maps in visible and NIR image fusion [11525-51]
- 11525 1P How image capturing setups influence the quality of SfM reconstructions for wind turbine blade inspection [11525-52]
- 11525 1Q Quantitative imaging of the resonator shape in the bundengan musical instrument [11525-53]

POSTER SESSION

11525 1S	Detection of acoustic signals from Distributed Acoustic Sensor data with Random Matrix Theory and their classification using Machine Learning [11525-55]
11525 1U	Adaptive statistical inferential methods for information processing [11525-57]
11525 1V	A computational approach of interval estimation for information processing [11525-58]
11525 1W	Ultrafast NIR-SWIR lasers with transient stimulated Raman chirped pulse amplification for advanced LIDARs [11525-59]
11525 1X	Design considerations for "lifetime enhancement of long range continuous IR zoom lens" [11525-60]
11525 1Y	An investigation of deep learning algorithms applied to automated diagnosis for diabetic retinopathy [11525-61]
11525 1Z	Real time monitoring of human respiration rate using infrared thermography [11525-62]
11525 21	Bessel ultrasonic probe for large depth of field using conical acoustic lens [11525-64]
11525 22	Fusion of infrared and visible images through multi-level co-occurrence filtering [11525-65]
11525 23	High-resolution remote range detection method based on uncompensated FMCW sources for low-cost FMCW LIDAR [11525-66]
11525 25	Very low cost LCD-based optical spatial phase modulator [11525-68]
11525 26	Lightfield imaging for industrial applications [11525-69]
11525 27	Compact four element triple field-of-view MWIR optical module [11525-70]
11525 28	Assessment of spatial optical trapping with digital holographic sensing for biological micro- particles studying [11525-71]
11525 29	On the features of the interference of a set of single charged optical vortices for non-contact surface roughness analysis [11525-72]
11525 2E	Fast focus-scanning optical-resolution photoacoustic microscopy with extended depth of field [11525-77]

11525 2F	Large volumetric optical-resolution photoacoustic microscopy based on contourlet transform fusion [11525-78]
11525 2G	Post communication data transmission by entangled photons having high data security [11525-79]
11525 2H	Several innovative methods to generate optical clock pulses by optical fiber coupler and optical saturable absorber [11525-80]
11525 2l	The test of the 4K sCMOS camera for astronomical application [11525-81]
11525 2J	Simulation study of interaction of pulse laser with brain using COMSOL [11525-82]
11525 2K	Transmission of photons in mouse brain using Monte Carlo method: simulation study [11525-83]
11525 2L	Distinction of bloods based on photoacoustic spectroscopy combined with PCA-LDA algorithm [11525-84]
11525 2M	Bessel-beam photoacoustic microscopy based on k-space pseudospectral method: simulation study [11525-88]
11525 2N	Deconvolution optical-resolution photoacoustic microscope for high-resolution imaging of brain [11525-89]
11525 2O	Optimization method to eliminate the influence of the conical acoustic lens on the transmission of laser beam using ZEMAX [11525-90]
11525 2P	Denoising method for photoacoustic microscopy using deep learning [11525-91]
11525 2Q	Three-dimensional large volumetric photoacoustic microscopy using Airy-beam [11525-92]
11525 2R	Multifocus optical-resolution photoacoustic microscope for large volumetric imaging using tunable acoustic gradient lens and optical delay method [11525-93]
11525 2S	Performance characteristics and permittivity modeling of a surface plasmon resonance sensor for metal surface monitoring in a synthetic maritime environment [11525-94]
11525 2T	Environmental temperature and material characterisation of planar evanescent microwave sensors for environmental analysis [11525-95]
11525 2U	Experimental modelling with theoretical validation of liquid crystal display elements for UAV optimal (optical) stealth [11525-96]
11525 2V	Crop seed classification based on a real-time convolutional neural network [11525-98]
11525 2W	Developing the kinematic model of the EOS scanning [11525-99]