Medical Imaging 2020

Image Processing

Ivana Išgum
Bennett A. Landman
Editors

17–20 February 2020
Houston, Texas, United States

Sponsored by
SPIE

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

Published by
SPIE

Volume 11313


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

code: 1605-7422/20/$21 · doi: 10.1117/12.2570657

Proc. of SPIE Vol. 11313  1131301-1
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 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:


ISSN: 1605-7422
ISSN: 2410-9045 (electronic)
ISBN: 9781510633933

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 © 2020, 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 $21.00 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 1605-7422/20/$21.00.

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.

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.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

### SESSION 1  IMAGE SYNTHESIS, GANS, AND NOVEL ARCHITECTURES

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 03</td>
<td>Multi-modality MRI arbitrary transformation using unified generative adversarial networks</td>
<td>[11313-1]</td>
</tr>
<tr>
<td>11313 05</td>
<td>Multi-modality super-resolution loss for GAN-based super-resolution of clinical CT images using micro CT image database</td>
<td>[11313-3]</td>
</tr>
<tr>
<td>11313 07</td>
<td>GANet: group attention network for diabetic retinopathy image segmentation</td>
<td>[11313-5]</td>
</tr>
<tr>
<td>11313 08</td>
<td>Fully automated segmentation of hyper-reflective foci in OCT images using a U-shape network</td>
<td>[11313-6]</td>
</tr>
<tr>
<td>11313 09</td>
<td>Adversarial domain adaptation for multi-device retinal OCT segmentation</td>
<td>[11313-7]</td>
</tr>
</tbody>
</table>

### SESSION 2  IMAGE ANALYSIS IN ULTRASOUND AND OCT: JOINT SESSION WITH CONFERENCES 11313 AND 11319

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 0A</td>
<td>Left ventricular and atrial segmentation of 2D echocardiography with convolutional neural networks</td>
<td>[11313-9]</td>
</tr>
<tr>
<td>11313 0B</td>
<td>Multiresolution LOGISMOS graph search for automated choroidal layer segmentation of 3D macular OCT scans</td>
<td>[11313-10]</td>
</tr>
<tr>
<td>11313 0C</td>
<td>Self-fusion for OCT noise reduction</td>
<td>[11313-11]</td>
</tr>
</tbody>
</table>

### SESSION 3  LESIONS AND PATHOLOGIES

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Paper ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 0D</td>
<td>Deep multi-task prediction of lung cancer and cancer-free progression from censored heterogenous clinical imaging</td>
<td>[11313-12]</td>
</tr>
<tr>
<td>11313 0E</td>
<td>Fine-grained tumor segmentation on computed tomography slices by leveraging bottom-up and top-down strategies</td>
<td>[11313-13]</td>
</tr>
<tr>
<td>SESSION 4  MACHINE LEARNING AND DEEP LEARNING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11313 0F</td>
<td>Extracting 2D weak labels from volume labels using multiple instance learning in CT hemorrhage detection [11313-14]</td>
<td></td>
</tr>
<tr>
<td>11313 0G</td>
<td>Coronary artery calcium scoring: Can we do better? (Image Processing Student Paper Award) [11313-15]</td>
<td></td>
</tr>
<tr>
<td>11313 0H</td>
<td>Finding novelty with uncertainty [11313-16]</td>
<td></td>
</tr>
<tr>
<td>11313 0I</td>
<td>Towards reduced-preparation spectral-CT-colonography utilizing local covariance [11313-17]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 5  REGISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 0J</td>
</tr>
<tr>
<td>11313 0K</td>
</tr>
<tr>
<td>11313 0L</td>
</tr>
<tr>
<td>11313 0M</td>
</tr>
<tr>
<td>11313 0N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 6  FMRI AND DTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 0S</td>
</tr>
</tbody>
</table>
Anatomically informed data augmentation for functional MRI with applications to deep learning [11313-28]

Neural effect induced by exercise intervention can be categorized by altered functional connectivity in early psychotic patients [11313-29]

Association between fMRI brain entropy features and behavioral measures [11313-30]

Numerical DWI phantoms to optimize accuracy and precision of quantitative parametric maps for non-Gaussian diffusion [11313-31]

SESSION 7  KEYNOTE AND HIGHLIGHTS

Variational intensity cross channel encoder for unsupervised vessel segmentation on OCT angiography [11313-33]

Cardiac cine MRI left ventricle segmentation combining deep learning and graphical models [11313-34]

Contrast phase classification with a generative adversarial network [11313-35]

SESSION 8  LABELING AND SEGMENTATION

Vessel wall segmentation of common carotid artery via multi-branch light network [11313-36]

Anatomical labeling of human airway branches using novel two-step machine learning and hierarchical features [11313-37]

Incorporating minimal user input into deep-learning-based image segmentation [11313-38]

Weakly supervised pancreas segmentation based on class activation maps [11313-39]

Detection of frame informativeness in endoscopic videos using image quality and recurrent neural networks [11313-40]

SESSION 9  DEEP LEARNING: SEGMENTATION

Spatial information-embedded fully convolutional networks for multi-organ segmentation with improved data augmentation and instance normalization [11313-41]

Identification of kernels in a convolutional neural network: connections between the level set equation and deep learning for image segmentation [11313-42]

Influence of decoder size for binary segmentation tasks in medical imaging [11313-43]
<table>
<thead>
<tr>
<th>Session 10</th>
<th>Segmentation: Anatomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 1C</td>
<td>Combining deep learning and model-based segmentation for labeled spine CT segmentation [11313-47]</td>
</tr>
<tr>
<td>11313 1D</td>
<td>Combining model- and deep-learning-based methods for the accurate and robust segmentation of the intra-cochlear anatomy in clinical head CT images [11313-48]</td>
</tr>
<tr>
<td>11313 1E</td>
<td>Multi-class semantic segmentation of pediatric chest radiographs [11313-49]</td>
</tr>
<tr>
<td>11313 1F</td>
<td>Exploiting clinically available delineations for CNN-based segmentation in radiotherapy treatment planning [11313-50]</td>
</tr>
<tr>
<td>11313 1G</td>
<td>Anatomy segmentation evaluation with sparse ground truth data [11313-51]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 11</th>
<th>Deep Learning: Uncertainty and Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 1H</td>
<td>Adding uncertainty to dermatological assistance [11313-52]</td>
</tr>
<tr>
<td>11313 1I</td>
<td>Semi-supervised multi-organ segmentation through quality assurance supervision [11313-53]</td>
</tr>
<tr>
<td>11313 1J</td>
<td>Visualization approach to assess the robustness of neural networks for medical image classification [11313-54]</td>
</tr>
<tr>
<td>11313 1K</td>
<td>An exploration of uncertainty information for segmentation quality assessment [11313-55]</td>
</tr>
<tr>
<td>11313 1L</td>
<td>Robust chest x-ray quality assessment using convolutional neural networks and atlas regularization [11313-56]</td>
</tr>
<tr>
<td>11313 1M</td>
<td>Automatic online quality control of synthetic CTs [11313-57]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 12</th>
<th>Nuclear and Molecular</th>
</tr>
</thead>
<tbody>
<tr>
<td>11313 1N</td>
<td>Homology-based approach for prognostic prediction of lung cancer using novel topologically invariant radiomic features [11313-58]</td>
</tr>
<tr>
<td>ID</td>
<td>Title</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1O</td>
<td>Fully convolutional network with sparse feature-maps composition for automatic lung tumor segmentation from PET images</td>
</tr>
<tr>
<td>1P</td>
<td>Ultra-low-dose 18F-FDG brain PET/MR denoising using deep learning and multi-contrast information</td>
</tr>
<tr>
<td>1Q</td>
<td>The improved reconstruction of fluorescence molecular tomography via regularized doubly orthogonal matching pursuit method</td>
</tr>
<tr>
<td>1R</td>
<td>Automated threshold selection on whole-body 18F-FDG PET/CT for assessing tumor metabolic response</td>
</tr>
<tr>
<td>1S</td>
<td>Identifying the common and subject-specific functional units of speech movements via a joint sparse non-negative matrix factorization framework</td>
</tr>
<tr>
<td>1U</td>
<td>Network features of simultaneous EEG and fMRI predict working memory load</td>
</tr>
<tr>
<td>1V</td>
<td>Hybrid dictionary learning-ICA approaches built on novel instantaneous dynamic connectivity metric provide new multiscale insights into dynamic brain connectivity</td>
</tr>
<tr>
<td>1W</td>
<td>Self-adaptive 2D-3D ensemble of fully convolutional networks for medical image segmentation</td>
</tr>
<tr>
<td>1X</td>
<td>Choroidal atrophy segmentation based on deep network with deep-supervision and EDT-auxiliary-loss</td>
</tr>
<tr>
<td>1Y</td>
<td>Multi-planar whole heart segmentation of 3D CT images using 2D spatial propagation CNN</td>
</tr>
<tr>
<td>1Z</td>
<td>An improved U-Net for nerve fibre segmentation in confocal corneal microscopy images</td>
</tr>
<tr>
<td>20</td>
<td>Segmentation of choroid neovascularization in OCT images based on convolutional neural network with differential amplification blocks</td>
</tr>
<tr>
<td>21</td>
<td>Automated retinopathy of prematurity screening using deep neural network with attention mechanism</td>
</tr>
<tr>
<td>22</td>
<td>Estimating standard-dose PET from low-dose PET with deep learning</td>
</tr>
<tr>
<td>23</td>
<td>Internal-transfer weighting of multi-task learning for lung cancer detection</td>
</tr>
<tr>
<td>24</td>
<td>Reduction of motion artifacts in head CT exams using multi-scale convolutional neural network</td>
</tr>
<tr>
<td>25</td>
<td>CAI-UNet for segmentation of liver lesion in CT image</td>
</tr>
</tbody>
</table>
11313 26  Enhancing infarct segmentation performance using domain-specific attention in acute ischemic stroke [11313-77]

11313 27  A grid-line suppression technique based on deep convolutional neural networks [11313-78]

11313 28  An end-to-end deep learning approach for landmark detection and matching in medical images [11313-79]

11313 29  Non-rigid MRI-CT image registration with unsupervised deep-learning-based deformation prediction [11313-80]

11313 2A  A target-oriented and multi-patch-based framework for image quality assessment on carotid artery MRI [11313-81]

11313 2B  Convolutional neural-network-based ordinal regression for brain age prediction from MRI scans [11313-82]

11313 2C  Segmentation of stem cell colonies in fluorescence microscopy images with transfer learning (Cum Laude Poster Award) [11313-83]

11313 2D  Automatic epicardial fat segmentation in cardiac CT imaging using 3D deep attention U-Net [11313-84]

11313 2E  New loss functions for medical image registration based on VoxelMorph [11313-85]

11313 2F  A GICA-TVGL framework to study sex differences in resting state fMRI dynamic connectivity [11313-86]

11313 2G  A generalized method for computation of n-dimensional Radon transforms [11313-87]

11313 2H  Enhanced low-rank plus group sparse decomposition for speckle reduction in OCT images [11313-88]

11313 2I  Metal artifacts reduction in computed tomography by Fourier coefficient correction using convolutional neural network [11313-89]

11313 2J  Super-resolution magnetic resonance imaging reconstruction using deep attention networks [11313-90]

11313 2K  Simultaneously spatial and temporal higher-order total variations for noise suppression and motion reduction in DCE and IVIM [11313-91]

11313 2L  Liver synthetic CT generation based on a dense-CycleGAN for MRI-only treatment planning [11313-92]

11313 2M  FunSyn-Net: enhanced residual variational auto-encoder and image-to-image translation network for fundus image synthesis [11313-93]

11313 2N  Deep similarity learning using a Siamese ResNet trained on similarity labels from disparity maps of cerebral MRA MIP pairs [11313-94]
<table>
<thead>
<tr>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validation and optimization of multi-organ segmentation on clinical imaging archives [11313-95]</td>
</tr>
<tr>
<td>A quasi-conformal mapping-based data augmentation technique for brain tumor segmentation [11313-96]</td>
</tr>
<tr>
<td>MRI correlates of chronic symptoms in mild traumatic brain injury [11313-97]</td>
</tr>
<tr>
<td>Development of a 3D carotid atlas for quantification of local volume change [11313-98]</td>
</tr>
<tr>
<td>Integrating deep transfer learning and radiomics features in glioblastoma multiforme patient survival prediction [11313-99]</td>
</tr>
<tr>
<td>An unsupervised deep learning approach for 4DCT lung deformable image registration [11313-101]</td>
</tr>
<tr>
<td>Cone-beam Computed Tomography (CBCT) and CT image registration aided by CBCT-based synthetic CT [11313-102]</td>
</tr>
<tr>
<td>Imposing implicit feasibility constraints on deformable image registration using a statistical generative model [11313-103]</td>
</tr>
<tr>
<td>Local structure orientation: a new method for histology and MRI coregistration [11313-104]</td>
</tr>
<tr>
<td>Unsupervised learning-based deformable registration of temporal chest radiographs to detect interval change [11313-105]</td>
</tr>
<tr>
<td>Weakly non-rigid MR-TRUS prostate registration using fully convolutional and recurrent neural networks [11313-106]</td>
</tr>
<tr>
<td>Feature-based retinal image registration for longitudinal analysis of patients with age-related macular degeneration [11313-107]</td>
</tr>
<tr>
<td>Multi-label segmentation of bone, muscle, and fat in CT volumes via convex relaxation [11313-108]</td>
</tr>
<tr>
<td>Group-wise attention fusion network for choroid segmentation in OCT images [11313-109]</td>
</tr>
<tr>
<td>Automatic lung segmentation in low-dose CT image with contrastive attention module [11313-110]</td>
</tr>
<tr>
<td>Attention-guided channel to pixel convolution network for retinal layer segmentation with choroidal neovascularization [11313-111]</td>
</tr>
<tr>
<td>Attention multi-scale network for pigment epithelial detachment segmentation in OCT images [11313-112]</td>
</tr>
<tr>
<td>Outlier guided optimization of abdominal segmentation [11313-113]</td>
</tr>
<tr>
<td>Reflection-equivariant convolutional neural networks improve segmentation over reflection augmentation [11313-114]</td>
</tr>
</tbody>
</table>
11313 38 Synthetic MRI-aided pelvic multi-organ segmentation in cone-beam computed tomography [11313-115]

11313 39 Comparison of training strategies for the segmentation of retina layers in optical coherence tomography images of rodent eyes using convolutional neural networks [11313-116]

11313 3A Multi-organ segmentation in head and neck MRI using U-Faster-RCNN [11313-117]

11313 3B Improved automated segmentation of human kidney organoids using deep convolutional neural networks [11313-118]

11313 3C Segmenting retinal OCT images with inter-B-scan and longitudinal information [11313-119]

11313 3D Multi-atlas-based tissue identification in the lower leg using pQCT [11313-120]

11313 3E Unsupervised local feature learning for sensitive three-dimensional ultrasound assessment of carotid atherosclerosis [11313-121]
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.

Abrâmoff, Michael D., 0B
Abramson, Richard G., 10, 11, 2O, 36
Abu Bakar Ali, Asad, 39
Acha, B., 31
Actor, Jonas A., 17
Alderliesten, Tanja, 1B, 28
Alessio, Adam, 1E
Al-Kofahi, Yousef, 38
Alamy, Wadha, 2W
Amouzandeh, Ghoncheh, 0W
An, Chansik, 0I
An, Dongsheng, 2P
An, Yu, 1Q
Anderson, Adam W., 2Q
Andreczzyk, Vincent, 1K
Antic, Sanja L., 0D, 23
Atimura, H., 1N
Atay, Yigit, 0C
Athwale, Akshay, 2M
Baldeon Calisto, Maria G., 1W
Bao, Dengsen, 35
Barker, Gareth J., 2B
Baxter, John S. H., 1A
Bay, Camden, 2S
Beers, Andrew, 1K
Bergman, J., 15
Bermudez, Camilo, 0F, 0L, 10
Binschadler, Michael, 1E
Biswas, Taposh, 3D
Blaber, Justin, 0L, 2Q
Boers, T. G. W., 15
Bosman, Peter A. N., 1B, 28
Boume, Roger, 2W
Bradley, Jeffrey D., 2T
Brück, Matthias, 1L
Buerger, Christian, 1C
Burgos, Ninon, 1J
Butman, John A., 0F
Bystrov, Daniel, 1L
Cai, Biao, 2F
Calabresi, Peter A., 09, 0Y, 3C
Calhoun, Vince D., 1V, 2F
Cao, Mingsong, 0P
Carass, Aaron, 09, 0H, 0Y, 37, 3C
Chang, Kwok-Leung, 11
Chang, Catie, 0V
Chang, Eric, 0O
Chang, Ken, 1K
Chapman, David, 2C

Chen, Antong, 39
Chen, Eric H. Y., 0U
Chen, Feng, 21
Chen, Li, 2A
Chen, Qiyuing, 32
Chen, Xin, 2S
Chen, Xinjian, 07, 08, 1O, 1X, 1Z, 20, 21, 2H, 32, 33, 34, 35
Chen, Xuei, 2R
Chen, Yunqiang, 0H, 10, 11, 2O, 36
Chenevert, Thomas L., 0W
Cheng, Xuena, 1X, 32, 35
Cheon, Sodam, 25
Chew, Emily Y., 22
Chia, Ser Mien, 39
Chin Fatt, Cherisse, 0T
Chin, Chih-Liang, 39
Chiu, Bernard, 11, 2R, 3E
Colliot, Olivier, 0K, 1J
Comellas, Alejandro P., 12
Cruz, Nelly M., 38
Cukras, Catherine, 2Z
Curran, Walter J., 03, 22, 29, 2D, 2J, 2L, 2T, 2U, 2Y, 38, 3A
Curvers, W., 15
Damania, Ronit J., 1H
Dawant, Benoit M., 1D
de Groof, J., 15
Deist, Timo M., 28
Ding, Jie, 0N
Depeursinge, Adrien, 1K
Deppen, Steve, 23
De Silva, Tharindu, 2Z
de Vos, Bob D., 0G, 0R
De With, Peter H. N., 15, 18
Dhanantwari, Amar, 0I
Ding, Yao, 2K
Dirks, Ine, 1R
Dong, Xue, 22, 38, 3A
Dormer, James D., 13
Dormont, Didier, 1J
Du, Anan, 0E
Du, Bo, 19
Du, Yang, 1Q
Dushatskiy, Arkadiy, 1B
El Fakhri, Georges, 1S
Elgohari, Baher A., 2K
Elhalawani, Hesham, 2K
Elliott, Daniel, 0P

Proc. of SPIE Vol. 11313  1131301-11
Downloaded From: https://www.spiedigitallibrary.org/conference-proceedings-of-spie on 21 Apr 2022
Terms of Use: https://www.spiedigitallibrary.org/terms-of-use
Fan, Audrey, 0M
Fan, Ying, 32
Fan, Yubo, 1D
Fang, Qiming, 2X
Fang, Xi, 19
Fei, Baowei, 13
Feng, Shuanglang, 07, 08, 1Z, 32
Fennel, Theron R., 3B
Ferrucci, Luigi, 3D
Filippatou, Angeliki, 0Y, 3C
Fockens, K., 15
Fornwalt, Brandon K., 0A
Franz, Astrid, 1C
Freedman, Benjamin S., 3B
Frysch, Robert, 2G
Fu, Jianwei, 24
Fu, Yabo, 03, 29, 2J, 2T, 2U, 2Y, 38
Fuentes, David T., 17
Galvao, Joana, 39
Gao, Dashan, 0H, 10, 1I, 2O, 36
Gao, Riqiang, 0D, 10, 1I, 23, 2O, 36
Geng, Shuanglang, 02, 2Y, 38
Genz, Andreas, 14
Ger, Rachel B., 2K
Gifford, Eric, 39
Gilhuijs, Kenneth G. A., 0R
Gong, enhao, 0M, 1P
Gooßen, André, 1L
Gorthi, Shankar Prasad, 26
Grewal, Monika, 28
Gu, Xiaomeng, 2X
Gulati, Tanmay, 0Q
Guo, Bang Jun, 2D
Guo, Fumin, 0Z
Guo, Jia, 0M
Haas, Benjamin, 0Q
Haggerty, Christopher M., 0A
Halenb, Milton, 2C
Halicek, Martin, 13
Han, Shizhong, 0H, 10, 1I, 2O, 36
Han, Shuo, 37
Han, Wei, 2S
Harder, Tim, 1L
Hayashi, Yuichiro, 16
He, Renjie, 2K
He, Xiaoyi, 0H, 0L, 0Y, 3C
Heckers, Stephan, 0L
Heine, Matthias, 14
Heidmann, Stefan, 0Q
Higgins, Kristin, 22, 2T
Hoebel, Katharina, 1K
Hoffman, Eric A., 12
Holste, Gregory, 1E
Honegger, Jonas, 0Q
Hotaif, Nathan, 22
Hsieh, Scott, 0P
Huo, Yuankai, 0D, 0L, 10, 11, 23, 2O, 36
Hutcheson, Katherine A., 2K
Išgum, Ivana, 0G, 0R, 1F, 1M
Jani, Ashesh, 29, 2Y, 38
Jannin, Pierre, 1A
Jedynak, Bruno M., 3C
Jeong, Jiwoong, 2Y
Jiang, Hongjian, 2A
Juhl, Kristine Aavild, 1Y
Jung, Joongeon, 27
Kalpathy-Cramer, Jayashree, 1K
Kerley, Calley I., 0F, 2Q
Keyaerts, Marleen, 1R
Kim, Donghyun, 27
Kim, Hoojoon, 27
Kim, Hyewon, 27
Kim, Hyunghyu, 27
Kim, Jae-Hun, 25
Kim, Kyongwoo, 27
Kinder, Tobias, 0L, 1C
Kofoid, Klaus Fuglsang, 1Y
Kong, Lingxin, 1Q
Kopriva, Ivica, 2H
Kotecha, Nikunj R., 1H
Krönke, Sven, 1L
Kuckertz, Sven, 0Q
Kundell, Srinivasa Rao, 26
Kyme, Andre, 2W
Lai, Stephen Y., 2K
Lai, Yuen, 1W
Landman, Bennett A., 0D, 0F, 0L, 0S, 10, 1I, 23, 2O, 2Q, 36
Lao, Yi, 0O
Lauria, Michael, 0P
Lee, Chen Fei, 39
Lee, Heesin, 27
Lee, Ho Hsin, 10, 1I, 2O, 36
Lee, Junghoon, 0H
Lee, Kyungmoo, 0B
Lee, Won Jae, 25
Lei, Yang, 03, 22, 29, 2D, 2J, 2L, 2T, 2U, 2Y, 38, 3A
Leiner, Tim, 0G
Lenga, Matthias, 1C
Li, Angie, 2S
Li, Jieyu, 1G
Li, Lingfeng, 0D
Li, Qiang, 2X
Liao, Guojun, 2E
Lin, Hong, 0E
Lin, Jingxia, 0U
Lin, Liyong, 2L
Lin, Mingquan, 11
Liu, Jiang, 0M
Liu, Jun, 0N
Liu, Tian, 03, 22, 29, 2D, 2J, 2L, 2T, 2U, 2Y, 38, 3A
Liu, Yanyan, 24
Liu, Yihao, 09, 0Y, 3C
Liu, Ying, 1U
Liu, Yingzi, 2L, 2U
Lorenz, Cristian, 1C
Low, Daniel, 0P
Lu, Pascal, 0K
Lu, Rui, 1X
Luo, Weiwei, 39
Ma, Yuhui, 20
McDonald, Michael, 3B
Mai, Qi, 2I
Makrogiannis, Sokratis, 3D
Malone, Joseph D., 0C
Malyarenko, Dariya I., 0W
Mao, Hui, 03, 22, 2J, 2Y, 3A
Massion, Pierre P., 0D, 23
Mcdonald, Mark, 3A
McHugo, Maureen, 0L
Mellema, Cooper, 0T
Mendrik, Adriënne M., 1B
Mettler, Daniel, 39
Miller, Robyn L., 1V
Müller, Beth, 2Q
Misawa, Kazunari, 16
Mohamed, Abdallah S. R., 2K
Montana, Giovanni, 2B
Montillo, Albert, 0T
Morgan, Victoria L., 0V
Morgas, Tomasz, 0Q
Mori, Kensaku, 05, 16
Mori, Masaki, 05
Moriya, Takayasu, 0S
Müller, Henning, 1K
Murkute, Jaideep V., 1H
Nadeem, Syed Ahmed, 12
Nagy, Nicholas, 1E
Nair, Nilinraj R., 1H
Nakamura, Shotaro, 05
Nam, Joshua J., 27
Nath, Vishwesh, 0S
Natori, Hiroshi, 05
Neumann, Christian, 2N
Newton, Allen, 2Q
Neyns, Bart, 1R
Ng, Matthew, 0Z
Ng, Sweet Ping, 2K
Nguyen, Kevin P., 0T
Ninomiya, K., 1N
Noble, Jack H., 1D
Nye, Jonathan A., 22
Oda, Hirohisa, 05
Oda, Masahiro, 05, 16
Oguz, Ipek, 0C
Oktar, Azubuike, 3D
Ong, Charlene Zhi Lin, 39
Orgun, Mehmet A., 0E
Ouyang, Jiahong, 1P
Pang, Shuchao, 0E
Pang, Yuixi, 0W
Papenberg, Nils, 0Q
Papier, Art, 1H
Park, Joonhyuk, 27
Patel, Jay, 1K
Patel, Mayur B., 0F
Patel, Pratiksh, 29, 2L, 2U, 2Y, 38
Pathak, Sudhir K., 0S
Paulsen, Rasmus R., 1Y
Paulson, Alexis B., 0D
Pauly, John, 0M, 1P
Peng, Yuanyuan, 21
Pérez-Carrasco, J. A., 31
Pfeiffer, John M., 0A
Pfeiffer, Tim, 2G
Pham, Dzung L., 0F
Phipps, Robert, 1H
Pohle-Fröhlich, Regina, 2N
Prince, Jerry L., 09, 0H, 0Y, 1S, 37, 3C
Poulopoulos, Raymond, 1H
Qin, Lei, 25
Quan, Guotao, 24
Raghunath, Sushravya, 0A
Reese, Timothy G., 1S
Reinhold, Jacob C., 0H
Remedios, Samuel W., 0F, 0L
Ren, Lei, 2L
Rex, Tonia S., 2Q
Reynolds, Jess E., 0L
Riviére, Béatrice, 17
Rogers, Baxter P., 0V
Rose, Georg, 2G
Roth, Holger R., 16
Roy, Snehashis, 0F
Ruan, Dan, 2V
Sabczynski, Jörg, 0I
Saha, Punam K., 12
Saidha, Shiv, 09, 0Y, 3C
Sander, Jörg, 0R
Sandler, Kim L., 0D, 23
Sang, Yudi, 2V
Santhanan, Anand P., 0P
Savona, Michael R., 10, 11, 2O, 36
Schilling, Kurt G., 0S, 2Q
Schneider, Walt, 0S
Schon, E., 15
Schumacher, Mona, 14
Schuster, David M., 38
Sengupta, Sourya, 2M
Serrano, C., 31
Seshan, Saty, 0P
Shahedi, Maysam, 13
Shastry, Arun H., 26
Shen, Chen, 16
Sheng, Ke, 0O
Shi, Fei, 1O, 12, 20, 2H, 32, 33, 35
Shi, Huimin, 11
Shinoki, Takehiro, 0J
Singanamalli, Asha, 3B
Sohn, Elliott H., 0B
Conference Committee

Symposium Chairs

Georgia D. Tourassi, Oak Ridge National Laboratory (United States)
Metin N. Gurcan, Wake Forest Baptist Medical Center (United States)

Conference Chairs

Ivana Išgum, Amsterdam UMC (Netherlands)
Bennett A. Landman, Vanderbilt University (United States)

Conference Program Committee

Elsa D. Angelini, Imperial College London (United Kingdom) and Columbia University (United States) and Télécom ParisTech (France)
Meritxell Bach-Cuadra, Université de Lausanne (Switzerland)
Ulas Bagci, University of Central Florida (United States)
Antong Chen, Merck & Co., Inc. (United States)
Olivier Colliot, Centre National de la Recherche Scientifique (France)
Tolga Çukur, Bilkent University (Turkey)
Benoit M. Dawant, Vanderbilt University (United States)
Marleen de Bruijne, Erasmus MC (Netherlands)
Lotta Maria Ellingsen, University of Iceland (Iceland)
Alexandre X. Falcão, Universidade Estadual de Campinas (Brazil)
Aaron Fenster, Robarts Research Institute (Canada)
James Fishbaugh, NYU Tandon School of Engineering (United States)
Alejandro F. Frangi, University of Leeds (United Kingdom)
Yu Gan, The University of Alabama (United States)
Mona K. Garvin, The University of Iowa (United States)
James C. Gee, University of Pennsylvania (United States)
Benjamin Glocker, Imperial College London (United Kingdom)
Miguel Angel González Ballester, Universitat Pompeu Fabra (Spain)
Hayit Greenspan, Tel Aviv University (Israel)
David R. Haynor, University of Washington (United States)
Tobias Heimann, Siemens Healthineers (Germany)
Christine P. Hendon, Columbia University (United States)
Stefan Klein, Erasmus MC (Netherlands)
Leigh Johnston, The University of Melbourne (Australia)
Tianhu Lei, MD Imaging Research (United States)
Karim Lekadir, Universitat de Barcelona (Spain)
Boudewijn P. F. Lelieveldt, Leiden University Medical Center (Netherlands)
Natasha Lepore, The University of Southern California (United States)
Marius George Linguraru, Children’s National Medical Center (United States)
Murray H. Loew, The George Washington University (United States)
Cristian Lorenz, Philips Research (Germany)
Frederik Maes, Katholieke Universiteit Leuven (Belgium)
Vincent A. Magnotta, The University of Iowa Hospitals and Clinics (United States)
Rashindra Manniesing, Radboud University Medical Center (Netherlands)
Diana Mateus, École Centrale de Nantes (France)
Jhimli Mitra, GE Global Research (United States)
Sunanda D. Mitra, Texas Tech University (United States)
Marc Modat, King’s College London (United Kingdom)
Albert Montillo, University of Texas Southwestern Medical Center (United States)
Kensaku Mori, Nagoya University (Japan)
Mads Nielsen, Niels Bohr Institute (Denmark)
Ipek Oguz, Vanderbilt University (United States)
Dzung L. Pham, Henry Jackson Foundation/USU (United States) and National Institutes of Health (United States) and Johns Hopkins University (United States)
Jerry L. Prince, Johns Hopkins University (United States)
Jiantao Pu, University of Pittsburgh (United States)
Xin Qi, Rutgers, The State University of New Jersey (United States)
Maryam E. Rettmann, Mayo Clinic (United States)
Letícia Rittner, Universidade Estadual de Campinas (Brazil)
Mirabela Rusu, Stanford University School of Medicine (United States)
Punam K. Saha, The University of Iowa (United States)
Lin Shi, The Chinese University of Hong Kong (China)
Rachel E. Sparks, King’s College London (United Kingdom)
Marius Staring, Leiden University Medical Center (Netherlands)
Martin A. Styner, The University of North Carolina at Chapel Hill (United States)
Kenji Suzuki, Illinois Institute of Technology (United States)
Tanveer F. Syeda-Mahmood, IBM Research - Almaden (United States)
Raphael Sznitman, Universität Bern (Switzerland)
Zeike A. Taylor, University of Leeds (United Kingdom)
Jayaram K. Udupa, University of Pennsylvania (United States)
Koen Van Leemput, Harvard Medical School (United States) and Massachusetts General Hospital (United States)
Tomaž Vrtovec, University of Ljubljana (Slovenia)
Wolfgang Wein, ImFusion GmbH (Germany)
Session Chairs

1  Image Synthesis, GANs, and Novel Architectures
   Punam Kumar Saha, The University of Iowa (United States)
   Mirabela Rusu, Stanford University School of Medicine (United States)

2  Image Analysis in Ultrasound and OCT: Joint Session with Conferences 11313 and 11319
   Jayaram K. Udupa, Penn Medicine (United States)
   Nicole V. Ruiter, Karlsruher Institut für Technologie (Germany)

3  Lesions and Pathologies
   Ipek Oguz, Vanderbilt University (United States)
   Kenji Suzuki, Tokyo Institute of Technology (Japan)

4  Machine Learning and Deep Learning
   Olivier Colliot, Centre National de la Recherche Scientifique (France)
   Jhimli Mitra, GE Global Research (United States)

5  Registration
   Murray H. Loew, The George Washington University (United States)
   Mirabela Rusu, Stanford University School of Medicine (United States)

6  fMRI and DTI
   Juan Carlos Prieto, The University of North Carolina at Chapel Hill (United States)
   Mads Nielsen, University of Copenhagen (Denmark)

7  Keynote and Highlights
   James C. Gee, University of Pennsylvania (United States)
   Jhimli Mitra, GE Global Research (United States)

8  Labeling and Segmentation
   Antong Chen, Merck & Co., Inc. (United States)
   Bennett A. Landman, Vanderbilt University (United States)

9  Deep Learning: Segmentation
   Dzung L. Pham, Henry M. Jackson Foundation (United States)
   Benoit M. Dawant, Vanderbilt University (United States)

10 Segmentation: Anatomy
   Maryam E. Rettmann, Mayo Clinic (United States)
   Letícia Rittner, Universidade Estadual de Campinas (Brazil)

11 Deep Learning: Uncertainty and Quality
   Benoit M. Dawant, Vanderbilt University (United States)
   Ipek Oguz, Vanderbilt University (United States)
2020 Medical Imaging Award Recipients

Robert F. Wagner Best Student Paper Award
Robert F. Wagner was an active scientist in the SPIE Medical Imaging meeting, starting with the first meeting in 1972 and continuing throughout his career. He ensured that the BRH, and subsequently the CDRH, was a sponsor for the early and subsequent Medical Imaging meetings, helping to launch and ensure the historical success of the meeting. The Robert F. Wagner All-Conference Best Student Paper Award (established 2014) is acknowledgment of his many important contributions to the Medical Imaging meeting and his many important advances to the field of medical imaging.

This award is co-sponsored by:

![The Medical Image Perception Society](image)

2020 Recipients:

First Place: **Multi-body registration for fracture reduction in orthopaedic trauma surgery** (11315-14)
R. Han, A. Uneri, P. Wu, R. Vijayan, P. Vagdargi, M. Ketcha, N. Sheth, Johns Hopkins University (United States), S. Vogt, G. Kleinszig, Siemens Healthineers (Germany) G. M. Osgood, John Hopkins Hospital (United States), J. H. Siewerdsen, John Hopkins University (United States)

Second Place: **Phase contrast CT enabled three-material decomposition in spectral CT imaging** (11312-47)
Xu Ji, Ran Zhang, Ke Li, Guang-Hong Chen, University of Wisconsin School of Medicine and Public Health (United States)

Image Processing Student Paper Awards sponsored by 12 Sigma Technologies

**Winner:** **Coronary artery calcium scoring: can we do better?** (11313-15)
Sanne G.M. van Velzen, Bob D. de Vos, Univerisity Medical Center Utrecht and Utrecht University (Netherlands), Helena M. Verkooijen, Tim Leiner, Univerisity Medical Center Utrecht (Netherlands), Max A. Viergever, Univerisity Medical Center Utrecht and Utrecht University (Netherlands), Ivana Išgume, University Medical Center Utrecht and Amsterdam University Medical Center (Netherlands)
Runner-up: Validation and optimization of multi-organ segmentation on clinical imaging archives (11313-95)
Olivia Tang, Yuchen Xu, Yucheng Tang, Ho Hin Lee, Vanderbilt University (United States), Yunqiang Chen, Dashan Gao, Shizhong Han, 12 Sigma Technologies (United States), Riqiang Gao, Vanderbilt University (United States), Michael R. Savona, Richard G. Abramson, Vanderbilt University Medical Center (United States), Yuankai Huo, Vanderbilt University (United States), Bennett A. Landman, Vanderbilt University and Vanderbilt University Medical Center (United States)