

Medical Imaging 2020

Image-Guided Procedures, Robotic Interventions, and Modeling

Baowei Fei
Cristian A. Linte
Editors

16–19 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)
SIIM—Society for Imaging Informatics in Medicine (United States)
IFCARS—International Foundation for Computer Assisted Radiology and Surgery (Germany)
WMIS—World Molecular Imaging Society

Published by
SPIE

Volume 11315

Proceedings of SPIE, 1605-7422, V. 11315

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

Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling, edited by
Baowei Fei, Cristian A. Linte, Proc. of SPIE Vol. 11315, 1131501 · © 2020 SPIE
CCC code: 1605-7422/20/\$21 · doi: 10.1117/12.2570843

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 2020: Image-Guided Procedures, Robotic Interventions, and Modeling*, edited by Baowei Fei, Cristian A. Linte, Proceedings of SPIE Vol. 11315 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 1605-7422

ISSN: 2410-9045 (electronic)

ISBN: 9781510633971

ISBN: 9781510633988 (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 © 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.



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
xvii	Conference Committee
xxi	Awards

SESSION 1 CALIBRATION AND TRACKING FOR IMAGE-GUIDED NAVIGATION

- 11315 02 Miniature C-arm simulator using wireless accelerometer based tracking [11315-1]
- 11315 03 Pivot calibration concept for sensor attached mobile c-arms [11315-2]
- 11315 04 3D catheter guidance including shape sensing for endovascular navigation [11315-3]
- 11315 05 Feasibility of 3D motion-compensated needle guidance for TIPS procedures [11315-4]
- 11315 06 Towards electromagnetic tracking of J-tip guidewire: precision assessment of sensors during bending tests [11315-5]

SESSION 2 AI METHODS FOR IMAGE-GUIDED THERAPY

- 11315 07 Validation of a metal artifact reduction method based on 3D conditional GANs for CT images of the ear [11315-6]
- 11315 08 Ultrasound image simulation with generative adversarial network [11315-7]
- 11315 09 Image registration with deep probabilistic classifiers: application in radiation therapy [11315-8]
- 11315 0A Automatic labeling of respiratory phases and detection of abnormal respiratory signals in free-breathing thoracic dynamic MR image acquisitions based on deep learning [11315-9]
- 11315 0B Image-based deformable motion compensation in cone-beam CT: translation to clinical studies in interventional body radiology [11315-10]
- 11315 0C Stabilized ultrasound imaging of a moving object using 2D B-mode images and convolutional neural network [11315-11]

SESSION 3 IMAGE-GUIDED ORTHOPEDIC APPLICATIONS

- 11315 0D Infrared image-guidance for intraoperative assessment of limb length discrepancy during total hip arthroplasty procedures [11315-12]
- 11315 0E Three-dimensional ultrasound for monitoring knee inflammation and cartilage damage in osteoarthritis and rheumatoid arthritis [11315-13]
- 11315 0F Multi-body registration for fracture reduction in orthopaedic trauma surgery (Robert F. Wagner Best Student Paper Award) [11315-14]
- 11315 0G Calibration and registration of a freehand video-guided surgical drill for orthopaedic trauma [11315-15]
- 11315 0H MRI-compatible needle guidance toolkit to streamline arthrography procedures: phantom accuracy study [11315-16]

SESSION 4 ULTRASOUND IMAGING AND IMAGE GUIDANCE: JOINT SESSION WITH CONFERENCES 11315 AND 11319

- 11315 0I Efficient target tracking for 3D ultrasound-guided needle steering [11315-17]
- 11315 0J Automatic brain structure-guided registration of pre and intra-operative 3D ultrasound for neurosurgery [11315-18]
- 11315 0K Automatic needle localization in intraoperative 3D transvaginal ultrasound images for high-dose-rate interstitial gynecologic brachytherapy [11315-19]

SESSION 5 IMAGE-GUIDED NEUROSURGICAL INTERVENTIONS

- 11315 0L Comparison of head pose tracking methods for mixed-reality neuronavigation for transcranial magnetic stimulation [11315-20]
- 11315 0M Localisation of the subthalamic nucleus in MRI via convolutional neural networks for deep brain stimulation planning [11315-21]
- 11315 0O A guidance system for electrode placement in epilepsy cases [11315-23]
- 11315 0P Brain deformation compensation for deep brain lead placement surgery: a comparison of simulations driven by surface vs deep brain sparse data [11315-24]

SESSION 7 AI-BASED METHODS FOR TISSUE CLASSIFICATION: DIAGNOSIS AND THERAPY APPLICATIONS

- 11315 0Q Classification of tumor signatures from electrosurgical vapors using mass spectrometry and machine learning: a feasibility study [11315-25]

- 11315 0R Towards democratizing AI in MR-based prostate cancer diagnosis: 3.0 to 1.5 Tesla [11315-26]
- 11315 0S Automatic segmentation of brain tumor in intraoperative ultrasound images using 3D U-Net [11315-27]

SESSION 8 KEYNOTE PRESENTATION

- 11315 0T Healthcare in need of innovation: exponential technology and biomedical entrepreneurship as solution providers (Keynote Paper) [11315-28]

SESSION 9 AUGMENTED REALITY FOR IMAGE-GUIDED THERAPY

- 11315 0U Augmented reality visualization of hyperspectral imaging classifications for image-guided brain tumor phantom resection [11315-29]
- 11315 0V Accuracy study of Smartglasses/Smartphone AR systems for percutaneous needle interventions [11315-30]
- 11315 0W Augmented reality-assisted biopsy of soft tissue lesions [11315-31]
- 11315 0X Towards augmented reality-based suturing in monocular laparoscopic training [11315-32]

SESSION 10 NOVEL IMAGING TECHNOLOGIES FOR INTERVENTIONAL GUIDANCE

- 11315 0Y Patient-specific deep deformation models (PsDDM) to register planning and interventional ultrasound volumes in image fusion-guided interventions [11315-33]
- 11315 0Z Image guided mitral valve replacement: registration of 3D ultrasound and 2D x-ray images [11315-34]
- 11315 10 Multi-view 3D echocardiography volume compounding for mitral valve procedure planning [11315-35]
- 11315 11 Assessment of proton beam ablation in myocardial infarct tissue using delayed contrast-enhanced magnetic resonance imaging (Updated version 28 April 2020) [11315-36]
- 11315 12 Transformation optimization and image blending for 3D liver ultrasound series stitching [11315-37]

SESSION 11 VIDEO AND OPTICAL METHODS FOR IMAGING

- 11315 13 Automatic A-line coronary plaque classification using combined deep learning and textural features in intravascular OCT images [11315-38]

- 11315 14 Motion induced segmentation of stone fragments in ureteroscopy video [11315-39]
- 11315 15 Evaluation of real-time guidewire navigation using virtual endoscopic 4D fluoroscopy [11315-40]
- 11315 16 Towards portable image guidance and automatic patient registration using an RGB-D camera and video projector [11315-41]
- 11315 17 Open-source platform for automated collection of training data to support video-based feedback in surgical simulators [11315-42]
- 11315 18 Improved visual SLAM for bronchoscope tracking and registration with pre-operative CT images [11315-43]

SESSION 12 ROBOT-ASSISTED IMAGE-GUIDED THERAPY

- 11315 19 Robotic tissue scanning with biophotonic probe [11315-44]
- 11315 1A Image-guided robotic k-wire placement for orthopaedic trauma surgery [11315-45]
- 11315 1B A mechatronic guidance system for positron emission mammography and ultrasound-guided breast biopsy [11315-46]
- 11315 1C Fiducial-free 2D/3D registration of the proximal femur for robot-assisted femoroplasty [11315-47]
- 11315 1D Feasibility of robot-assisted ultrasound imaging with force feedback for assessment of thyroid diseases [11315-48]

SESSION 13 MODELING APPLICATIONS FOR IMAGE-GUIDED THERAPEUTICS

- 11315 1E Estimating tongue deformation during laryngoscopy using hybrid FEM-multibody model and intraoperative tracking: a cadaver pilot study [11315-49]
- 11315 1F The image-to-physical liver registration sparse data challenge: characterizing inverse biomechanical model resolution [11315-50]
- 11315 1G Image data-driven thermal dose prediction for microwave ablation therapy [11315-51]
- 11315 1H Modeling the surgical exposure of anatomy in robot-assisted laparoscopic partial nephrectomy [11315-52]

SESSION 14 AI-BASED IMAGE SEGMENTATION AND FEATURE DETECTION

- 11315 1I CNN-based hierarchical coarse-to-fine segmentation of pelvic CT images for prostate cancer radiotherapy [11315-53]
- 11315 1J CondenseUNet: a memory-efficient condensely-connected architecture for bi-ventricular blood pool and myocardium segmentation [11315-54]
- 11315 1K How well do U-Net-based segmentation trained on adult cardiac magnetic resonance imaging data generalize to rare congenital heart diseases for surgical planning? [11315-55]
- 11315 1L Textual fiducial detection in breast conserving surgery for a near-real time image guidance system [11315-56]
- 11315 1M A deep learning approach for surgical instruments detection in Orthopaedic surgery using transfer learning [11315-57]

SESSION 15 JOURNAL OF MEDICAL IMAGING SPECIAL SECTION ON INTERVENTIONAL AND SURGICAL DATA SCIENCE

- 11315 1O SpineCloud: image analytics for predictive modeling of spine surgery outcomes [11315-108]
- 11315 1Q A combined radiomics and cyst fluid inflammatory markers model to predict preoperative risk in pancreatic cystic lesions [11315-110]
- 11315 1R Preoperative angular insertion depth prediction in case of lateral wall cochlear implant electrode arrays [11315-111]
- 11315 1S Integrative radiomic analysis for pre-surgical prognostic stratification of glioblastoma patients: from advanced to basic MRI protocols [11315-112]

POSTER SESSION

- 11315 1T Multi-destination procedure planning for comprehensive lymph node staging bronchoscopy [11315-58]
- 11315 1U Virtual radial-probe endobronchial ultrasound for image-guided bronchoscopy [11315-59]
- 11315 1V Alignment of cortical vessels viewed through the surgical microscope with preoperative imaging to compensate for brain shift [11315-60]
- 11315 1W Rigid and deformable corrections in real-time using deep learning for prostate fusion biopsy [11315-61]
- 11315 1X Automated classification of brain tissue: comparison between hyperspectral imaging and diffuse reflectance spectroscopy [11315-62]

- 11315 1Y **Automatic fiducial marker detection and localization in CT images: a combined approach** [11315-63]
- 11315 1Z **Error analysis for a navigation system using 3D abdominal ultrasound** [11315-64]
- 11315 20 **Flexible piezoelectric sensor for real-time image-guided colonoscopies: a solution to endoscopic looping challenges in clinic** [11315-65]
- 11315 21 **Feasibility study of catheter segmentation in 3D Frustum ultrasounds by DCNN** [11315-66]
- 11315 22 **Blood flow anomaly detection via generative adversarial networks: a preliminary study** [11315-67]
- 11315 23 **Exploiting confident information for weakly supervised prostate segmentation based on image-level labels** [11315-68]
- 11315 24 **Workflow for creation and evaluation of virtual nephrolithotomy training models** [11315-69]
- 11315 25 **Value based decision support to prioritize development of innovative technologies for image-guided vascular surgery in the hybrid operating theater** [11315-70]
- 11315 26 **Open source software platform for interstitial ablation treatment planning** [11315-71]
- 11315 27 **Automatic segmentation of spinal ultrasound landmarks with U-net using multiple consecutive images for input** [11315-72]
- 11315 28 **Applications of VR medical image visualization to chordal length measurements for cardiac procedures** [11315-73]
- 11315 29 **Stereovision-updated image guidance in multi-level open spine surgery: short vs. long exposure** [11315-74]
- 11315 2A **Assessment of skill translation of intrathecal needle insertion using real-time needle tracking with an augmented reality display** [11315-75]
- 11315 2B **Multi-slot extended view imaging on the O-Arm: image quality and application to intraoperative assessment of spinal morphology** [11315-76]
- 11315 2C **Computer vision-guided bronchoscopic navigation using dual CNN-generated depth images and ICP registration** [11315-77]
- 11315 2E **Patient-specific, dynamic models of hypoplastic left heart syndrome tricuspid valves for simulation and planning** [11315-79]
- 11315 2F **A Windows GUI application for real-time image guidance during motion-managed proton beam therapy** [11315-80]
- 11315 2G **Automated segmentation of computed tomography colonography images using a 3D U-Net** [11315-81]

- 11315 2H Spherical harmonics for modeling shape transformations of breasts following breast surgery [11315-82]
- 11315 2I Deep learning-based automatic prostate segmentation in 3D transrectal ultrasound images from multiple acquisition geometries and systems [11315-83]
- 11315 2K Assessment of therapy applicator targeting with a mechanically assisted 3D ultrasound system for minimally invasive focal liver tumor therapy [11315-85]
- 11315 2L Video-based automatic and objective endoscopic sinus surgery skill assessment [11315-86]
- 11315 2M Multi-slot intraoperative imaging and 3D-2D registration for evaluation of long surgical constructs in spine surgery [11315-88]
- 11315 2O Development of ultrasonography assistance robot for prenatal care [11315-90]
- 11315 2P Data-driven detection and registration of spine surgery instrumentation in intraoperative images (Cum Laude Poster Award) [11315-91]
- 11315 2Q Force and torque feedback in endoscopic vessel harvesting [11315-92]
- 11315 2R Multi-step segmentation for prostate MR image based on reinforcement learning [11315-93]
- 11315 2S Image-based extraction of breathing signal from cone-beam CT projections [11315-94]
- 11315 2T A standardized method for accuracy study of MRI-compatible robots: case study: a body-mounted robot [11315-95]
- 11315 2U Preoperative prediction of insertion depth of lateral wall cochlear implant electrode arrays [11315-96]
- 11315 2V Cochlear implant electrode sequence optimization using patient specific neural stimulation models [11315-97]
- 11315 2W Renal biopsy under augmented reality guidance (Image-Guided Procedures, Robotic Interventions, and Modeling Student Paper Award) [11315-98]
- 11315 2X Development of a novel tumor phantom model for head and neck squamous cell carcinoma and its applications [11315-99]
- 11315 2Y Automated segmentation of cardiac chambers from cine cardiac MRI using an adversarial network architecture [11315-100]
- 11315 2Z Optical imaging of dental plaque pH [11315-101]
- 11315 30 Texture kinetic features from pre-treatment DCE MRI for predicting pathologic tumor stage regression after neoadjuvant chemoradiation in rectal cancers [11315-102]
- 11315 31 A comprehensive workflow and framework for immersive virtual endoscopy of dissected aortae from CTA data [11315-104]

- 11315 32 A personalized approach for microwave ablation treatment planning fusing radiomics and bioheat transfer modeling [11315-105]
- 11315 33 Obtaining the potential number of object models/atlasses needed in medical image analysis [11315-106]

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.

Ajani, Bhavya, 1W	Cahill, Patrick J., 0A
Akbari, Hamed, 1S	Cai, Yunliang, 29
Al Efshat, Mohammad A., 1Q	Cakir, Ahmet, 2V
Ali, Sharib, 14	Capostagno, S., 0B
Allen, Daniel R., 02	Carnahan, Patrick, 10, 28, 2E
Allen, Peter J., 1Q	Carson, Matthew D., 2Z
Alshara, Yasmeen, 2W	Carton, François-Xavier, 0S
Anari, Jason B., 0A	Chabanas, Matthieu, 0S
Antunes, Jacob T., 30	Chakraborty, Jayasree, 1Q
Appleton, Tom, 0E	Chakravorti, Srijata, 07
Armand, Mehran, 1C	Chalian, Majid, 0W
Aronson, Joshua, 0P	Chaurasia, Akash, 0D
Askan, Gokce, 1Q	Chen, Elvis C. S., 02, 06, 10, 28, 2E
Asselin, Mark, 0Q, 16, 19	Chen, Xiaojun, 31
Attiyeh, Marc A., 1Q	Chen, Zhang, 23, 2R
Babic, Drazenko, 1X	Chou, Yuting, 1Q
Bainbridge, Daniel, 10, 28	Choueib, Saleh, 2A
Bakas, Spyridon, 1S	Clarke, Collin, 02
Balachandran, Vinod P., 1Q	Cleary, K., 0H, 2T
Bardosi, Zoltan, 1Y	Condino, Sara, 06
Barker, Kevin, 2K	Connolly, Laura, 0Q, 19
Barr, Colton, 16	Corner, Stephen M., 2F
Barr, Keiran, 2G	Cotin, Stephane, 1V
Bascom, Rebecca, 1U	Dakkak, Jessica, 20
Basturk, Olca, 1Q	D'Angelica, Michael I., 1Q
Bax, Jeffrey, 1B, 2K	Dangi, Shusil, 2Y
Baxter, John S. H., 0M	Daniel, Bruce, 0L
Bednarz, Bryan, 0Y	Davatzikos, Christos, 1S
Beerbaum, Philipp, 1K	Davis, Brian J., 15
Beltran, Chris, 2F	Dawant, Benoit M., 07
Benassi, Thomas, 0D, 20	Deaton, Nancy, 0Z
Bender, Evan, 0D	Deisher, Amanda J., 11, 2F, 34
Bera, Kaustav, 30	Deng, Shujie, 28
Berg, Jonah, 2C	Desai, Jaydev P., 0Z
Beskin, V., 0H, 2T	De Silva, T., 0G, 1O
Bettati, Patric, 0W	de With, Peter H. N., 1X, 21
Bezerra, Hiram, 13	Dhou, Salam, 2S
Bhardwaj, Aditya, 1W	Ding, Alice K., 1G
Bhati, Mahendra T., 0L	Do, Richard K. G., 1Q
Bhuiyan, MD Fiaz Islam, 0Z	Doerr, S. A., 1O, 2B, 2M, 2P
Bilello, Michel, 1S	Doggen, Carine J. M., 25
Bisleri, Gianluigi, 2Q	Dormer, James D., 0W, 0Z, 23, 2R
Bly, Randall A., 2L	Drebin, Jeffrey A., 1Q
Boctor, Emad M., 0C	Durtschi, Maxwell S., 29
Boone, Nora, 2E	Edstrom, Erik, 1X
Borgard, Heather, 1E	Egger, Jan, 31
Brady, Justin T., 30	Ehtiati, T., 0B
Burstrom, Gustav, 1X	Eixmann, Tim, 04
Caffo, B., 1O	Elangovan, Sanjay, 20

- Elbatarny, Lydia, 08
 Ellermann, Katrin, 31
 Elmi-Terander, Adrian, 1X
 Engelhardt, Sandy, 0X, 1K
 Ernst, Floris, 04
 Erus, Guray, 1S
 Etkin, Amit, 0L
 Evans, Linton T., 29
 Fan, Carolyn, 0X
 Fan, Xiaoyao, 0O, 0P, 29
 Farshad, Mazda, 03
 Fauver, Mark E., 2Z
 Fei, Baowei, 0U, 0W, 0Z, 2W
 Fels, Sidney, 1E
 Fenster, Aaron, 0E, 0K, 1B, 2I, 2K
 Ferrari, Mauro, 06
 Ferrari, Vincenzo, 06
 Fiard, Gaelle, 0I
 Fichtinger, Gabor, 08, 0Q, 16, 17, 19, 24, 26, 27,
 2A, 2G, 2Q
 Figl, Michael, 1Z
 Filippov, Mihail, 24
 Foo, Thomas K., 0J, 0Y
 Freysinger, Wolfgang, 1Y
 Friebel, Michael H., 0T
 Friedman, Kenneth, 30
 Frisken, Sarah, 0J, 1V
 Fürnstahl, Philipp, 03
 Gahan, Jeffrey, 2W
 Gao, Cong, 1C
 García-Vázquez, Verónica, 04
 Gardi, Lori, 1B, 2K
 Geelkerken, Robert H., 25
 Gharaibeh, Yazan, 13
 Ghose, Soumya, 0J, 0Y
 Gillies, Derek J., 0E, 0K, 2I, 2K
 Ginty, Olivia, 2E
 Golby, Alexandra, 0J, 1V
 Goldsmith, Louise, 14
 Gonen, Mithat, 1Q
 Gooding, Jim, 09
 Gormley, William B., 16
 Grebenisan, Andrew, 0R
 Greil, Gerald, 1K
 Grupp, Robert B., 1C
 Gsaxner, Christina, 31
 Gu, Xinyu, 2L
 Gunacker, Simon, 31
 Gupta, Soumya, 14
 Gyacskov, Igor, 0K, 2I
 Ha, Sung Min, 1S
 Hager, G., 1O
 Halicek, Martin, 0U
 Halter, Ryan J., 1E, 1H, 2X
 Han, R., 0F, 1A, 1O
 Hannaford, Blake, 2L
 Hanson, S. E., 2H
 Haouchine, Nazim, 1V
 Hargreaves, Brian, 0L
 Harrington, Kate A., 1Q
 Hasan, S. M. Kamrul, 1J
 Hashtroodi-Zaad, Keyvan, 2Q
 Hata, Nobuhiko, 2C
 Hayashi, Yuichiro, 18
 Heiselman, Jon S., 1F, 1G, 1L
 Helm, P. A., 2B, 2M, 2P
 Hendriks, Benno H. W., 1X
 Herman, Michael G., 11, 2F, 34
 Herz, Christian, 2E
 Heslinga, Friso G., 25
 Higgins, William E., 1T, 1U
 Hill, Matthew, 0D
 Hohmann, S., 11, 34
 Honma, Hirotoshi, 18
 Hookey, Lawrence, 2G
 Hossain, Belayat, 1M
 Hrinivich, W. Thomas, 0K
 Huang, Chuqin, 2Z
 Huang, James, 0U, 0W
 Huang, Y., 2P
 Hummel, Johann, 1Z
 Hummel, Marjan, 25
 Hussain, Tarique, 1K
 Hüttmann, Gereon, 04
 Iommil, David, 1Z
 Iwata, Hiroyasu, 2O
 Izard, Jason, 0R
 Jäckle, Sonja, 04
 Jaeger, Melanie, 2A
 Jamzad, Amoon, 0Q, 19
 Jannin, Pierre, 0M
 Janssen, Natasja, 2A
 Jarnagin, William R., 1Q
 Ji, Songbai, 29
 Jiang, Bote, 26
 Jin, Ze, 33
 Jithendra, Aditi, 0D
 Johnson, Brett, 2W
 Jolley, Matthew A., 2E
 Jones, C. K., 2B, 2M, 2P
 Joschko, Abigail, 02
 Judson, Blake O., 2W
 Jupitz, Sydney, 0Y
 Jusomjai, Kasidit, 32
 Jutras, Jean-David, 09
 Juvekar, Parikshit, 1V
 Kakani, Nirmal, 2K
 Kaminski, Jakub T., 1D
 Kaufmann, Martin, 0Q
 Kekec, Taygun, 12
 Kenet, Adam, 20
 Ketcha, M. D., 0F, 1A, 1O, 2B, 2M, 2P
 Khan, Mohammad M. R., 1R, 2U
 King, Franklin, 2C
 Kingham, T. Peter, 1Q
 Kitasaka, Takayuki, 18
 Kleemann, Markus, 04
 Kleinszig, G., 0F, 1A
 Kloss, Jonathan, 0X
 Kobashi, Syoji, 1M

- Koehler, Sven, 1K
 Koffijberg, Hendrik, 25
 Kokko, Michael A., 1H
 Kolen, Alexander F., 21
 Kolluru, Chaitanya, 13
 Konishi, H., 11, 34
 Kronreif, Gernot, 26
 Kruse, Jon J., 11, 2F, 34
 Kudavelly, Srinivas Rao, 1W
 Kuhlengel, Trevor K., 1T
 Labadie, Robert F., 1R, 2U
 Ladwa, Amrita, 20
 Laeseke, Paul F., 05, 15
 Laframboise, Jacob, 17, 2G
 Lai, Marco, 1X
 Lapouge, Guillaume, 0I
 Lasso, Andras, 16, 19, 2E
 Latus, Heiner, 1K
 Lawrence, Sharon A., 1Q
 Le, Phuc, 2W
 Lee, E. J., 0H
 Lee, Juhwan, 13
 Lee, Junghoon, 1I
 Lee, Lauren K., 2Z
 Lee, Sing Chun, 03
 Leung, Lai Yee, 22
 Leuze, Christoph, 0L
 Li, Chen, 0P, 29
 Li, Gen, 2R
 Li, Janning, 31
 Li, Ming, 0V
 Li, Pan, 2T
 Li, Qinmei, 2W
 Li, Robert, 0D
 Li, Xiaojian, 23, 2R
 Lin, Shan, 2L
 Linte, Cristian A., 1J, 2Y
 Liu, Simon, 20
 Liu, Xinqi, 2C
 Liu, Ziteng, 2V
 Lloyd, John, 1E
 Long, Dilara, 0V
 Lott, Carina, 0A
 Luo, Ma, 1L
 MacDonald, Michael, 0Y
 Maguet, Ehouarn, 0M
 Mahadevan, Eashwar, 20
 Manbachi, Amir, 0D, 20
 Manni, Francesca, 1X
 Marinelli, Luca, 22
 McCarren, Kathleen, 0D
 McDonough, Joseph M., 0A
 McGarry, Ciara, 2A
 McIntyre, Caitlin A., 1Q
 McNab, Jennifer A., 0L
 Meerwaldt, Robbert, 25
 Melito, Gian Marco, 31
 Menard, Alexandre, 0R
 Merchant, F. A., 2H
 Meszoely, Ingrid M., 1L
 Miga, Michael I., 1F, 1G, 1L
 Mills, David, 0J, 0Y
 Min, Lan, 21
 Mirza, Sohail K., 29
 Mistretta, Charles A., 15
 Mitra, Jhimli, 0J, 0Y, 22
 Mo, Larry, 22
 Moe, Kris S., 2L
 Moelker, Adriaan, 12
 Monfaredi, R., 0H, 2T
 Moore, John, 02, 06, 10, 28, 2E
 Mori, Kensaku, 18
 Mori, Masaki, 18
 Morrison, Jonathan, 22
 Mousavi, Parvin, 09, 0Q, 0R, 19
 Mukhopadhyay, Soumik, 1W
 Müller-Stich, Beat Peter, 0X
 Munkvold, Bodil K. R., 0S
 Nam, Hannah H., 2E
 Nanda, Siddhartha, 30
 Narayanan, Roshini, 20
 Natori, Hiroshi, 18
 Navab, Nassir, 03
 Newman, L. K., 11, 34
 Ng, Kenneth, 20
 Nickel, Felix, 0X
 Nicol, Christopher, 0Q, 19
 Niessen, Wiro J., 12
 Nisar, Hareem, 06
 Nishio, Shoichi, 1M
 Noble, Jack H., 07, 0S, 1R, 2U, 2V
 Nowroozilariki, Z., 2H
 Oda, Masahiro, 18
 Oni, Julius, 0D
 Orlando, Nathan, 2I
 Osgood, G. M., 0F, 0G, 1A
 Packer, D. L., 11, 34
 Padala, Muralidhar, 0Z
 Papernick, Sam, 0E
 Park, Claire K., 1B
 Park, Jun-Sung, 1W
 Parker, K. D., 11, 34
 Paspulati, Raj M., 30
 Pastel, David, 2X
 Pathompatai, Chanok, 32
 Patterson, Lindsey, 2A
 Pätz, Torben, 04
 Paulsen, Keith D., 0O, 0P, 29
 Paulussen, Elvira, 1X
 Paydarfar, Joseph A., 1E, 2X
 Pepe, Antonio, 31
 Perdomo-Pantoja, A., 1O
 Periyasamy, Sarvesh, 05, 15
 Persson, Oscar, 1X
 Peters, Terry M., 02, 06, 10, 28, 2E
 Pfefferle, Matthew, 2W
 Piazza, Roberta, 06
 Pickardt, Thomas, 1K
 Pieper, Steve, 16, 2T
 Pigeau, Grace, 08, 27

- Pinter, Csaba, 26
 Poignet, Philippe, 0I
 Ponukumati, Aravind, 2X
 Prabhu, David, 13
 Prakash, Punit, 32
 Preetha, Chandrakanth Jayachandran, 0X
 Pulvirenti, Alessandra, 1Q
 Pushparajah, Kuberan, 28
 Qiu, Catherine, 0A
 Quintanilla, Erick, 2X
 Rafatzand, Khashayar, 1D
 Rahman, Nahian, 0Z
 Rasmussen, Todd, 22
 Rathore, Saima, 1S
 Reece, G. P., 2H
 Regodic, Milovan, 1Y
 Reinertsen, Ingerid, 0S
 Rettmann, M. E., 11, 34
 Richey, Winona L., 1L
 Rittscher, Jens, 14
 Roberts, David W., 0O
 Robertson, Faith C., 16
 Robinson, Adam, 1I
 Rodgers, Jessica R., 0K
 Rozycski, Martin, 1S
 Rubino, Rachel, 0Q, 19
 Rudan, John, 0Q
 Sabah, Shafiya, 2S
 Sainsbury, Ben, 24
 Sako, Chiharu, 1S
 Salomons, Gregory, 09
 Sampathkumar, U., 2H
 Sánchez, C. Antonio, 1E
 Santilli, Alice, 26
 Sarcar, Shourya, 0Y
 Sarikouch, Samir, 1K
 Sathyaranayana, Supriya, 0L
 Schonewille, Abigael, 08, 27
 Schreiner, John, 09
 Schulz-Hildebrandt, Hinnerk, 04
 Sebek, Jan, 32
 Sedghi, Alireza, 09, 0Q, 0R
 Seibel, Eric J., 2Z
 Seibold, Matthias, 03
 Seifabadi, Reza, 0V
 Seigne, John D., 1H
 Shahbazi, Mahya, 0C
 Shahedi, Maysam, 0U, 0W, 2W
 Shahub, Sarah, 2W
 Shan, Caifeng, 1X, 21
 Sharani, Lalith, 0X
 Sharda, Sikander, 1W
 Sharma, K., 0H
 Sharma, Manuja, 2Z
 Sheng, Jun, 0Z
 Sheth, N. M., 0F, 0G, 1A
 Shi, Yuan, 2X
 Shinohara, Russell, 1S
 Shukla, Gaurav, 1S
 Si, Xiangyu, 2R
 Siampli, E., 2T
 Siddiq, Kamran, 20
 Siemens, Robert, 0R
 Sieren, Malte Maria, 04
 Siewersden, J. H., 0B, 0F, 0G, 1A, 1O, 2B, 2M, 2P
 Simpson, Amber L., 1Q
 Simpson, John M., 28
 Singanamalli, Asha, 22
 Singh, Ashish, 1S
 Sisniega, A., 0B, 0G
 Skolasky, R. L., 1O
 Skyrman, Simon, 1X
 Smith, L. Scott, 0J, 0Y, 22
 Son, Yuri, 1W
 Song, Daniel Y., 1I
 Sotiras, Aristeidis, 1S
 Speidel, Michael A., 05, 15
 Sramek, Michael, 2X
 State, Claire, 0D
 Stayman, J. W., 0B
 Strother, Charles M., 15
 Sultana, Sharmin, 1I
 Sun, Changjian, 0A
 Sun, Yuanyuan, 12
 Sunderland, Kyle, 17, 24, 27
 Swamy, Akash, 1X
 Taeprasartsit, Pinyo, 32
 Takabatake, Hirotugu, 18
 Takafunio, Hiranaka, 1M
 Takasuka, Hannah, 0D
 Tandon, Animesh, 1K
 Taylor, Russell H., 0C, 1C
 Tempary, Clare, 0Y
 ter Mors, Thijs G., 25
 Tessier, David, 2K
 Theodore, N., 1O
 Tian, Zhiqiang, 23, 2R
 Tong, Yubing, 0A
 Torigian, Drew A., 0A, 33
 Toth, Jennifer, 1U
 Troccaz, Jocelyne, 0I
 Tryggestad, Erik J., 2F
 Tsumura, Ryosuke, 2O
 Turney, Ben, 14
 Udupa, Jayaram K., 0A, 33
 Unberath, Mathias, 1C
 Uneri, A., 0F, 0G, 1A, 1O, 2B, 2M, 2P
 Ungi, Tamas, 08, 0Q, 17, 19, 24, 27, 2A, 2G, 2Q
 Upendra, Roshan Reddy, 2Y
 Vagdargi, P., 0F, 0G, 1A
 Valladares, Alejandra, 1Z
 Van Citters, Douglas W., 1H
 van Walsum, Theo, 12
 Vargas, Jose, 2W
 Vedula, S. S., 1O
 Venugopal, Prem, 22
 Vijayan, R. C., 0F, 1A, 1O
 Viswanath, Satish E., 30
 Vogt, S., 0F, 1A
 von Haxthausen, Felix, 04

Wagner, Martin G., 05, 15
Wallace, Kirk, 22
Wan Chan Tseung, Hok Seum, 2F
Wang, Cheng, 18
Wang, Jianing, 07
Wehrmann, Fabian Siegfried, 0X
Weiss, C. R., 0B
Wells, William M. III, 09, 1V
Wetzstein, Gordon, 0L
Wheeler, Gavin, 28
Wibowo, Henky, 32
Wiercigroch, Julia, 2Q
Williams, Travis L., 1Q
Willis, Joseph E., 30
Wilson, David, 13
Witham, T., 1O
Wolf, Ivo, 1K
Wood, Bradford J., 0V
Wu, Caiyun, 0A
Wu, Catherine O., 24
Wu, P., 0F, 1A, 2B
Wu, Victoria, 08, 27
Wu, Xiaotian, 1E, 2X
Wu, Yixuan, 0C
Xie, Tian, 0C
Xu, Sheng, 0V
Yam, Scott, 0Q, 19
Yan, Jerry, 0D
Yan, Justin, 20
Yang, Hongxu, 21
Yarmolenko, P., 0H
Yates, Lauren, 19
Yeo, Desmond Teck-Beng, 0J, 0Y
Zevin, Boris, 17
Zhang, Haichong K., 1D
Zhang, X., 2B, 2M, 2P
Zhang, Yinshu, 23
Zhang, Zheng, 2F
Zhao, Wennan, 1U
Zhao, Yiyuan, 07
Zimin, Vladislav N., 13

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

Baowei Fei, The University of Texas at Dallas (United States) and The University of Texas Southwestern Medical Center (United States)
Cristian A. Linte, Rochester Institute of Technology (United States)

Conference Programme Committee

Purang Abolmaesumi, The University of British Columbia (Canada)
Matthieu Chabanas, Université Grenoble Alpes (France)
Elvis C. S. Chen, Robarts Research Institute (Canada)
Sandrine de Ribaupierre, Western University (Canada)
Gabor Fichtinger, Queen's University (Canada)
Ryan J. Halter, Thayer School of Engineering at Dartmouth (United States)
David Hawkes, University College London (United Kingdom)
David R. Haynor, University of Washington (United States)
William E. Higgins, The Pennsylvania State University (United States)
David R. Holmes III, Mayo Clinic (United States)
Pierre Jannin, Université de Rennes 1 (France)
David M. Kwartowitz, Grand Canyon University (United States)
Shuo Li, Western University (Canada)
Michael I. Miga, Vanderbilt University (United States)
Kensaku Mori, Nagoya University (Japan)
Parvin Mousavi, Queen's University (Canada)
Jack H. Noble, Vanderbilt University (United States)
Maryam E. Rettmann, Mayo Clinic (United States)
Frank Sauer, Siemens Healthineers (United States)
Eric J. Seibel, University of Washington (United States)
Guy Shechter, Philips Healthcare (United States)
Jeffrey H. Siewerdsen, Johns Hopkins University (United States)
Amber L. Simpson, Memorial Sloan-Kettering Cancer Center (United States)
Stefanie Speidel, Nationale Centrum für Tumorerkrankungen Dresden (Germany)
Tamas Ungi, Laboratory for Percutaneous Surgery (Canada)
Satish E. Viswanath, Case Western Reserve University (United States)
Robert J. Webster III, Vanderbilt University (United States)

Andrew D. Wiles, Northern Digital Inc. (Canada)
Ivo Wolf, Hochschule Mannheim (Germany)
Ziv R. Yaniv, National Institute of Allergy and Infectious Diseases
(United States)

Session Chairs

- 1 Calibration and Tracking for Image-guided Navigation
Elvis C. S. Chen, Robarts Research Institute (Canada)
Tamas Ungi, Laboratory for Percutaneous Surgery (Canada)
- 2 AI Methods for Image-guided Therapy
Jack H. Noble, Vanderbilt University (United States)
Matthieu Chabanas, Université Grenoble Alpes (France)
- 3 Image-guided Orthopedic Applications
David R. Haynor, University of Washington (United States)
David R. Holmes III, Mayo Clinic (United States)
- 4 Ultrasound Imaging and Image Guidance: Joint Session with Conferences 11315 and 11319
Haichong Kai Zhang, Worcester Polytechnic Institute (United States)
Parvin Mousavi, Queen's University (Canada)
- 5 Image-guided Neurosurgical Interventions
Ivo Wolf, Hochschule Mannheim (Germany)
David M. Kwartowitz, Grand Canyon University (United States)
- 7 AI-based Methods for Tissue Classification: Diagnosis and Therapy Applications
Jeffrey H. Siewerdsen, Johns Hopkins University (United States)
- 8 Keynote Presentation
Cristian A. Linte, Rochester Institute of Technology (United States)
Baowei Fei, The University of Texas at Dallas (United States)
- 9 Augmented Reality for Image-guided Therapy
Eric J. Seibel, University of Washington (United States)
Maryam E. Rettmann, Mayo Clinic (United States)
- 10 Novel Imaging Technologies for Interventional Guidance
David R. Holmes III, Mayo Clinic (United States)
Ziv R. Yaniv, National Institute of Allergy and Infectious Diseases
(United States)

- 11 Video and Optical Methods for Imaging
William E. Higgins, The Pennsylvania State University (United States)
Ryan J. Halter, Thayer School of Engineering at Dartmouth
(United States)
- 12 Robot-assisted Image-guided Therapy
Ziv R. Yaniv, National Institute of Allergy and Infectious Diseases
(United States)
Elvis C. S. Chen, Robarts Research Institute (Canada)
- 13 Modeling Applications for Image-guided Therapeutics
Matthieu Chabanas, Université Grenoble Alpes (France)
Maryam E. Rettmann, Mayo Clinic (United States)
- 14 AI-based Image Segmentation and Feature Detection
Kensaku Mori, Nagoya University (Japan)
Satish E. Viswanath, Case Western Reserve University (United States)
- 15 Journal of Medical Imaging Special Section on Interventional Data Science
Amber L. Simpson, Queen's University (United States)
Michael I. Miga, 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

SPIE.

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-Guided Procedures, Robotic Interventions, and Modeling Young Scientist Awards sponsored by Siemens Healthineers

Winner: Development of ultrasonography assistance robot for prenatal care (11315-90)

Ryosuke Tsumuraa, Waseda University (Japan) and Worcester Polytechnic Institute (United States), Hiroyasu Iwata, Waseda University (Japan)

Runner-up: Motion induced segmentation of stone fragments in ureteroscopy video (11315-39)

Soumya Gupta, Sharib Ali, University of Oxford (United Kingdom), Louise Goldsmith, Ben Turney, Oxford University Hospitals NHS Trust (United Kingdom), Jens Rittscher, University of Oxford (United Kingdom)

