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**Image-Guided Procedures, Robotic Interventions, and Modeling**

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Ziv R. Yaniv
Editors

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Volume 9786
Contents

xi Authors
xvii Conference Committee
xxi Introduction
xxiii 2016 Medical Imaging Award Recipients

Part One

SESSION 1 CARDIAC PROCEDURES

9786 02 Improved image guidance technique for minimally invasive mitral valve repair using real-time tracked 3D ultrasound [9786-1]
9786 03 Cognitive tools pipeline for assistance of mitral valve surgery [9786-2]
9786 04 Dynamic tracking of prosthetic valve motion and deformation from bi-plane x-ray views: feasibility study [9786-3]
9786 05 Classification of calcium in intravascular OCT images for the purpose of intervention planning [9786-4]
9786 06 Fusion of CTA and XA data using 3D centerline registration for plaque visualization during coronary intervention [9786-5]

SESSION 2 SEGMENTATION AND 2D AND 3D REGISTRATION

9786 07 Random walk based segmentation for the prostate on 3D transrectal ultrasound images [9786-6]
9786 08 Resection planning for robotic acoustic neuroma surgery [9786-7]
9786 09 Fat segmentation on chest CT images via fuzzy models [9786-8]
9786 0A Automatic masking for robust 3D-2D image registration in image-guided spine surgery [9786-9]
9786 0B Robust patella motion tracking using intensity-based 2D-3D registration on dynamic bi-plane fluoroscopy: towards quantitative assessment in MPFL reconstruction surgery [9786-10]
SESSION 3  SPINE AND PERCUTANEOUS PROCEDURES

9786-0C Fast generation of digitally reconstructed radiograph through an efficient preprocessing of ray attenuation values [9786-11]

9786-0D Accurate biopsy-needle depth estimation in limited-angle tomography using multi-view geometry [9786-12]

9786-0E Automatic geometric rectification for patient registration in image-guided spinal surgery [9786-13]

9786-0F Real-time self-calibration of a tracked augmented reality display [9786-14]

9786-0G Clinical workflow for spinal curvature measurement with portable ultrasound [9786-15]

9786-0H MIND Demons for MR-to-CT deformable image registration in image-guided spine surgery (Robert F. Wagner All-Conference Best Student Paper Award) (Young Scientist Award) [9786-16]

SESSION 4  ULTRASOUND IMAGE GUIDANCE: JOINT SESSION WITH CONFERENCES 9786 AND 9790

9786-0I Automatic detection of a hand-held needle in ultrasound via phased-based analysis of the tremor motion [9786-17]

9786-0J Ultrasound to video registration using a bi-plane transrectal probe with photoacoustic markers [9786-18]

9786-0K Classification of prostate cancer grade using temporal ultrasound: in vivo feasibility study [9786-19]

SESSION 5  REGISTRATION

9786-0L Deformable registration of x-ray to MRI for post-implant dosimetry in prostate brachytherapy [9786-20]

9786-0M Evaluation of a μCT-based electro-anatomical cochlear implant model [9786-21]

9786-0N Fast simulated annealing and adaptive Monte Carlo sampling based parameter optimization for dense optical-flow deformable image registration of 4DCT lung anatomy [9786-22]

9786-0O Automatic pose correction for image-guided nonhuman primate brain surgery planning [9786-23]

9786-0P Accurate tracking of tumor volume change during radiotherapy by CT-CBCT registration with intensity correction [9786-24]
<table>
<thead>
<tr>
<th>SESSION 6</th>
<th>ROBOTIC SYSTEMS AND TREATMENT PLANNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>9786 0Q</td>
<td>Towards disparity joint upsampling for robust stereoscopic endoscopic scene reconstruction in robotic prostatectomy [9786-25]</td>
</tr>
<tr>
<td>9786 0R</td>
<td>Endoscopes and robots for tight surgical spaces: use of precurved elastic elements to enhance curvature [9786-26]</td>
</tr>
<tr>
<td>9786 0S</td>
<td>Disposable patient-mounted geared robot for image-guided needle insertion [9786-27]</td>
</tr>
<tr>
<td>9786 0T</td>
<td>Comparison of portable and conventional ultrasound imaging in spinal curvature measurement [9786-90]</td>
</tr>
<tr>
<td>9786 0U</td>
<td>Image-guided preoperative prediction of pyramidal tract side effect in deep brain stimulation (Young Scientist Award Runner Up) [9786-29]</td>
</tr>
<tr>
<td>9786 0V</td>
<td>Rapid virtual stenting for intracranial aneurysms [9786-30]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 7</th>
<th>TISSUE DEFORMATION AND MOTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9786 0W</td>
<td>Surface driven biomechanical breast image registration [9786-31]</td>
</tr>
<tr>
<td>9786 0X</td>
<td>Modeling and simulation of tumor-influenced high resolution real-time physics-based breast models for model-guided robotic interventions [9786-32]</td>
</tr>
<tr>
<td>9786 0Y</td>
<td>Accuracy of lesion boundary tracking in navigated breast tumor excision [9786-33]</td>
</tr>
<tr>
<td>9786 0Z</td>
<td>Diaphragm motion characterization using chest motion data for biomechanics-based lung tumor tracking during EBRT [9786-34]</td>
</tr>
<tr>
<td>9786 10</td>
<td>Determination of surgical variables for a brain shift correction pipeline using an Android application [9786-35]</td>
</tr>
<tr>
<td>9786 11</td>
<td>Non-rigid point set registration of curves: registration of the superficial vessel centerlines of the brain [9786-36]</td>
</tr>
<tr>
<td>9786 12</td>
<td>A novel craniotomy simulation system for evaluation of stereo-pair reconstruction fidelity and tracking [9786-37]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SESSION 8</th>
<th>INTRAOPERATIVE IMAGING AND VISUALIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9786 13</td>
<td>Biplane reconstruction and visualization of virtual endoscopic and fluoroscopic views for interventional device navigation [9786-38]</td>
</tr>
<tr>
<td>9786 14</td>
<td>Visual feedback mounted on surgical tool: proof of concept [9786-39]</td>
</tr>
<tr>
<td>9786 15</td>
<td>CT thermometry for cone-beam CT guided ablation [9786-40]</td>
</tr>
<tr>
<td>Session 9</td>
<td>Endoscopy/Laparoscopy</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------</td>
</tr>
<tr>
<td>9786 16</td>
<td>A computational model for estimating tumor margins in complementary tactile and 3D ultrasound images [9786-41]</td>
</tr>
<tr>
<td>9786 17</td>
<td>Freehand 3D-US reconstruction with robust visual tracking with application to ultrasound-augmented laparoscopy [9786-42]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 10</th>
<th>Keynote and New Robotic Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>9786 1F</td>
<td>Toward automated cochlear implant insertion using tubular manipulators [9786-50]</td>
</tr>
<tr>
<td>9786 1G</td>
<td>Increasing safety of a robotic system for inner ear surgery using probabilistic error modeling near vital anatomy (Young Scientist Award Runner Up) [9786-51]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 11</th>
<th>Prostate Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>9786 1H</td>
<td>A comparison of needle tip localization accuracy using 2D and 3D trans-rectal ultrasound for high-dose-rate prostate cancer brachytherapy treatment planning [9786-52]</td>
</tr>
<tr>
<td>9786 1I</td>
<td>An MRI guided system for prostate laser ablation with treatment planning and multi-planar temperature monitoring [9786-53]</td>
</tr>
<tr>
<td>9786 1J</td>
<td>How does prostate biopsy guidance error impact pathologic cancer risk assessment? [9786-54]</td>
</tr>
<tr>
<td>9786 1K</td>
<td>Impact of region contouring variability on image-based focal therapy evaluation [9786-55]</td>
</tr>
</tbody>
</table>
9786 1L Structure Sensor for mobile markerless augmented reality [9786-56]
9786 1M Visual design and verification tool for collision-free dexterous patient specific neurosurgical instruments [9786-57]
9786 1N A web-based computer aided system for liver surgery planning: initial implementation on RayPlus [9786-58]
9786 1O Kinect based real-time position calibration for nasal endoscopic surgical navigation system [9786-59]
9786 1P An improved robust hand-eye calibration for endoscopy navigation system [9786-60]
9786 1Q Towards robust specularity detection and inpainting in cardiac images [9786-61]
9786 1R Real-time mosaicing of fetoscopic videos using SIFT [9786-62]
9786 1S Multiple video sequences synchronization during minimally invasive surgery [9786-63]
9786 1T Visualization framework for colonoscopy videos [9786-64]
9786 1U HPC enabled real-time remote processing of laparoscopic surgery [9786-65]
9786 1V Content-based retrieval in videos from laparoscopic surgery [9786-66]
9786 1W Cost-effective surgical registration using consumer depth cameras [9786-67]
9786 1X Exploring the effects of dimensionality reduction in deep networks for force estimation in robotic-assisted surgery [9786-68]
9786 1Y Current sensing for navigated electrosurgery: proof of concept [9786-69]
9786 1Z Characterization of a phantom setup for breast conserving cancer surgery [9786-70]
9786 20 Image-guided intracranial cannula placement for awake in vivo microdialysis in nonhuman primates [9786-71]
9786 21 Patch-based label fusion for automatic multi-atlas-based prostate segmentation in MR images (Cum Laude Poster Award) [9786-72]
9786 22 Phantom-based ground-truth generation for cerebral vessel segmentation and pulsatile deformation analysis [9786-73]
9786 23 A general approach to liver lesion segmentation in CT images [9786-74]
9786 24 A comparison study of atlas-based 3D cardiac MRI segmentation: global versus global and local transformations [9786-75]
9786 25 Surface mesh to voxel data registration for patient-specific anatomical modeling [9786-76]
9786 26 Estimation of line-based target registration error [9786-77]
9786 27 A MRI-CT prostate registration using sparse representation technique [9786-78]
9786 29 Fusion of cone-beam CT and 3D photographic images for soft tissue simulation in maxillofacial surgery [9786-80]
9786 2A Image updating for brain deformation compensation in tumor resection [9786-81]
9786 2B A fully automatic image-to-world registration method for image-guided procedure with intraoperative imaging updates [9786-82]
9786 2C Optimal atlas construction through hierarchical image registration [9786-83]
9786 2D Single slice US-MRI registration for neurosurgical MRI-guided US [9786-84]
9786 2E Rapidly-steered single-element ultrasound for real-time volumetric imaging and guidance [9786-85]
9786 2F Investigation of permanent magnets in low-cost position tracking [9786-86]
9786 2G Image-guided endobronchial ultrasound [9786-87]
9786 2H A motorized ultrasound system for MRI-ultrasound fusion guided prostatectomy [9786-88]
9786 2I Visualization of hepatic arteries with 3D ultrasound during intra-arterial therapies [9786-89]
9786 2J 3D shape tracking of minimally invasive medical instruments using optical frequency domain reflectometry [9786-91]
9786 2K Measurement of electromagnetic tracking error in a navigated breast surgery setup [9786-92]
9786 2L Image-guided navigation surgery for pelvic malignancies using electromagnetic tracking [9786-93]
9786 2M Feasibility of tracked electrodes for use in epilepsy surgery [9786-94]
9786 2N 4D cone-beam CT imaging for guidance in radiation therapy: setup verification by use of implanted fiducial markers [9786-95]
9786 2O Effects of voxelization on dose volume histogram accuracy [9786-96]
9786 2P Partition-based acquisition model for speed up navigated beta-probe surface imaging [9786-97]
9786 2Q Stent enhancement in digital x-ray fluoroscopy using an adaptive feature enhancement filter [9786-98]
9786 2R Evaluation of left ventricular scar identification from contrast enhanced magnetic resonance imaging for guidance of ventricular catheter ablation therapy [9786-99]
Interactive visualization for scar transmurality in cardiac resynchronization therapy

A robust automated left ventricle region of interest localization technique using a cardiac cine MRI atlas

Classification of coronary artery tissues using optical coherence tomography imaging in Kawasaki disease
Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four 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.

Abdolmanafi, Atefeh, 2U
Abi-Jaoudeh, Nadine, 15
Abolmaesumi, Purang, 0K
Agarwal, Harsh, 1I
Ahmed, Hashim U., 1K
Alderliesten, Tanja, 2N
Alsaleh, Samar M., 1Q, 1X
Anderson, Ryan, 2F
Aviles, Angelica I., 1Q, 1X
Badoual, Anaïs, 2I
Bagchi, Ansuman, 0O, 20
Bainbridge, Daniel, 02
Baksh, Aidan, 2K
Balachandran, Ramya, 08, 1G
Barratt, Dean C., 1K
Bascom, Rebecca, 2G
Baum, Zachary, 0F, 2K
Baumgarten, C., 0U
Baxter, John S., 2D
Beecks, Christian, 1V
Behar, Jonathan M., 2S
Beigi, Parmida, 0I
Bel, Arjan, 2N
Belhaoua, Abdelkrim, 1S
Ben-Ziadi, Yehuda Kfr, 24, 2T
Bernardo, Marcelino, 1I
Bezerra, Hiram G., 05
Bigot, Alexandre, 2I
Blachon, Gregoire S., 1G
Boctor, Emaad M., 0J
Bodani, Vivek, 1M
Bodenstedt, Sebastian, 18
Bone, Ashleigh, 0O, 20
Borschneck, Daniel, 0G, 0T
Brinkmann, Benjamin, 2M
Brost, Alexander, 2S
Buelow, Thomas, 0W
Burgner-Kahrs, Jessica, 1F
Bux, R., 1L
Bymes, Patrick D., 1B, 2G
Cai, Yunliang, 0E
Cakir, Ahmet, 0M
Cao, Li, 23
Carter, K., 14, 1Y
Casals, Alicia, 1Q, 1X
Chadebecq, François, 1R
Chadwell, Jacob T., 1Z
Chang, Silvia, 0K
Cheirsilp, Ronnarit, 2G
Chen, Antong, 0O, 20
Chen, Danyang, 0V
Chen, Elvis C., S., 17, 26
Chen, Zine, 0V
Cheng, Alexis, 0J
Chin, Joseph L., 1J
Choyke, Peter, 1I
Christie, Jason, 09
Chu, Yauki, 1O
Chung, Soyoung, 29
Clancy, Neil T., 19
Clements, Logan W., 10, 12
Collins, Jarrod A., 1Z
Conley, Rebekah H., 10, 12, 1Z
Cool, Derek W., 1J
Corso, Jason J., 0V
Curran, Walter J., 21, 27
Daga, Pankaj, 1R
Dahdah, Negib, 2U
Dangi, Shusil, 24
Daryanani, Aditya, 24
David, Anna L., 1R
Dawant, Benoît M., 08, 0M, 12
de Oliveira, Júlia E. E., 25
De Silva, T., 0A, 0H
De Simone, Raffaele, 03, 1A
de With, Peter H. N., 0D
Deprest, Jan, 1R
Deserno, Thomas M., 25
De Stefano, Zachary, 15
Dijkstra, Jouke, 06
Dillmann, Rüdiger, 18
Dillon, Neal P., 1G
Dong, Belma, 0O, 20
Donaldson, Ian A., 1K
Dou, Tai H., 0N
Drake, James, 1M
D’Souza, David, 1H
Duffy, Edward, 1U
Duong, Luc, 2U
Dwyer, George, 1R
Eastwood, Kyle, 1M
Edirisinghe, Chandima, 1H
Eiben, Björn, 0W
Elson, Daniel S., 19
Engel, C. Jay, 0Y, 14, 2K
Engelhardt, Sandy, 03, 1A
Escoto, Abelardo, 16
Esnault, Matthieu, 0B
Leveridge, Michael, 0K
Li, Kang, 0C
Li, Ming, 15
Li, Shenh, 2B
Li, Tianhong, 1N
Li, Yanfang, 1P
Linder, Bence, 1M
Linte, Cristian A., 24, 2T
Liu, Tian, 21, 27
Liu, Xiabi, 07
Lodge, Kenneth, 0O
Lollis, S. Scott, 0E
Looi, Thomas, 1M
Loranger, Sebastien, 2J
Lorenz, Cristian, 0W
Lubbers, Laura S., 0O, 20
Luo, Ming, 1N
Luo, Xiongbiao, 0Q, 1C
Lux, Mathias, 1V
Ma, Burton, 26
Ma, Ling, 07
Ma, Shaodong, 1O
Maier-Hein, Lena, 19, 1L
Majdani, Omid, 1F
Maleshkova, Maria, 03
Malrain, C., 0U
Mao, Hui, 0V
Martin, Peter R., 1J
Master, Viraj V., 07
Mayer, Benjamin, 19
McBrayer, Kepra L., 08
McLeod, A. Jonathan, 0Q, 1C
Meinzer, Hans-Peter, 1A
Meng, Hui, 0V
Meszoely, Ingrid M., 1Z
Metaxas, Dimitris N., 0C
Miao, Yu, 1P
Michaud, François, 2I
Michener, Maria, 20
Miga, Michael I., 10, 12, 1Z
Min, Yungang, 0N
Mirza, Sohal K., 0E
Mirretta, Charles A., 13
Mitchell, Jason E., 1G
Miyahara, Ryoji, 1D
Monge, Frédéric, 2P
Montgomery, Tamara O., 20
Montreuil, Jacques, 1H
Moore, John, 02, 17
Moreau, Johan, 1S
Mori, Kensaku, 1D, 1P
Morin, Evelyn, 0Y, 14, 1Y
Mountney, Peter, 2S
Mousavi, Parvin, OK
Mousa, Madeleine, 0K, 1J
Müller, M., 1L
Müller-Stich, Beat Peter, 1B
Nadeem, Saad, 1T
Naish, Michael D., 16
Navab, Nassir, 1D, 2P
Negussie, Ayele, 1I
Neylon, John, 0N, 0X
Ng, Gary C., 0I
Nguyen, Thien-Dang, 1F
Nieh, Peter T., 07
Nijkamp, Jasper, 2L
Noble, Jack H., 08, 0M
Nolden, Marco, 03
Oda, Masahiro, 1D
Odhner, Dewey, 23, 2C
Olson, Jonathan D., 0E, 2A
O'Malley, Stacey, 0O
Otake, Yoshito, 08
Ourselin, Sebastien, 1R
Packer, D. L., 2R
Paliwal, Nikhil, 0V
Panayiotou, Maria, 2S
Pardasani, Utsav, 2D
Parent, Francois, 2J
Park, Seyoun, 0L, 0P
Partanen, Ari, 11
Patel, Rajni V., 16
Paulsen, Keith D., 0E, 2A
Paufler, Stephen E., 0Q, 1C, 1J
Pednekar, Gargi, 09
Penicka, Martin, 06
Peters, Terry M., 02, 0Q, 17, 1C, 26, 2D
Pezeshki, Padina, 0Y, 14
Philipp, Patrick, 03
Pinter, Csaba, 2O
Pinto, Peter, 1I, 2H
Plishker, William, 0P
Potter, Michael, 1W
Prabhu, David, 05
Prasad, Arpan Suravi, 2U
Prince, J. L., 0H
Quon, Harry, 0P
Radoüx, Jean-Pierre, 1S
Rankin, Adam, 02
Rau, Thomas S., 1F
Raval, Amish N., 04
Ray, Soumya, 05
Razavi, Reza, 2S
Reaungamornrat, S., 0H
Reiml, Sabrina, 2S
Remirez, Andria A., 0R
Renger, John, 0O, 20
Reitlinger, Achim, 03
Reitmann, M. E., 2R
Rhode, Kawai S., 2S
Rinaldi, Christopher A., 2S
Robb, Richard, 2M
Roberts, David W., 0E, 2A
Robinson, Adam, 0P
Rohl, Robert, 0I
Ronaghi, Zahra, 1U
Rossi, Peter J., 21, 27
Rossitti, Sandro, 11
Zachary, Josey, 2Q
Zang, Xiaonan, 2G
Zariwala, Hatim A., 0O, 20
Zhang, Haichong K., 0J
Zhang, Huimao, 1P
Zhang, Yan, 19
Zhao, Liang, 0V
Zhao, Y., 0U
Zinger, Sveta, 0D
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4 Ultrasound Image Guidance
   Joint Session with Conferences 9786 and 9790
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   Michael I. Miga, Vanderbilt University (United States)
   Pierre Jannin, Université de Rennes 1 (France)

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   George J. Grevera, Saint Joseph’s University (United States)
   Amber L. Simpson, Memorial Sloan Kettering Cancer Center (United States)

9 Endoscopy/Laparoscopy
   Kensaku Mori, Nagoya University (Japan)
   William E. Higgins, The Pennsylvania State University (United States)

10 Keynote and New Robotic Applications
   Robert J. Webster III, Vanderbilt University (United States)
   Ziv Yaniv, U.S. National Library of Medicine (United States)
11 Prostate Procedures

**Purang Abolmaesumi**, The University of British Columbia (Canada)
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**Session Workshop Chair**

Sensing Challenges and Prospects in Miniaturizing Surgical Robots and Tools
**Jessica Burgner-Kahrs**, Leibniz Universität Hannover (Germany)

Interventional Procedures: Emerging Technologies and Clinical Applications
**Ziv R. Yaniv**, U.S. National Library of Medicine (United States)
Introduction

Welcome to the 2016 edition of the SPIE Image-Guided Procedures, Robotic Interventions, and Modeling conference proceedings. This year we received 113 abstract submissions and accepted 101 as full manuscripts which were presented at the conference during the oral and poster sessions.

The keynote presentation by Kenneth Goldberg from the University of California Berkeley was outstanding. The title of the talk was Robot-Assisted Tumor Resection: Palpation, Incision, Debridement and Adhesive Closure. Prof. Goldberg presented a fascinating view on the future of automation in robotic surgery. He described new tooling and learning algorithms to facilitate supervised automation of surgical subtasks. In particular, he described new approaches to palpation, dissection, retraction, debridement, and adhesive closure.

This year we held two parallel workshops; Sensing Challenges and Prospects in Miniaturizing Surgical Robots and Tools, and a joint workshop with the physics conference Interventional Procedures: Emerging Technologies and Clinical Applications.

Jessica Burgner-Kahrs organized the Sensing Challenges and Prospects in Miniaturizing Surgical Robots and Tools workshop. It featured three presentations on cutting edge research in robotics and sensing technologies. First, Jenny Dankelman from TU Delft in the Netherlands spoke about numerous medical devices being developed at Delft, including steerable needles, robotic catheters, and hand-held laparoscopic instruments. Next, Dan Popa of the University of Louisville spoke about sensors and the micro-manufacturing technologies used to create them. Lastly, Robert Webster of Vanderbilt University spoke about the need to consider sensing, design, and motion planning simultaneously in order to create optimal flexible robots, such as concentric tube robots. A major theme that emerged from the workshop was the need to integrate sensing systems into the material of the robot. Another was the need for many different kinds of sensors, including those measuring position, orientation, force, strain, contact, temperature for various surgical applications.

The joint workshop with the Conference 9790 was well attended and included talks from leading researchers in the field. Terry Peters from Robarts Research Institute described Imaging Systems for Minimally-Invasive Surgery. Jeffrey Siewerdsen from Johns Hopkins University talked about Interventional Imaging Technologies for Therapy Guidance. Kullervo Hynynen from Sunnybrook Health Sciences Center described Applications of Non-Invasive Surgery and Targeted Therapeutics, and Puneet Sharma from Siemens Healthcare talked about Technology Transfer of Interventional Imaging Technologies to the Clinic.
This year’s Young Scientist Award went to Sureerat Reaungamornrat from Johns Hopkins University (United States) for her paper titled **MIND Demons for MR-to-CT deformable image registration in image-guided spine surgery**. She also received the Robert F. Wagner All-Conference Best Student Paper Award for this work. This year we had two co-runners up for the Young Scientist Award, Clément Baumgarten from the University of Rennes I (France) for his paper titled **Image-guided preoperative prediction of pyramidal tract side effect in deep brain stimulation** and Neal Dillon from Vanderbilt University (United States) for his paper titled **Increasing safety of a robotic system for inner ear surgery using probabilistic error modeling near vital anatomy**. The winner of Best Poster Award this year was Xiaofeng Yang from Emory University (United States) and the two honorable mention awardees were Maggie Hess from Queen’s University (Canada) and Burton Ma from York University (Canada). We would like to thank Siemens Healthcare for sponsoring the Young Scientist Award prizes and Northern Digital Inc. for sponsoring the prizes for our Best Poster Awards.

We are grateful to all of our committee members for their help in reviewing abstracts, evaluating student papers, and judging posters. Their commitment enables us to maintain the high scientific standards of our conference. We also recognize the outstanding service of Ziv Yaniv from the National Institutes of Health as chair of the conference; he has completed his term and is resuming his role as a committee member. Baowei Fai from Emory University is our new co-chair, and will begin his four year term next year.

Finally, we would like to thank all the attendees who gave talks, presented posters, and actively participated in the meeting. The success of the conference is in no small part due to you. Next year, the conference will take place in Orlando, Florida. We look forward to seeing you there for another great conference!

Robert J. Webster III  
Ziv Yaniv
2016 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 cosponsored by:

The Medical Image Perception Society

2016 Recipients:

First Place: MIND Demons for MR-to-CT deformable image registration in image-guided spine surgery (9786-16)
S. Reaungamornrat, T. De Silva, A. Uneri, Johns Hopkins Univ. (United States), J.-P. Wolinsky, Johns Hopkins Hospital (United States), A. J. Khanna, Johns Hopkins Health Care & Surgery Ctr. (United States), G. Kleinszig, S. Vogt, Siemens Healthcare (Germany), J. L. Prince, J. H. Siewerdsen, Johns Hopkins Univ. (United States)

Second Place: Design, fabrication, and implementation of voxel-based 3D printed textured phantoms for task-based image quality assessment in CT (9783-76)
Justin Solomon, Duke Univ. School of Medicine (United States), Alexandre Ba, Institut Univ. de Radiophysique Appliquée (Switzerland), Andrew Dao, Duke Univ. (United States), Joseph Lo, Elianna Bier, Duke Univ. School of Medicine (United States), François Bochud, Institut Univ. de Radiophysique Appliquée (Switzerland), Michael Gehm, Duke Univ. (United States), Ehsan Samei, Duke Univ. School of Medicine (United States)

Conference 9786 Awards

Young Scientist Awards sponsored by Siemens

First Place: MIND Demons for MR-to-CT deformable image registration in image-guided spine surgery (9786-16)
S. Reaungamornrat, T. De Silva, A. Uneri, Johns Hopkins Univ. (United States), J.-P. Wolinsky, Johns Hopkins Hospital (United States), A. J. Khanna, Johns Hopkins Health Care & Surgery Ctr. (United States), G. Kleinszig, S. Vogt, Siemens Healthcare (Germany), J. L. Prince, J. H. Siewerdsen, Johns Hopkins Univ. (United States)
Runner Up: **Image-guided preoperative prediction of pyramidal tract side effect in deep brain stimulation** *(9786-29)*
C. Baumgarten, Y. Zhao, INSERM (France), LTSI, Univ. de Rennes 1 (France); P. Sauleau, C. Malrain, Ctr. Hospitalier Univ. de Rennes (France); P. Jannin, INSERM (France), LTSI, Univ. de Rennes 1 (France); C. Haegelen, INSERM (France), LTSI (France); Ctr. Hospitalier de Rennes (France)

Runner Up: **Increasing safety of a robotic system for inner ear surgery using probabilistic error modeling near vital anatomy** *(9786-51)*
Neal P. Dillon, Michael A. Siebold, Jason E. Mitchell, Vanderbilt Univ. (United States), Gregoire S. Blachon, Ramya Balachandran, Vanderbilt Univ. Medical Ctr. (United States), J. Michael Fitzpatrick, Vanderbilt Univ. (United States), Robert J. Webster III, Vanderbilt Univ. Medical Ctr. (United States)

**Cum Laude Poster Award**

First Place: **Patch-based label fusion for automatic multi-atlas-based prostate segmentation in MR images** *(9786-72)*
Xiaofeng Yang, Ashesh B. Jani, Peter J. Rossi, Hui Mao, Walter J. Curran, Tian Liu, Winship Cancer Institute, Emory Univ. (United States)