## Medical Imaging 2018

## Biomedical Applications in Molecular, Structural, and Functional Imaging

Barjor Gimi Andrzej Krol Editors

11–13 February 2018 Houston, Texas, United States

Sponsored by SPIE

Co-sponsored by DECTRIS Ltd. (Switzerland)

## Cooperating Organizations

AAPM—American Association of Physicists in Medicine (United States)
IFCARS—International Foundation for Computer Assisted Radiology and Surgery (Germany)
MIPS—Medical Image Perception Society (United States)
RSNA—Radiological Society of North America (United States)
WMIS—World Molecular Imaging Society

Published by SPIE

**Volume 10578** 

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 Medical Imaging 2018: Biomedical Applications in Molecular, Structural, and Functional Imaging, edited by Barjor Gimi, Andrzej Krol, Proceedings of SPIE Vol. 10578 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510616455

ISBN: 9781510616462 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)  $\cdot$  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 1605-7422/18/\$18.00

Printed in the United States of America Vm7 i ffUb 5 ggc WJUHY gz +b Wz i b XYf" JW bgY Zfca 'GD-9.

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

xi	Authors
XV	Conference Committee
x∨ii	Introduction
xix	2018 Medical Imaging Award Recipients
SESSION 1	MRI AND FMRI
10578 02	Classifying Alzheimer's disease using probability distribution distance of fractional anisotropy and trace from diffusion tensor imaging in combination with whole-brain segmentations [10578-1]
10578 03	Brain functional mapping and network connectivity of reconstructed magnetic susceptibility data [10578-2]
10578 04	Alternating segmentation and simulation for contrast adaptive tissue classification [10578-3]
10578 05	Tests of clustering thalamic nuclei based on various dMRI models in the squirrel monkey brain [10578-4]
10578 06	Quantitative dynamic MRI (QdMRI) volumetric analysis of pediatric patients with thoracic insufficiency syndrome [10578-5]
SESSION 2	KEYNOTE AND EMERGING TRENDS
10578 08	Development of ultrafast detector for advanced time-of-flight brain PET [10578-7]
10578 09	Comparing diffusion tensor and spherical harmonic tractography for in utero studies of fetal brain connectivity [10578-8]
10578 0A	Investigating directed functional connectivity between the resting state networks of the human brain using mutual connectivity analysis $[10578-9]$
SESSION 3	NEUROLOGICAL IMAGING I
10578 OB	Resilient modular small-world directed brain networks in healthy subjects with large-scale Granger causality analysis of resting-state functional MRI [10578-10]

10578 0C	Investigating large-scale Granger causality analysis in presence of noise and varying sampling rate [10578-11]
10578 0D	Automatic outlier detection using hidden Markov model for cerebellar lobule segmentation [10578-12]
10578 OE	Segmentation and assessment of structural plasticity of hippocampal dendritic spines from 3D confocal light microscopy [10578-13]
10578 OF	Multi-atlas segmentation of the hydrocephalus brain using an adaptive ventricle atlas [10578-14]
SESSION 4	CARDIOVASCULAR IMAGING
10578 OI	Toward modeling the effects of regional material properties on the wall stress distribution of abdominal aortic aneurysms [10578-17]
10578 OJ	3D printed cardiovascular patient specific phantoms used for clinical validation of a CT-derived FFR diagnostic software [10578-18]
10578 OK	Comparison of myocardial scar geometries from 2D and 3D LGE-MRI [10578-19]
SESSION 5	NOVEL IMAGING TECHNIQUES AND APPLICATIONS
SESSION 5	NOVEL IMAGING TECHNIQUES AND APPLICATIONS
10578 OL	NOVEL IMAGING TECHNIQUES AND APPLICATIONS  Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]
	Use of material decomposition in the context of neurovascular intervention using standard flat
10578 OL	Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]  Super-resolution ultrasound imaging with Gaussian fitting method and plane wave transmission
10578 OL 10578 OM	Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]  Super-resolution ultrasound imaging with Gaussian fitting method and plane wave transmission [10578-21]  A simulation platform using 3D printed neurovascular phantoms for clinical utility evaluation of
10578 OL 10578 OM 10578 ON	Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]  Super-resolution ultrasound imaging with Gaussian fitting method and plane wave transmission [10578-21]  A simulation platform using 3D printed neurovascular phantoms for clinical utility evaluation of new imaging technologies [10578-22]  A balanced super-resolution optical fluctuation imaging method for super-resolution
10578 OL 10578 OM 10578 ON 10578 OO	Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]  Super-resolution ultrasound imaging with Gaussian fitting method and plane wave transmission [10578-21]  A simulation platform using 3D printed neurovascular phantoms for clinical utility evaluation of new imaging technologies [10578-22]  A balanced super-resolution optical fluctuation imaging method for super-resolution ultrasound [10578-23]
10578 OL 10578 OM 10578 ON 10578 OO 10578 OP	Use of material decomposition in the context of neurovascular intervention using standard flat panel and a high-resolution CMOS detector [10578-20]  Super-resolution ultrasound imaging with Gaussian fitting method and plane wave transmission [10578-21]  A simulation platform using 3D printed neurovascular phantoms for clinical utility evaluation of new imaging technologies [10578-22]  A balanced super-resolution optical fluctuation imaging method for super-resolution ultrasound [10578-23]  Sparse-view CT reconstruction with improved GoogLeNet [10578-24]

10578 OU	3D scar segmentation from LGE-MRI using a continuous max-flow method [10578-29]
10578 0V	Automatic segmentation of eyeball structures from micro-CT images based on sparse annotation [10578-30]
SESSION 7	OPTICAL
10578 0X	Optical detection of oral carcinoma via structured illumination fluorescence lifetime imaging [10578-32]
10578 0Y	Evaluation of chemotherapeutic response of temozolomide in orthotopic glioma using bioluminescence tomography [10578-33]
10578 OZ	Dynamic cone beam x-ray luminescence computed tomography with principal component analysis $[10578-34]$
10578 10	A fast reconstruction algorithm for fluorescence molecular tomography via multipath subspace pursuit method [10578-35]
SESSION 8	NEUROLOGICAL IMAGING II
10578 13	An improved approach of high graded glioma segmentation using sparse autoencoder and fuzzy c-means clustering from multi-modal MR images [10578-38]
10578 14	Improving self super resolution in magnetic resonance images [10578-39]
10578 15	Automatic callosal fiber convergence plane computation through DTI-based divergence map [10578-40]
10578 16	Fluorescence imaging of lymphatic outflow of cerebrospinal fluid in mice [10578-41]
10578 17	Corpus callosum parcellation methods: a quantitative comparative study [10578-42]
SESSION 9	CANCER
10578 18	Determining the importance of parameters extracted from multi-parametric MRI in the early prediction of the response to neo-adjuvant chemotherapy in breast cancer [10578-43]
10578 19	End-to-end breast ultrasound lesions recognition with a deep learning approach [10578-44]
10578 1A	A real-time 4-bit imaging electrical impedance sensing biopsy needle for prostate cancer detection [10578-45]

10578 1C	Interrogation of evolving tumor vasculature using high-resolution CT imaging and a nanoparticle contrast agent [10578-47]
10578 1D	Automatic segmentation of corneal ulcer area based on ocular staining images [10578-48]
SESSION 10	IMAGING AGENTS
10578 1E	Optimization of an iodine-based nanoparticle contrast agent for molecular CT imaging [10578-49]
10578 1G	Enlarging the field of view in magnetic particle imaging using a moving table approach [10578-51]
10578 11	Direct prior regularization from anatomical images for cone beam x-ray luminescence computed tomography reconstruction [10578-53]
SESSION 11	BONE AND MUSCULOSKELETAL
10578 1J	Robust quantitative assessment of trabecular microarchitecture in extremity cone-beam CT using optimized segmentation algorithms [10578-54]
10578 1K	Automatic quantification framework to detect cracks in teeth [10578-55]
10578 1L	MRI-based active shape model of the human proximal femur using fiducial and secondary landmarks and its validation [10578-56]
10578 1M	Micro-CT analysis of trabecular parameters gradients in femurs of mice affected by chronic kidney disease [10578-57]
	POSTERS: CARDIOVASCULAR AND PULMONARY IMAGING
10578 1N	Nonrigid 2D registration of coronary artery angiograms with periodic displacement field [10578-58]
10578 10	Lesion detection for cardiac ablation from auto-fluorescence hyperspectral images [10578-59]
10578 1P	MRI-based three-dimensional modeling and assessment of epicardial adipose tissue [10578-60]
10578 1Q	Automated segmentation and feature extraction in cardiac electrical impedance tomography images [10578-61]
10578 1R	<b>3D</b> segmentation of the ascending and descending aorta from CT data via graph-cuts [10578-62]

10578 1S	Multi-pathways CNN for robust vascular segmentation [10578-63]
10578 1T	Sensitivity of FFR-CT to manual segmentation [10578-64]
10578 1U	SLIC robust (SLICR) processing for fast, robust CT myocardial blood flow quantification (Cum Laude Poster Award) [10578-65]
10578 1V	Pulmonary function diagnosis based on diaphragm movement using dynamic flat-panel detector imaging: an animal-based study [10578-66]
10578 1W	Bronchial based pulmonary acinus analysis in human lungs using a synchrotron radiation micro-CT [10578-67]
	POSTERS, ININOVATIONS IN IMAGE PROCESSING
	POSTERS: INNOVATIONS IN IMAGE PROCESSING
10578 1X	Capillary detection in transverse muscle sections [10578-68]
10578 1Y	Coronary calcification identification in optical coherence tomography using convolutional neural networks [10578-69]
10578 1Z	Exploit <sup>18</sup> F-FDG enhanced urinary bladder in PET data for deep learning ground truth generation in CT scans [10578-70]
10578 20	Unsupervised segmentation of 3D medical images based on clustering and deep representation learning [10578-71]
10578 21	Low dose CT reconstruction with nonlocal means-based prior predicted from normal-dose CT database [10578-72]
10578 22	Hierarchical model-based object localization for auto-contouring in head and neck radiation therapy planning [10578-73]
10578 24	Automated delineation of organs-at-risk in head and neck CT images using multi-output support vector regression [10578-75]
10578 25	Automatic generation of the dental scheme based on 2D radiographs [10578-76]
10578 26	Ventricular segmentation and quantitative assessment in cardiac MR using convolutional neural networks [10578-77]
	POSTERS: NEUROLOGICAL IMAGING
10578 27	Diffusion tensor imaging of the spine in pediatric patients [10578-78]
10578 28	Altered structural-functional coupling of large-scale brain networks in early Tourette syndrome children [10578-79]

10578 29	Determining disease evolution driver nodes in dementia networks [10578-80]
10578 2A	Semi-supervised sparse representation classifier with random sample subset ensembles in fMRI-based brain state decoding [10578-81]
10578 2B	Intensified CCD camera based fNIRS-DOT imaging system for whole functional brain mapping in children $\ [10578-82]$
	POSTERS: NOVEL IMAGING TECHNIQUES AND APPLICATIONS
10578 2E	An EIT system for mobile medical diagnostics [10578-85]
10578 2F	Uptake of L-maurocalcine in DAOY cells and bio-distribution in mice by SPECT/CT imaging [10578-86]
10578 2G	Bayesian inference and model selection for physiologically-based pharmacokinetic modeling of superparamagnetic iron oxide nanoparticles [10578-87]
10578 2H	SVA: shape variation analyzer [10578-89]
	POSTERS: OPTICAL
10578 2K	3D modeling of chromosomes territories in normal and aneuploid nuclei [10578-92]
10578 2L	Segmentation of brain lesions from CT images based on deep learning techniques [10578-93]
10578 2M	A competing round-robin prediction model for histologic subtype prediction of lung adenocarcinomas based on thoracic computed tomography [10578-94]
10578 2N	Comparison of Gaussian filter versus wavelet-based denoising on graph-based segmentation of retinal OCT images [10578-95]
10578 20	Lower jawbone data generation for deep learning tools under MeVisLab [10578-96]
10578 2P	<b>Detection and registration of vessels for longitudinal 3D retinal OCT images using SURF</b> [10578-97]
10578 2Q	Lung tumor segmentation based on the multi-scale template matching and region growing [10578-98]
10578 2R	Automatic coronary artery lumen segmentation in computed tomography angiography using paired multi-scale 3D CNN [10578-99]

10578 2S	Heart chamber segmentation from CT using convolutional neural networks [10578-100]
10578 2T	Automated connectivity-based cortical mapping using registration-constrained classification [10578-101]