Medical Imaging 2022

Digital and Computational Pathology

John E. Tomaszewski Aaron D. Ward Richard M. Levenson Editors

20–24 February 2022 San Diego, California, United States

21–27 March 2022 ONLINE

Sponsored by SPIE

Cooperating Organizations
American Association of Physicists in Medicine
International Foundation for Computer Assisted Radiology and Surgery
Medical Image Perception Society (United States)
Radiological Society of North America
Society for Imaging Informatics in Medicine (United States)
World Molecular Imaging Society

Published by SPIE

Volume 12039

Proceedings of SPIE, 1605-7422, V. 12039

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 2022: Digital and Computational Pathology, edited by John E. Tomaszewski, Aaron D. Ward, Richard M. Levenson, Proc. of SPIE 12039, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510649538

ISBN: 9781510649545 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2022 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

vii Conference Committee

GRADING AND CLASSIFICATION OF PATHOLOGY IMAGES

	GRADING AND CLASSIFICATION OF PATHOLOGY IMAGES
12039 04	Identifying the origination of liver metastasis using a hand-crafted computational pathology approach [12039-6]
12039 05	Weakly supervised histopathological image representation learning based on contrastive dynamic clustering [12039-7]
12039 06	Selecting training samples for ovarian cancer classification via a semi-supervised clustering approach [12039-8]
12039 07	Automatic flagging of AI segmentation errors in computational pathology [12039-9]
12039 08	Tau protein discrete aggregates in Alzheimer's disease: neuritic plaques and tangles detection and segmentation using computational histopathology [12039-10]
	AUTOMATED QUANTIFICATION OF TISSUE BIOMARKERS
12039 09	Automatic generation of the ground truth for tumor budding using H&E stained slides [12039-11]
12039 0A	Cancer cell segmentation for cellularity prediction via a weakly labeled/strongly labeled hybrid convolutional neural network [12039-12]
12039 OB	WeakSTIL: weak whole-slide image level stromal tumor infiltrating lymphocyte scores are all you need [12039-13]
12039 OC	Predicting HER2 scores from registered HER2 and H&E images [12039-14]
12039 0D	Deep ordinal regression for automatic tumor cellularity assessment from pathological images [12039-15]
	MULTISPECTRAL, MULTIMODALITY, AND FUSED IMAGING
12039 OE	In the use of artificial intelligence and hyperspectral imaging in digital pathology for breast cancer cell identification [12039-16]
12039 OF	Dense multi-object 3D glomerular reconstruction and quantification on 2D serial section whole slide images [12039-17]

12039 OG	Automatic detection of head and neck squamous cell carcinoma on pathologic slides using polarized hyperspectral imaging and deep learning [12039-18]
12039 OH	Thyroid carcinoma detection on whole histologic slides using hyperspectral imaging and deep learning [12039-19]
	MULTI-STAIN AND MULTIPLEXED IMAGE ANALYSIS
12039 OJ	Cell phenotyping using unsupervised clustering on multiplexed fluorescence images of breast cancer tissue specimens [12039-21]
12039 OK	Inpainting missing tissue in multiplexed immunofluorescence imaging [12039-22]
12039 OL	Spatial analysis of cellular arrangement using quantitative, single-cell imaging of protein multiplexing [12039-23]
12039 OM	Personalized stain style transfer layers for distributed histology classification [12039-24]
12039 ON	Procedural generation of synthetic multiplex immunohistochemistry images using cell-based image compression and conditional generative adversarial networks [12039-25]
	COMPUTATIONAL PATHOLOGY: FROM RESEARCH TO APPLICATION
12039 OP	Unsupervised super resolution network for hyperspectral histologic imaging [12039-26]
12039 OQ	Integrating image analysis with single cell RNA-seq data to study podocyte-specific changes in diabetic kidney disease [12039-27]
12039 OR	Self-supervised learning with large-scale web image mining for characterizing glomerular lesions [12039-28]
	COMPUTER-AIDED DIAGNOSIS, PROGNOSIS, AND PREDICTIVE ANALYSIS
12039 OS	HistoLens: a generalizable tool for increasing accessibility and interpretability of quantitative analyses in digital pathology [12039-29]
12039 OT	Using deep learning to predict tumor mutational burden in lung squamous cell carcinoma from 20 centers [12039-30]
12039 OU	Computational integration of renal histology and urinary proteomics using neural networks [12039-31]
12039 OV	Computer extracted features of tumor-infiltrating lymphocytes (TILs) architecture are prognostic of progression-free survival in stage III colon cancer [12039-32]

12039 OW	Deep neural network for cell type differentiation in myelodysplastic syndrome diagnosis performs similarly when trained on compensated or uncompensated data [12039-33]
12039 OX	A hybrid computational pathology method for the detection of perineural invasion junctions [12039-34]
12039 OY	Preserving dense features for Ki67 nuclei detection [12039-35]
	SEGMENTATION OF CELLULAR AND TISSUE STRUCTURES
12039 10	Shape-based tumor microenvironment analysis to differentiate non-small cell lung cancer subtypes: a radio-pathomic study [12039-1]
12039 13	Group affinity weakly supervised segmentation from prior selected tissue in colorectal histopathology images [12039-4]
12039 14	CellSegNet: an adaptive multi-resolution hybrid network for cell segmentation [12039-5]
	POSTER SESSION
	POSIEK SESSION
12039 15	Deformable histopathology-MRI image registration using deep learning [12039-36]
12039 16	Display systems for digital pathology: what are proper luminance, contrast and resolution settings? [12039-37]
12039 17	Anonymising pathology data using generative adversarial networks [12039-38]
12039 18	Muti-stage attention-based network for brain tumor subtype classification [12039-39]
12039 19	Eosinophilic esophagitis multi-label feature recognition on whole slide imaging using transfer learning [12039-40]
12039 1A	Quantitative evaluation of color difference between actual specimens and whole-slide imaging-scanned images calibrated with commercial color charts [12039-41]
12039 1C	Survival time prediction from unannotated lung cancer histopathology images [12039-43]
12039 1D	Prediction of tumor mutation burden from H&E whole-slide images: a comparison of training strategies with convolutional neural networks [12039-44]
12039 1E	Sparse capsule networks for informative representation learning in digital pathology [12039-45]
12039 1F	Automatic tumour segmentation in H&E-stained whole-slide images of the pancreas. [12039-47]
12039 1G	Automated tubular morphometric visualization for whole kidney biopsy [12039-48]

12039 1H	A deep learning-based computational prediction model for characterizing cellular biomarker distribution in tumor microenvironment [12039-49]
12039 11	Detection of lung cancer metastases in lymph nodes using a multiple instance learning approach [12039-50]
12039 1J	A cloud-based tool for federated segmentation of whole slide images [12039-51]
12039 1K	RAE-Net: a deep learning system for staging of estrous cycle [12039-53]
12039 1M	Deep learning-enabled classification of gastric ulcers from wireless capsule endoscopic images [12039-55]
12039 1N	CrowdDeep: deep-learning from the crowd for nuclei segmentation [12039-56]
12039 10	Histopathological image classification based on self-supervised vision transformer and weak labels [12039-57]
12039 1P	Investigating intra-tumor heterogeneity in non-small cell lung cancer using multiplexed immunohistochemistry and deep learning [12039-58]

Conference Committee

Symposium Chairs

Metin N. Gurcan, Wake Forest Baptist Medical Center (United States) **Robert M. Nishikawa**, University of Pittsburgh (United States)

Conference Chairs

John E. Tomaszewski, University at Buffalo (United States) **Aaron D. Ward**, The University of Western Ontario (Canada)

Conference CoChair

Richard M. Levenson, 2022 Acting Chair, University of California, Davis (United States)

Conference Program Committee

Selim Aksoy, Bilkent University (Turkey)

Ulysses J. Balis, University of Michigan Health System (United States) **Rohit Bhargava**, University of Illinois at Urbana-Champaign (United States)

Ulf-Dietrich Braumann, Fraunhofer-Institut für Zelltherapie und Immunologie IZI (Germany)

Bradley Brimhall, The University of Texas Health Science Center at San Antonio (United States)

Matthew J. Cecchini, London Health Sciences Center (Canada)

Weijie Chen, U.S. Food and Drug Administration (United States)

Keith C. Cheng, Penn State College of Medicine (United States)

Wei-Chung Cheng, U.S. Food and Drug Administration (United States)

Eric Cosatto, NEC Labs. America, Inc. (United States)

Scott Doyle, Rutgers, The State University of New Jersey (United States)

Alton B. Farris, Emory University (United States)

Michael D. Feldman, The University of Pennsylvania Health System (United States)

Marios A. Gavrielides, AstraZeneca Pharmaceuticals LP (United States)

April Khademi, Ryerson University (Canada)

Elizabeth A. Krupinski, Emory University School of Medicine (United States)

Tom R. L. Kimpe, Barco N.V. (Belgium)

Richard M. Levenson, University of California, Davis (United States)

Olivier Lezoray, Université de Caen Basse-Normandie (France)

Geert Litjens, Radboud Universiteit Medical Center (Netherlands)

Anant Madabhushi, Case Western Reserve University (United States)

Derek R. Magee, University of Leeds (United Kingdom)

Anne L. Martel, Sunnybrook Research Institute (Canada)

Erik Meijering, The University of New South Wales (Australia)

James P. Monaco, Inspirata, Inc. (United States)

Mehdi Moradi, IBM Research (United States)

Bahram Parvin, Lawrence Berkeley National Laboratory (United States)

Nasir M. Rajpoot, The University of Warwick (United Kingdom)

Berkman Sahiner, U.S. Food and Drug Administration (United States)

Pinaki Sarder, University at Buffalo (United States)

Chukka Srinivas, Amazon Lab126 (United States)

Darren Treanor, University of Leeds (United Kingdom)

Jeroen van der Laak, Radboud Universiteit Nijmegen Medical Center (Netherlands)

Mitko Veta, Technische Universiteit Eindhoven (Netherlands)

Martin J. Yaffe, Sunnybrook Research Institute (Canada)

Bülent Yener, Rensselaer Polytechnic Institute (United States)