PROCEEDINGS OF SPIE

Multimodal Sensing: Technologies and Applications

Ettore Stella Shahriar Negahdaripour Dariusz Ceglarek Christian Möller Editors

26–27 June 2019 Munich, Germany

Sponsored by SPIE

Cooperating Organsations ELI Beamlines (Czech Republic) HiLASE (Czech Republic) Laserlab Europe European Optical Society

Published by SPIE

Volume 11059

Proceedings of SPIE 0277-786X, V. 11059

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 *Multimodal Sensing*: Technologies and Applications, edited by Ettore Stella, Shahriar Negahdaripour, Dariusz Ceglarek, Christian Möller, Proceedings of SPIE Vol. 11059 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

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

ISBN: 9781510627970 ISBN: 9781510627987 (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 © 2019, 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/19/\$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

- vii Authors
- ix Conference Committee

MULTIMODAL SENSING FOR SURVEILLANCE

- 11059 03 Radar for indoor surveillance: state of art and perspectives (Invited Paper) [11059-2]
- 11059 04 Microwave imaging through an unknown wall by a MIMO configuration and SVD approach [11059-3]
- 11059 05 **Radiometer effectiveness in real cases for disclosing stealth** [11059-4]
- 11059 06 Passive radar for measuring passive sensors: direct signal interference suppression on FPGA using orthogonal matching pursuit and stochastic gradient descent [11059-5]

HOLOGRAPHY TECHNOLOGY: JOINT SESSION

- 11059 07 Time resolved digital holography applied to droplets fragmentation by shockwave (Invited Paper) [11059-6]
- 11059 08 How holographic imaging can improve machine learning [11059-7]

MULTIWAVE LIGHT TECHNOLOGY

- 11059 09 Automated visual inspection of friction stir welds: a deep learning approach [11059-8]
- 11059 0A Multi-wave light technology enabling closed-loop in-process quality control for automotive battery assembly with remote laser welding (Invited Paper) [11059-9]
- 11059 0B **3D convolutional neural networks to estimate assembly process parameters using 3D** point-clouds [11059-10]
- 11059 0C Model-based interfacing of large-scale metrology instruments [11059-11]
- 11059 OE Robust principal component analysis of ultrasonic sectorial scans for defect detection in weld inspection [11059-13]

MULTIMODAL SENSING FOR INFRASTRUCTURE MONITORING

- 11059 OF UAV radar imaging for target detection (Invited Paper) [11059-14]
- 11059 0H Study of complementary multi-sensors data influence on infrared thermography measurements for in situ long-term monitoring [11059-16]
- 11059 01 Automatic network-level bridge monitoring by integration of InSAR and GIS catalogues [11059-17]
- 11059 0J Methodology for utilization of a generalised antenna in gprMax simulator [11059-18]

HYPERSPECTRAL IMAGING APPLICATIONS

- 11059 0K Palm-sized and tough two-dimensional spectroscopic imager: the so-called hyperspectral camera for visible and mid-infrared light. Proposal of plant-species identification regardless of zenith and azimuth angles based on only two types of basic spectroscopic data (near-surface and internal reflectance) [11059-31]
- 11059 0L Unsupervised feature extraction based on improved Wasserstein generative adversarial network for hyperspectral classification [11059-32]
- 11059 0M Target detection based on classification in shadow region of hyperspectral image [11059-33]

MACHINE LEARNING APPLICATIONS

- 11059 OP **Multimodal data fusion for object recognition** [11059-19]
- 11059 OR Challenges of designing hand recognition for a manual assembly assistance system [11059-21]
- 11059 0S Convolutional neural networks for recognition and segmentation of aluminum profiles [11059-22]
- 11059 0T Scene disparity estimation with convolutional neural networks [11059-23]
- 11059 0U Image acquisition, evaluation and segmentation of thermal cutting edges using a mobile device [11059-24]

MULTIMODAL SENSING APPLICATIONS

- 11059 0Y An effective approach for 3D point cloud registration in railway contexts [11059-28]
- 11059 0Z Multiple honey bees tracking and trajectory modeling [11059-29]

11059 10 New applications of electronic speckle pattern interferometry in novel materials and structures [11059-30]

POSTER SESSION

11059 12	Study of the 360° light field display [11059-37]
11059 13	A full Stokes imaging polarimeter based on a consumer CMOS camera [11059-38]
11059 14	Power law scaling of test error versus number of training images for deep convolutional neural networks [11059-39]
11059 15	Research on real-time tracking algorithm of weld seam based on Fourier transform profilometry [11059-40]
11059 16	Research of spatial alignment techniques for multimodal image fusion [11059-41]
11059 17	Predictive models for abundance estimation and distribution maps of the striped dolphin Stenella coeruleoalba and the bottlenose dolphin Tursiops truncatus in the Northern Ionian Sea (North-eastern Central Mediterranean) [11059-42]
11059 18	An electro-optical system for transverse displacement measurement with rotation parameters estimation of the measurement unit [11059-43]
11059 1A	Floor-integrated optical fall detector for frail people [11059-45]