

PROGRESS IN BIOMEDICAL OPTICS AND IMAGING

Vol. 19 No. 19

Optics and Biophotonics in Low-Resource Settings IV

**David Levitz
Aydogan Ozcan
David Erickson**
Editors

**27–28 January 2018
San Francisco, California, United States**

Sponsored and Published by
SPIE

Volume 10485

Proceedings of SPIE 0277-786X, V. 10485

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

Optics and Biophotonics in Low-Resource Settings IV, edited by David Levitz, Aydogan Ozcan, David Erickson
Proc. of SPIE Vol. 10485, 1048501 · © 2018 SPIE · CCC code: 1605-7422/18/\$18 · doi: 10.1117/12.2322647

Proc. of SPIE Vol. 10485 1048501-1

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.

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 *Optics and Biophotonics in Low-Resource Settings IV*, edited by David Levitz, Aydogan Ozcan, David Erickson, Proceedings of SPIE Vol. 10485 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 1605-7422
ISSN: 1996-756X (electronic)

ISBN: 9781510614550
ISBN: 9781510614567 (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 © 2018, 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 \$18.00 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/18/\$18.00.

Printed in the United States of America.

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

**SPIE. DIGITAL
LIBRARY**

SPIDigitalLibrary.org

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

- v *Authors*
vii *Conference Committee*

SMARTPHONE BASED OPTICAL INSTRUMENTS

- 10485 02 **Smartphone-based assessment of blood alteration severity** [10485-1]

MACHINE LEARNING IN IMAGING, SENSING AND DIAGNOSTICS

- 10485 07 **Characterization of cervigram image sharpness using multiple self-referenced measurements and random forest classifiers** [10485-6]
- 10485 08 **Image processing and machine learning techniques to automate diagnosis of Lugol's iodine cervigrams for a low-cost, point-of-care, digital colposcope** [10485-7]
- 10485 0A **Automatic and accurate segmentation of cerebral tissues in fMRI dataset with combination of image processing and deep learning** [10485-9]

LOW-COST AND MOBILE SPECTRAL IMAGING AND SENSING

- 10485 0C **Hyperspectral imaging with near-infrared-enabled mobile phones for tissue oximetry** [10485-11]
- 10485 0D **Scattering and absorption measurements of cervical tissues measures using low cost multi-spectral imaging** [10485-12]
- 10485 0F **Detecting adulterants in milk with lower cost mid-infrared and Raman spectroscopy** [10485-14]

FLUORESCENCE-BASED IMAGING AND SENSING METHODS

- 10485 0K **Design and development of a simple, low-cost, UV-fluorescence multi-spectral imaging system** [10485-19]
- 10485 0M **Smartphone-based fluorescence spectroscopy device aiding in preliminary skin screening** [10485-21]
- 10485 0N **A portable microscopy system for fluorescence, polarized, and brightfield imaging** [10485-22]

EMERGING TECHNOLOGIES

- 10485 OT **Spatial mapping and analysis of aerosols during a forest fire using computational mobile microscopy** [10485-29]
- 10485 OU **Low cost thermal camera for use in preclinical detection of diabetic peripheral neuropathy in primary care setting** [10485-30]
- 10485 OV **Smartphone-coupled rhinolaryngoscopy at the point of care** [10485-31]
- 10485 OW **Light assisted drying (LAD) for protein stabilization: optical characterization of samples** [10485-32]

COMPUTATIONAL IMAGING AND SENSING

- 10485 OZ **3D on-chip microscopy of optically cleared tissue** [10485-35]
- 10485 10 **On-chip ultraviolet holography for high-throughput nanoparticle and biomolecule detection** [10485-36]

POSTER SESSION

- 10485 14 **Smartphone-based grading of apple quality** [10485-40]
- 10485 16 **Comparison of low-cost handheld retinal camera and traditional table top retinal camera in the detection of retinal features indicating a risk of cardiovascular disease** [10485-42]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Asiedu, Mercy Nyamewaa, 08
Assia, Shai, 0V
Bai, Bijie, 0T
Bar-Am, Kfir, 0D
Ben-Or, Yau, 07
Bernat, Amir S., 0D
Bitan, Gal, 10
Bolton, Frank J., 0D, 0V
Burge, M., 0U
Calder, C., 0U
Carmichael, J., 0U
Cataldo, Leigh, 0D
Champlin, Cary, 07
Chaudhary, Usamah, 08
Chen, Cheng, 0T
Chen, Harrison, 0Z
Chen, Yu, 0C
Coker, Zachary, 0K
Connett, Marie, 0F
Coté, Gerard, 0N
Daloglu, Mustafa Ugur, 10
Das, Anshuman, 0M
Ebrahim, E., 16
Elliott, Gloria D., 0W
Ghassemi, Pejman, 0C
Gordon, Paul, 0N
Gorocs, Zoltán, 10
Horning, Matt, 07
Hu, Liming, 07
Jaiswal, Mayoore S., 07
Jarry, Z., 0U
Joshi, V., 0U, 16
Kahn, Bruce S., 0D
Keller, Matthew D., 0F
Kong, Zhenglun, 0A
Kulkarni, Rajan P., 0Z
Lam, Christopher T., 08
Lee, Changwon, 0F
Levitz, David, 07, 0D, 0V
Lewis, Cody, 0N
Li, Ting, 02, 0A, 14
Li, Wei, 02
Li, Xianglin, 02, 14
Lin, Jonathan L., 0C
Luo, Junyi, 0A
Luo, Yi, 0T
Malik, Ravinder, 10
Manivannan, N., 0U
McKinnon, Madison E., 0W

McLeod, Euan, 10
Mertens-Talcoff, Susanne U., 0N
Mink, Jonah, 0V
Mueller, Jenna, 08
Nemeth, S., 16
Ozcan, Aydogan, 0T, 0Z, 10
Peterson, Curtis W., 0V
Pfefer, Joshua, 0C
Ramanujam, Nimmi, 08
Ray, Aniruddha, 10
Rivenson, Yair, 0Z
Sahoo, Aparajita, 0M
Sapiro, Guillermo, 08
Schmitt, John W., 08
Sebag, Cathy M., 0V
Shiledar, Ashutosh, 0T
Shin, Yoonjung, 0Z
Simhal, Anish, 08
Simon, J., 0U
Soliz, P., 0U, 16
Sung, Kevin, 0Z
Tamamitsu, Miu, 0T
Teng, Da, 0Z
Tovar, Carlos, 0K
Trammell, Susan R., 0W
Vahtel, M., 0U
Venancio, Vinicius Paula, 0N
Wahi, Akshat, 0M
Wang, Hongda, 0Z
Wang, Wenbo, 0F
Wattinger, Rolla, 0N
Wiggdahl, J., 16
Wilson, Benjamin K., 07, 0F
Wong, Jeffrey, 0T
Wu, Yichen, 0T
Xiong, Matthew, 10
Xu, Shengpu, 0A
Xue, Jiaxin, 0Z
Yakovlev, Vladislav V., 0K
Yang, Sam, 0Z
Young, Madison A., 0W
Zamora, G., 0U, 16
Zhang, Yibo, 0T, 0Z

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology
(United States)

R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts
General Hospital (United States) and Harvard Medical School
(United States)

Program Track Chairs

Tuan Vo Dinh, Fitzpatrick Institute for Photonics, Duke University
(United States)

Anita Mahadevan-Jansen, Vanderbilt University (United States)

Conference Chairs

David Levitz, MobileODT (Israel)

Aydogan Ozcan, University of California, Los Angeles (United States)

David Erickson, Cornell University (United States)

Conference Program Committee

Gerard L. Coté, Texas A&M University (United States)

Wolfgang Drexler, Medizinische Universität Wien (Austria)

Matthew D. Keller, Intellectual Ventures Laboratory (United States)

Anita Mahadevan-Jansen, Vanderbilt University (United States)

Chetan A. Patil, Temple University (United States)

Nirmala Ramanujam, Duke University (United States)

Avi Rasooly, National Institutes of Health (United States)

Eric A. Swanson, OCT News (United States)

Sebastian Wachsmann-Hogiu, McGill University (Canada)

Ian M. White, University of Maryland, College Park (United States)

Session Chairs

- 1 Smartphone Based Optical Instruments

Gerard L. Coté, Texas A&M University (United States)

- 2 Machine Learning in Imaging, Sensing and Diagnostics

Matthew D. Keller, Intellectual Ventures Laboratory (United States)

- 3 Low-Cost and Mobile Spectral Imaging and Sensing
David Levitz, MobileODT Ltd. (Israel)
- 4 Low-Cost and Compact OCT Instrumentation
Eric A. Swanson, Acacia Communications Inc. (United States)
- 5 Fluorescence-Based Imaging and Sensing Methods
David Levitz, MobileODT Ltd. (Israel)
- 6 Optical Methods in Lab-on-a-Chip and Point of Care Applications
Aydogan Ozcan, University of California, Los Angeles (United States)
- 7 Emerging Technologies
Yair Rivenson, University of California, Los Angeles (United States)
- 8 Computational Imaging and Sensing
Chetan A. Patil, Temple University (United States)