PROCEEDINGS OF SPIE

Diffuse Optical Spectroscopy and Imaging IX

Davide Contini Yoko Hoshi Thomas D. O'Sullivan Editors

25–28 June 2023 Munich, Germany

Sponsored by SPIE

Co-sponsored by Optica (United States)

Published by SPIE

Volume 12628

Proceedings of SPIE 0277-786X, V. 12628

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

Diffuse Optical Spectroscopy and Imaging IX, edited by Davide Contini, Yoko Hoshi, Thomas D. O'Sullivan, Proc. of SPIE Vol. 12628, 1262801 © 2023 SPIE · 0277-786X · doi: 10.1117/12.3005459 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 *Diffuse Optical Spectroscopy and Imaging IX*, edited by Davide Contini, Yoko Hoshi, Thomas D. O'Sullivan, Proc. of SPIE 12628, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510664654 ISBN: 9781510664661 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2023 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

ix Conference Committee

CLINICAL AND PRECLINICAL APPLICATIONS OF DIFFUSE OPTICS I

12628 06 Non-invasive monitoring of canine tissue hemodynamics undergoing a hyperbaric chamber treatment (HBO₂) by time domain near infrared spectroscopy [12628-5]

CLINICAL AND PRECLINICAL APPLICATIONS OF DIFFUSE OPTICS II

- 12628 07 Initial examples of the SOLUS multimodal potential [12628-6]
- 12628 08 Evaluation of neoadjuvant chemotherapy-induced changes in contralateral healthy breast tissue through diffuse optical spectroscopy [12628-7]
- 12628 0A Daily monitoring of CT26 murine tumor model using hyperspectral imaging and optical profilometry [12628-9]
- 12628 0B Colorectal cancer surgical guidance by using diffuse reflectance spectroscopy [12628-10]

CEREBRAL HEMODYNAMICS AND NEURAL ACTIVITY I

- 12628 0D Classification of brain injury severity using a hybrid broadband NIRS and DCS instrument with a machine learning approach [12628-12]
- 12628 OF Cerebral hemodynamics monitoring during extracorporeal membrane oxygenation in piglets [12628-14]

CEREBRAL HEMODYNAMICS AND NEURAL ACTIVITY II

- 12628 0H Assessing TD fNIRS capability to detect hemodynamic oscillations in cerebral cortex [12628-16]
- 12628 01 Cerebral resting state oscillations study with TD fNIRS [12628-17]
- 12628 0K Scalp-based parcellation for longitudinal fNIRS studies [12628-19]

CEREBRAL HEMODYNAMICS AND NEURAL ACTIVITY III

- 12628 0M Effects of red blood cell transfusion on neonatal cerebral hemodynamics: a TD-NIRS and DCS study [12628-21]
- 12628 OP Importance of depth-enhanced optical methods for measuring cerebral hemodynamics during transient hypotension [12628-24]

THEORY, ALGORITHMS AND MODELING I

- 12628 0Q Evaluation of hyperspectral imaging measurements of changes in hemoglobin oxygenation and oxidation of cytochrome-c-oxidase using a liquid blood phantom [12628-25]
- 12628 OR Reconstruction of Raman spectra of two-layer diffusive media: model-based approach in time-domain [12628-26]
- 12628 0S Fourier-space evaluation of tissue order in animal models of peritonitis [12628-27]
- 12628 0U Infant head subsurface imaging using high-density diffuse optical tomography [12628-29]
- 12628 0V Forward or backward? comparison of direct inversion and forward optimization techniques for DL-DOT [12628-30]

ADVANCES IN INSTRUMENTATION AND TECHNOLOGY I

12628 0X High density speckle contrast optical tomography system for in vivo imaging of deep tissue blood flow [12628-32]

ADVANCES IN INSTRUMENTATION AND TECHNOLOGY II

- 12628 12 Time-multiplexing approach for fast time-domain near-infrared optical tomography combined with neural-network-enhanced image reconstruction [12628-37]
- 12628 14 Experimental depth estimation of cancer invasion via circularly polarized light scattering [12628-39]

ADVANCES IN INSTRUMENTATION AND TECHNOLOGY III

- 12628 15 **Towards time-domain diffuse optics with extreme photon rate** [12628-40]
- 12628 16 Time-domain diffuse correlation spectroscopy performance at different source-detector

separation [12628-41]

- 12628 18 Use of bioresorbable fibers for interstitial time-domain diffuse optical spectroscopy using fast-gating [12628-43]
- 12628 19 Three-dimensional NIR-II tumor blood vessels and bone imaging using rotational stereo vision in small animals [12628-44]

ADVANCES IN INSTRUMENTATION AND TECHNOLOGY IV

- 12628 1A Short and long-term photostability of 3D printed fluorescent phantoms for near-infrared diffuse optical imaging (Invited Paper) [12628-45]
- 12628 1B A microfluidic-based cerebral perfusion phantom for laser speckle imaging in small animals [12628-46]
- 12628 1C HyperProbe consortium: innovate tumour neurosurgery with innovative photonic solutions [12628-47]
- 12628 1D Automated focus tracking for non-aligned SLOT samples and tomographic jitter correction [12628-48]
- 12628 1E Simulation of light propagation through the maternal abdomen: towards transabdominal fetal pulse oximetry [12628-49]

THEORY, ALGORITHMS AND MODELING II

- 12628 1F The role of spatial preprocessing in deep learning-based DOT [12628-50]
- 12628 1G Hybrid method for solving the radiative transport equation [12628-51]
- 12628 11 Solution of the radiative transport equation for the single scattered radiance of two-layered media [12628-53]
- 12628 1J Development of a tunable dynamical tissue phantom for laser speckle imaging of blood flow [12628-96]

POSTER SESSION

- 12628 1K
 Analytical photon measurement density functions in flat and spherical layered media

 [12628-54]
- 12628 1L Use of derivative diffuse reflectance spectroscopy in CAM assay combined with multivariate analysis as an approach to detect features of vulnerable plaques [12628-55]

12628 1P	Geometrically tunable fast diffuse reflectance spectroscopy for a better understanding of photoplethysmography [12628-59]
12628 1Q	Near infrared diffuse reflectance spectroscopy for fat quantification in non-alcoholic fatty liver disease [12628-60]
12628 1V	Light propagation in scattering media based on Maxwell's equations and on the radiative transfer equation [12628-66]
12628 1X	Theoretical computation of photon mean partial pathlengths in multilayered turbid media [12628-68]
12628 1Y	Laser speckle imaging-assisted disk diffusion test for early estimation of sterile zone radius [12628-70]
12628 1Z	Monte Carlo modeling of photoacoustic guided technique in scattering media [12628-71]
12628 20	Diffuse optical tomography setup using a nanosecond laser [12628-72]
12628 23	Development of a portable diffuse reflectance spectroscopy system between 850 and 1000nm [12628-75]
12628 24	Digital modeling of a heterogeneous and dynamic brain phantom: application to the choice of an RGB camera for intraoperative functional brain mapping studies [12628-76]
12628 26	Identifying chromophore fingerprints of brain tumor tissue on hyperspectral imaging using principal component analysis [12628-78]
12628 27	Laser speckle correlation microscopy system to image microvascular perfusion [12628-79]
12628 28	Influence of the heterogeneity of extracerebral tissues on scalp-cortex correlation of fNIRS for infants [12628-80]
12628 29	Optical characterisation and study of ex vivo glioma tissue for hyperspectral imaging during neurosurgery [12628-81]
12628 2A	Wavelength and illumination angle dependent studies for vein imaging using OpticStudio [12628-82]
12628 2B	Testing novel miniature NIR spectrometers for wearable broadband NIRS devices [12628-83]
12628 2C	A digital instrument simulator to optimize the development of a hyperspectral imaging system for neurosurgery [12628-84]
12628 2D	Accuracy of tissue oxygen saturation measurement with multidistance CW fNIRS: a phantom study [12628-85]
12628 2E	Evaluation of muscle aging with TD NIRS and DCS [12628-86]
12628 2F	Experimental decorrelation requirement for robust estimation of fluorophores using multiple-wavelength excitation fluorescence spectroscopy [12628-87]

12628 2G	Fibre optic probes for hysteroscopic measurement of uterine hypoxia [12628-88]
12628 21	Relation between fluence rate and mean photons pathlengths: an alternative option for Monte Carlo-based calculations of fluence [12628-90]
12628 2J	Validation test of Monte Carlo codes employed in biomedical optics applications [12628-91]
12628 2K	Breast tumor detection using regularized deep-learning diffuse optical tomography [12628-92]
12628 2L	A virtual comparison of different time-of-flight-based diffuse optical spectroscopic techniques [12628-93]
12628 2N	A stochastic differential equation-based Monte Carlo simulation to model light propagation in dynamic turbid media [12628-97]
12628 20	A deep learning approach to enhance the temporal resolution of laser speckle imaging system for blood flow measurement [12628-98]

Conference Committee

Symposium Chairs

Ronald Stroka, Ludwig-Maximillians-University Munich (Germany) **Alex Vitkin**, Ontario Cancer Institute (Canada)

Symposium Co-chairs

 Hamid Deghani, University of Birmingham (United Kingdom)
 Wang-Yuhl William Oh, Korea Advanced Institute of Science and Technology (Korea, Republic of)
 Peter T. C. So, Massachusetts Institute of Technology (United States)

Conference Chairs

Davide Contini, Politecnico di Milano (Italy) Yoko Hoshi, Hamamatsu University School of Medicine (Japan) Thomas D. O'Sullivan, University of Notre Dame (United States)

Conference Programme Committee

Caterina Amendola, Politecnico di Milano (Italy) Wesley B. Baker, The Children's Hospital of Philadelphia (United States) Nienke Bosschaart, Universiteit Twente (Netherlands) **Regine Choe**, University of Rochester (United States) Jean-Marc Dinten, MINATEC (France) Adam T. Eggebrecht, Washington University School of Medicine in St. Louis (United States) Dirk Grosenick, Physikalisch-Technische Bundesanstalt (Germany) **Shudong Jiang**, Thayer School of Engineering at Dartmouth (United States) Jana M. Kainerstorfer, Carnegie Mellon University (United States) Hiroshi Kawaguchi, National Institute of Advanced Industrial Science and Technology (Japan) Adam Liebert, Nalecz Institute of Biocybernetics and Biomedical Engineering PAN (Poland) Shinpei Okawa, Hamamatsu University School of Medicine (Japan) Felix Scholkmann, Universität Bern (Switzerland) Ilias Tachtsidis, University College London (United Kingdom) Marta Zanoletti, ICFO - Institut de Ciències Fotòniques (Spain)