# Optics and Biophotonics in Low-Resource Settings V

David Levitz Aydogan Ozcan Editors

2–3 February 2019 San Francisco, California, United States

Sponsored and Published by SPIE

**Volume 10869** 

Proceedings of SPIE, 1605-7422, V. 10869

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

Optics and Biophotonics in Low-Resource Settings V, edited by David Levitz, Aydogan Ozcan, Proc. of SPIE Vol. 10869, 1086901 · © 2019 SPIE · CCC code: 1605-7422/19/\$18 · doi: 10.1117/12.2531667

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 *Optics and Biophotonics in Low-Resource Settings V*, edited by David Levitz, Aydogan Ozcan, Proceedings of SPIE Vol. 10869 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510623804

ISBN: 9781510623811 (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 \$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 1605-7422/19/\$18.00.

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**

v vii	Authors Conference Committee
	EMERGING TECHNOLOGIES
10869 04	One-shot Stokes polarimetry for low-cost skin cancer detection [10869-3]
10869 06	Optical breast spectroscopy as a pre-screening tool to identify women who benefit most from mammography [10869-5]
	TOMOGRAPHIC METHODS
10869 OB	A tabletop Diffuse Optical Tomographic (DOT) experimental demonstration system [10869-11]
	MACHINE LEARNING I
10869 OD	Image quality assessment and improvement in a smartphone device with an auxiliary lens [10869-13]
	SMARTPHONE-BASED IMAGING AND SENSING TECHNOLOGIES I
10869 OM	Dotlens smartphone microscopy and nano-colorimetry [10869-22]
10869 00	Development and testing of a smartphone adapter for image quality assurance and whole slide imaging [10869-24]
	POINT OF CARE TECHNOLOGIES
10869 0\$	Compact modules for off-axis holography in microfluidics: features and design solutions [10869-28]
10869 OU	Effect of light-assisted drying (LAD) on protein functionality [10869-30]

10869 OV A nanophotonic-based assay for point-of-care medical diagnostics of malaria in low and middle income countries [10869-46] **OXIMETRY AND SPECTRAL METHODS** 10869 11 Assessing changes in oxygen saturation using a low cost multi-spectral imaging system [10869-36] 10869 12 Low-cost smartphone based imaging device to detect subsurface tissue oxygenation of wounds [10869-37] 10869 13 A low cost mobile controlled CW-NIRS absolute oximeter to prevent child mortality in low-income countries [10869-38] 10869 17 Preliminary study of canine oral cancer by Raman spectroscopy [10869-42] 10869 18 Reliability of vital parameter sensors in harsh environments [10869-43] **POSTER SESSION** 

Smartphone-based quantitative reader for detection of food-borne bacteria by lateral flow

İ۷

10869 1A

assay [10869-45]

# **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.

Almog, Yaniv, 0D Alonso, Miguel, 12 Ansermino, J. Mark, 13 Arunasalam, Aliyah, 00 Askari, Shahbaz, 13 Bae, Euiwon, 1A Bar-Am, Kfir, 0O, 11 Beaudry, Shaylene, 13 Beckers, Ingeborg E., 18 Bendale, Kiran, 17 Bernat, Amir S., 0D, 0O, 11 Bhujbal, Mithila, 17 Bianco, V., OS Bolton, Frank J., OD, OO, 11

Cacace, T., OS

Chaudhari, Pradeep, 17

Cohen, Miri, 0D

De Silva Indrasekara, Agampodi Swarnapali, 0V

Deering, Amanda, 1A Dumont, Guy A., 13 Dunsmuir, Dustin, 13 Elliott, Gloria D., 0U Elminger, Whitney, 00 Ferraro, P., OS

Freedman, Elizabeth, OV Gera, Poonam, 17

Godavarty, Anuradha, 12

Heo, Yoojung, 1A Hole, Arti, 17

Jacques, Steven L., 11 Jünemann, Sebastian, 18

Jung, Youngkee, 1A

Kaile, Kacie, 12

Kalia, Sunil, 04

Kanhirodan, Rajan, OB

Kauer, Josef, 18 Klimt, Moritz, 18

Krefting, Dagmar, 18

Kumar, Piyush, 17

Kumbakumba, Elias, 13

Lee, Tim K., 04

Lee, Walter T., 0V

Leiva, Kevin, 12

Levitz, David, 0D, 0O, 11

Lilge, Lothar, 06

Liublin, Wjatscheslaw, 18

Louie, Daniel C., 04

Lui, Harvey, 04

Mahadevan, Jagadeesh, 12

Mandracchia, B., OS Mohan, Vishwanathan, 12 Murali Krishna, C., 17

Napoleone, Gabrielle, 13

Ngo, Hoan T., OV Nauven, Hoana, 0M Olbrich, Sebastian, 18 Pagano, Roberto, 13

Pagliarulo, V., OS Paturzo, M., OS

Petersen, Christian, 13 Saikia, Manob Jyoti, OB

Sebag, Cathy, 00 Shih, Wei-Chuan, 0M Strobbia, Pietro, OV

Taylor, Steve M., 0V Tchvialeva, Lioudmila, 04

Trammell, Susan R., OU

Tsah, David, 0D V., Ramnarayan, 12

Vo-Dinh, Tuan, 0V Vohra, Priya, 0V Walter, E. Jane, 06

Weiser, Reuven, 0D

Wiens, Matthew O., 13 Young, Madison A., 0U

# **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)

# Symposium Co-chairs

**Jennifer K. Barton**, The University of Arizona (United States) **Wolfgang Drexler**, Medical University of Vienna (Austria)

## **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)

#### Conference Program Committee

David Erickson, Cornell University (United States)
Gerard L. Coté, Texas A&M University (United States)
Wolfgang Drexler, Medical University of Vienna (Austria)
Matthew D. Keller, Intellectual Ventures Laboratory (United States)
Avi Rasooly, National Institutes of Health (United States)
Anita Mahadevan-Jansen, Vanderbilt University (United States)
Chetan A. Patil, Temple University (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

- Emerging Technologies
   David Levitz, MobileODT Ltd. (Israel)
- 2 Tomographic Methods Hatice Ceylan Koydemir, University of California, Los Angeles (United States)

- 3 Machine Learning I Yair Rivenson, University of California, Los Angeles (United States)
- 4 Machine Learning II

  David Levitz, MobileODT (Israel)
- Smartphone-Based Imaging and Sensing Technologies I
   Zoltán S. Göröcs, University of California, Los Angeles (United States)
- 6 Point of Care Technologies

  Matthew D. Keller, Intellectual Ventures Laboratory (United States)
- 7 Smartphone-Based Imaging and Sensing Technologies II **Yair Rivenson**, University of California, Los Angeles (United States)
- 8 Oximetry and Spectral Methods
  Anita Mahadevan-Jansen, Vanderbilt University (United States)