



Joint Congress of IFCARS, ISCAS, CAR, CMI, CAD, IPCAI

## CARS 2021 Final Program

CARS 2021 Computer Assisted Radiology and Surgery  
35<sup>th</sup> International Congress and Exhibition  
June 21 - 25, 2021

Klinikum rechts der Isar der TUM, Munich, Germany

[www.cars-int.org](http://www.cars-int.org)

### CARS 2021 Opening Ceremony

Monday, June 21, 2021

**13:30-15:00 Opening Ceremony**

**President of CARS 2021**

**Dirk Wilhelm, MD**

**CARS 2021 General Chairs**

Hubertus Feussner, MD, Alois Knoll, PhD, Alexander Lenz, PhD, Tim Lüth, PhD, Petra Mela, PhD, Nassir Navab, PhD, Daniel Ostler, MSc, Simon Schiele, MSc, Thomas Wendler, MSc

**Keynote Lectures:**

**AI and the Future of Radiology**

**Daniel Rückert, PhD, FREng, FMedSci, FIEEE**

Alexander von Humboldt Professor for AI in Medicine and Healthcare at the Technical University of Munich, Germany

**Through the Keyhole – Next Generation Surgical Robotics**

**Jessica Burgner-Kahrs, PhD**

Associate Director, University of Toronto Robotics Institute  
Associate Chair, Computer Science, University of Toronto, Canada

**19:30 CARS 2021 Reception**



**CARS 2021 President**

Dirk Wilhelm, MD

**CARS 2021 General Chairs**

Hubertus Feussner, MD  
Alois Knoll, PhD  
Alexander Lenz, PhD  
Tim Lüth, PhD  
Petra Mela, PhD  
Nassir Navab, PhD  
Daniel Ostler, MSc  
Simon Schiele, MSc  
Thomas Wendler, MSc

**CARS 2021 Scientific Medical Committee**

Rickmer F. Braren, MD  
Rüdiger von Eisenhart-Rothe, MD  
Marcus Makowski, MD  
Bernhard C. Meyer, MD  
Barbara Wollenberg, MD

**CARS Organizer**

Heinz U. Lemke, PhD

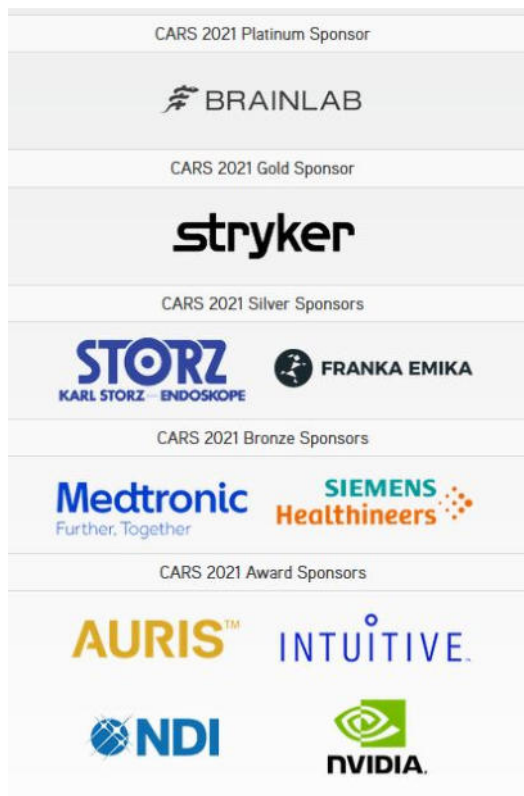
**CARS Conference Office**

Franziska Schweikert  
Klettgaustrasse 20  
79790 Küssaberg  
Germany  
Tel. +49-7742-922 434  
Email: fschweikert@cars-int.org  
www.cars-int.org

**CARS Congress Organizing Committee**

Christos Angelopoulos, DDS (US)  
Elizabeth Beckmann, BSc (GB)  
Leonard Berliner, MD (US)  
Ulrich Bick, MD (DE)  
Davide Caramella, MD (IT)  
Kevin Cleary, PhD (US)  
Mario A. Cypko, PhD (NL)  
Takeyoshi Dohi, PhD (JP)  
Kunio Doi, PhD (US)  
Volkmar Falk, MD, PhD (DE)  
Allan G. Farman, PhD, DSc (US)  
Hubertus Feussner, MD (DE)  
Guy Frija, MD (FR)  
Miguel Á. González Ballester, PhD (ES)  
Makoto Hashizume, MD, PhD (JP)  
Yoshihiko Hayakawa, PhD (JP)  
Javier Herrero Jover, MD, PhD (ES)  
David Hilderbrand (US)  
Pierre Jannin, PhD (FR)  
Leo Joskowicz, PhD (IL)  
Heinz U. Lemke, PhD (DE) (Chair)  
Kensaku Mori, PhD (JP)  
Nassir Navab, PhD (DE)  
Terry M. Peters, PhD (CA)  
Osman M. Ratib, MD, PhD (CH)  
Hans G. Ringertz, MD, PhD (SE)  
Yoshinobu Sato, PhD (JP)  
Ramin Shahidi, PhD (US)  
Akinobu Shimizu, PhD (JP)  
Gabriele von Voigt, PhD (DE)  
Dirk Wilhelm, MD (DE)  
Hiroyuki Yoshida, PhD (US)

**We acknowledge the support of the following Sponsors and Exhibitors:**



## CARS 2021 - 35th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS)

Monday, June 21, 2021

**8:50 Welcome to CARS 2021**

**President: Dirk Wilhelm, MD (DE)**



---

## 35th International Congress and Exhibition on Computer Assisted Radiology (CAR)

**Chair: Ulrich Bick, MD (DE)**

Monday, June 21, 2021

**9:00-10:00 Medical Imaging**

**Session Chairs:** Rüdiger von Eisenhart-Rothe, MD (DE), Klaus Wörtler, MD (DE)

### **Image reconstruction using end-to-end deep learning for low-dose CT**

D. Bauer, C. Ulrich, A. K. Golla, T. Russ, C. Tönnies, J. Leuschner, M. Schmidt, L. Schad, F. Zöllner, Ruprecht-Karls-University Heidelberg, Mannheim; University Bremen (DE) [CAR-LE-88]

### **Micro-CT-assisted cross-modality super-resolution of clinical CT: utilization of synthesized training dataset**

T. Zheng, H. Oda, S. Nakamura, M. Mori, H. Takabatake, H. Natori, M. Oda, K. Mori, Nagoya Univ.; Sapporo Kosei General Hosp.; Sapporo Minami-sanjo Hosp.; Keiwakai Nishioka Hosp., Sapporo (JP) [CAR-LE-36]

### **A novel complementation method of an acoustic shadow region utilizing a convolutional neural network for ultrasound-guided therapy**

M. Matsuyama, N. Koizumi, A. Otsuka, K. Kobayashi, S. Yagasaki, Y. Watanabe, J. Zhou, Y. Nishiyama, N. Matsumoto, H. Tsukihara, K. Numata, Univ. of Electro-Communications; The Univ. of Tokyo; Yokohama City University Medical Center (JP) [CAR-LE-21-00052]

### **Good and Bad Boundaries in Ultrasound Compounding: Preserving Anatomic Boundaries While Suppressing Artifacts**

A. L. Y. Hung, J. Galeotti, Carnegie Mellon Univ., Pittsburgh, PA (US) [CAR-LE-21-00045]

### **A robotic ultrasound diagnostic system for tracking kidney motion and adjusting contact posture using an organ tracking robot**

J. Zhou, K. Kobayashi, R. Igarashi, Y. Watanabe, T. Fujibayashi, M. Yamada, M. Matsuyama, H. Tsukihara, K. Yoshinaka, N. Matsumoto, M. Ogawa, H. Miyazaki, K. Numata, H. Nagaoka, T. Iwai, H. Iijima, Y. Nishiyama, N. Koizumi, Univ. of Electro-Communications; The Univ. of Tokyo; Obayashi Manufacturing Co., Ltd; Nihon Univ. Hospital; Yokohama City Univ. Medical Center; National Inst. of Advanced Industrial Science and Technology, Ibaraki (JP) [CAR-LE-21-00051]

Monday, June 21, 2021

**10:00-11:30 Imaging Informatics – Segmentation (1)**

**Session Chairs:** Gabriele von Voigt, PhD (DE), Rickmer F. Braren, MD (DE)

### **Cryo-balloon catheter reconstruction in X-Ray fluoroscopy using U-net**

I. Vernikouskaya, D. Bertsche, T. Dahme, V. Rasche, Ulm Univ. Medical Center (DE) [CAR-LE-21-00009]

### **Evaluation of Optical Flow Methods on Neurosurgical Microscope Video Data**

M. Philipp, M. Gutt-Will, S. Saur, A. Mathis, A. Raabe, F. Mathis-Ullrich, Karlsruhe Inst. of Technology; Carl Zeiss Meditec AG, Oberkochen (DE); Inselspital Bern (CH) [CAR-LE-21-00016]

### **Scalable Quorum-based Deep Neural Networks with Adversarial Learning for Automated Lung Lobe Segmentation in Fast Helical Free Breathing CTs**

B. Stiehl, M. Lauria, K. Singhrai, J. Goldin, I. Barjaktarevic, D. Low, A. Santhanam, Univ. of California, Los Angeles (US) [CAR-LE-21-00022]

### **Development and evaluation of a 3D annotation software for interactive COVID-19 lesion segmentation in chest CT**

S. Bendazzoli, I. Brusini, M. Astaraki, M. Persson, J. Yu, B. Connolly, S. Nyrén, F. Strand, Ö. Smedby, C. Wang, KTH Royal Institute of Technology, Huddinge; Karolinska University Hospital, Stockholm (SE) [CAR-LE-21-00026]

**A cascaded fully convolutional network framework for dilated pancreatic duct segmentation**

C. Shen, H. R. Roth, Y. Hayashi, M. Oda, T. Miyamoto, G. Sato, K. Mori, Nagoya Univ.; Chiba Kensei Hospital; Chiba Kensei Hosp., Nagoya (JP); NVIDIA, Bethesda, MD (US) [CAR-LE-21-00061]

**Self-localization Vertebrae Instance Segmentation Network for Transforaminal Endoscopic Surgery Planning**

W. Peng, L. Li, L. Liang, H. Ding, L. Zang, S. Yuan, G. Wang, Tsinghua Univ., Beijing; Beijing Chaoyang Hosp. (CN) [CAR-LE-21-00031]

**3-Dimensional Unsupervised Deep Learning Methods for Anomaly Segmentation**

M. Bengs, F. Behrendt, J. Krüger, R. Opfer, A. Schlaefer, Hamburg Univ. of Technology; jung diagnostics GmbH (DE) [CAR-LE-21-00037]

**Thyroid Nodule Segmentation and Pathological Clustering in Ultrasound Images using a Fast Deep Convolutional Neural Network**

D. Sheet, V. Goel, E. J. Gomes Ataíde, H. Maheshwari, R. K. Ghosh, A. Kumar, A. Illanes, S. Schenke, S. Ghazzawi, M. C. Kreissl, M. Friebe, Indian Inst. of Technology Kharagpur (IN); Universitätsklinikum Magdeburg; Otto-von-Guericke-Universität Magdeburg (DE) [CAR-LE-21-00040]

*Monday, June 21, 2021*

**11:30-13:00 Imaging Informatics – Segmentation (2)**

**Session Chairs:** Alois C. Knoll, PhD (DE), Masahiro Oda, PhD (JP)

**Segmentation Study of Brain Tumor Contours in 3D Intraoperative Ultrasound Imaging**

C. Chalopin, J. G. Avina-Cervantes, E. Angel-Raya, I. Cruz-Aceves, W. Wein, D. Lindner, Univ. of Guanajuato, Salamanca; CONACYT, Guanajuato (MX); Univ. Leipzig; Univ. Hosp. Leipzig; ImFusion GmbH, Munich (DE) [CAR-LE-20-00693]

**Automatic Mandible Segmentation from CT Image Using 3D Fully Convolutional Neural Network Based on DenseASPP and Attention Gates**

X. Chen, J. Xu, J. Liu, D. Zhang, Z. Zhou, X. Jiang, C. Zhang, Shanghai 9th Peoples Hospital Affiliated to Shanghai Jiaotong University School of Medicine; Shanghai Jiao Tong Univ. (CN); Univ. of Munster (DE) [CAR-LE-21-00065]

**Capsule Networks for the Segmentation of Small Intravascular Ultrasound Image Datasets**

L. Bargsten, S. Raschka, A. Schlaefer, Univ. of Technology Hamburg-Harburg (DE) [CAR-LE-21-00030]

**Automatic linear measurements of the fetal brain on MRI with deep neural networks**

L. Joskowicz, N. Avidis, B. Yehuda, O. Ben-Zvi, D. Link-Sourani, L. Ben-Sira, E. Miller, E. Zharkov, D. Ben-Bashat, The Hebrew University of Jerusalem; Tel Aviv Sourasky Medical Center; Shaare Zedek Medical Center (IL); Children's Hospital of Eastern Ontario (CA) [CAR-LE-21-00032]

**Definition and Extraction of 2D Shape Indices of Intracranial Aneurysm Necks for Rupture Risk Assessment**

S. Mittenentzwei, O. Beuing, B. Neyazi, E. I. Sandalcioglu, N. Larsen, B. Preim, S. Saalfeld, Otto-von-Guericke-Universität Magdeburg; AMEOS Hospital Bernburg; Univ. Hospital Schleswig-Holstein Campus Kiel (DE) [CAR-LE-21-00042]

**CNN-based joint non-correspondence detection and registration of retinal optical coherence tomography images**

J. Andresen, T. Kepp, J. Ehrhardt, C. von der Burchard, J. Roider, H. Handels, Univ. of Lübeck; Christian-Albrechts Univ. of Kiel (DE) [CAR-LE-70]

**COVID-19 lung infection and normal region segmentation from CT volumes using FCN with local and global spatial feature encoder**

M. Oda, Y. Hayashi, Y. Otake, M. Hashimoto, T. Akashi, K. Mori, Nagoya Univ.; Nara Inst. of Science and Technology; Keio Univ. School of Medicine; Juntendo Univ., Tokyo (JP) [CAR-LE-50]

**An ensemble of deep learning models to segment the optic disc in eye fundus images**

M. Ali, M. Jabreel, M. Abdel-Nasser, A. Valls, M. Baget Bernaldiz, Univ. Rovira i Virgili; Inst. Investigació Sanitària Pere Virgili (IISPV), Tarragona (ES) [CAR-LE-40]

---

*Monday, June 21, 2021*

**13:30-15:00 CARS 2021 Opening**

---

Monday, June 21, 2021

**15:00-16:00 Imaging Informatics - Advanced Processing (1)**

**Session Chairs:** Osman Ratib, MD (CH), Julia Schnabel, PhD (DE)

**A three-dimensional guidance based on fiber optical shape sensing, electromagnetic tracking and preoperative data for endovascular procedures**

S. Jäckle, A. Lange, V. García-Vázquez, T. Eixmann, F. Matysiak, M. Sieren, H. Schulz-Hildebrandt, G. Hüttmann, F. Ernst, S. Heldmann, T. Pätz, T. Preusser, Fraunhofer MEVIS, Lübeck; Univ. Lübeck; Univ. Hosp. Schleswig-Holstein, Lübeck; Fraunhofer MEVIS, Bremen (DE) [CAR-LE-106]

**Cascaded Neural Network-based CT Image Processing for Aortic Root Analysis**

N. Krüger, A. Meyer, L. Tautz, M. Hüllebrand, I. Wamala, J. Kempfert, V. Falk, A. Hennemuth, German Heart Center Berlin; Fraunhofer MEVIS, Bremen; Charité - Universitätsmedizin Berlin (DE) [CAR-LE-21-00103]

**Investigation of visibility of head-mounted display for vascular observation**

T. Shinohara, A. Morioka, N. Nakasako, Kindai University, Kinokawa (JP) [CAR-LE-16]

**IRDBB: archiving and communication model of curated imaging data for research and machine learning**

J. Spaltenstein, G. Pasquier, N. van Dooren, P. Mildenerger, B. Gibaud, O. Ratib, Univ. of Geneva (CH); Univ. of Rennes (FR); Johannes Gutenberg-Univ., Mainz (DE) [CAR-LE-71]

**KHEOPS: Open Source platform for storage and sharing of imaging biobanks**

J. Spaltenstein, N. Roduit, G. Pasquier, N. van Dooren, S. Cicciu, O. Ratib, Univ. of Geneva (CH) [CAR-LE-13]

Monday, June 21, 2021

**16:00-17:00 Imaging Informatics - Advanced Processing (2)**

**Session Chairs:** Randy E. Ellis, PhD (CA), Thomas Wendler, PhD (DE)

**Depth-based branching level estimation for bronchoscopic navigation**

M. Oda, C. Wang, Y. Hayashi, T. Kitasaka, H. Takabatake, M. Mori, H. Honma, H. Natori, K. Mori, Nagoya Univ.; Aichi Inst. of Technology, Toyota; Sapporo Minami-Sanjo Hosp.; Sapporo Kosei General Hosp.; Keiwa-Kai Nishioka Hosp., Sapporo (JP) [CAR-LE-20-00702]

**Generation of annotated multimodal ground truth datasets for abdominal medical image registration**

D. F. Bauer, T. Russ, B. Waldkirch, C. Tönnies, W. Segars, L. Schad, F. Zöllner, A.-K. Golla, Ruprecht-Karls-Universität Heidelberg, Medizinische Fakultät Mannheim (DE); Duke Univ., Durham, NC (US) [CAR-LE-21-00047]

**Dimensionality Reduction for Mass Spectrometry Imaging**

E. Ritcey, R. Ellis, R. Theriault, Queen's University, Kingston, ON (CA) [CAR-LE-14]

**A Novel 2D Ultrasound Probe Calibration Framework using an RGB-D Camera and a 3D-printed Marker**

Y. Zhou, G. Lelu, B. Labbé, G. Pasquier, P. Le Gargasson, A. Murienne, L. Launay, IRT b-com, Cesson-Sevigne (FR) [CAR-LE-21-00079]

**An end-to-end unsupervised affine and deformable registration framework for multi-structure medical image registration**

Z. Chen, X. Gao, G. Zheng, Shanghai Jiao Tong University (CN) [CAR-LE-99]

Monday, June 21, 2021

**17:00-18:00 Image Guided Interventions**

**Session Chairs:** Thomas Neumuth, PhD (DE), Philipp Paprottka, MD (DE)

**Multimodal Pre-Operative Biomarkers Can Predict Deep Brain Stimulation Outcomes**

J. Baxter, M. Peralta, C. Haegelen, P. Jannin, Université de Rennes 1; Hopital Pontchaillou CHU Rennes (FR) [CAR-LE-21-00028]

**Thyroid nodule volume estimation and RF ablation using 3D matrix ultrasound; a phantom study**

T. Boers, S. Braak, M. Versluis, S. Manohar, University of Twente, Enschede; Ziekenhuisgroep Twente (NL) [CAR-LE-56]

**DRR to C-arm X-Ray Image Translation with Application to Trauma Surgery**

M. Himstedt, S. Häger, S. Heldmann, A. Petersik, E. Zähringer, H. Gottschling, S. Manuel, T. Lieth, J. Modersitzki, Fraunhofer MEVIS, Lübeck; Stryker, Schönkirchen (DE) [CAR-LE-104]

**Development of an IRE model with experimental validation: An approach to estimate and optimize the IRE dose**

G. Wardhana, J. P. Almeida, M. Abayazid, J. J. Fütterer, Univ. of Twente, Enschede; Radboud Univ. Medical Center, Nijmegen (NL) [CAR-LE-21-00034]

**Dental implant planning, guide design and accuracy evaluation using free and open source software: An in vivo study**

D. Trikeriotis, A. Theodoropoulou, M. Mountricha, Private practice, Athens (GR) [CAR-LE-9]

## **CARS – Computer Assisted Radiology and Surgery 35th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS)**

**Chairs: Dirk Wilhelm, MD (DE), Heinz U. Lemke, PhD (DE)**

*Monday, June 21, 2021*

### **18:00-19:00 5th ISCAS / CAD-AI / IFCARS Joint Symposium on Multidisciplinary Computational Anatomy (MCA)**

**Session Chairs: Makoto Hashizume, MD (JP), Hiroyuki Yoshida, PhD (US), Marcus Makowski, MD (DE)**

#### **FEM-based patient-individual modelling and simulation of knee joint motion**

E. Theilen, C. v. Dresky, L. Walczak, K. Izadpanah, T. Lange, S. Bendak, D. Gehring, J. Ketterer, C. Huber, J. Georgii, Fraunhofer Inst. for Digital Medicine MEVIS, Bremen; Univ. of Freiburg Medical Center; Univ. of Freiburg; Stryker Leibinger GmbH & Co. KG, Freiburg (DE) [CARS-MCA-LE-76]

#### **Luminal Enhancement in Intracranial Aneurysms: Fact or Feature? – A Quantitative Multimodal Flow Analysis**

F. Gaidzik, M. Pravidivtseva, N. Larsen, O. Jansen, J.–B. Hövener, P. Berg, Otto-von-Guericke-Univ. Magdeburg; Univ. Hospital Schleswig-Holstein Campus Kiel (DE) [CARS-MCA-LE-21-00038]

#### **Automatic extraction of the knee joint's anatomical configuration in 3D**

E. Taghizadeh, K. Izadpanah, T. Lange, P. Rovedo, H. Meine, Univ. of Bremen; Univ. Hospital Freiburg (DE) [CARS-MCA-LE-80]

#### **AI-based 3D-reconstruction of the colon from monoscopic colonoscopy videos - First results**

T. Wittenberg, R. Hackner, S. Walluscheck, E. Lehmann, M. Raithel, V. Bruns, Fraunhofer Inst. for Integrated Circuits IIS; E & L medical systems; Malteser Waldkrankenhaus, Erlangen (DE) [CARS/MCA-LE-77]

#### **Image-based decision support system for catheter-based pulmonary valve replacement**

V. S. Arikatla, J. Yan, S. Ching, A. Wilson, A. Lasso, C. Herz, A. Enquobahrie, M. A. Jolley, Kitware, Inc, Carrboro, NC; Children's Hosp. of Philadelphia, PA (US); Queen's Univ., Kingston, ON (CA) [CARS-MCA-LE-90]

---

## **23rd International Conference on Computer-Aided Diagnosis and Artificial Intelligence (CAD-AI)**

**Chairman: Hiroyuki Yoshida, PhD (US)**

*Tuesday, June 22, 2021*

### **7:55 Morning Reception**

**Dirk Wilhelm, MD**

### **8:00-8:50 CAD-AI in Breast**

**Session Chairs: Martin Fiebich, PhD (DE), Hiroshi Fujita, PhD (JP)**

#### **A Computer-aided Diagnosis System based on 3-D Attention-CNN architecture for Tumor Diagnosis on Automated Breast Ultrasound**

R.- F. Chang, J. Zhang, Y. S. Huang, H. Xiang, X. Lin, National Taiwan Univ., Taipei (TW); Sun Yat-sen Univ. Cancer Center, Guangzhou (CN) [CAD-LE-7]

#### **Malignant tumor detection on screening breast MRI with deep learning**

Y. L. Huang, Z. L. Tse, D. R. Chen, H. K. Wu, Tunghai University, Taichung; Changhua Christian Hospital (TW) [CAD-LE-100]

#### **New computer-aided detection schemes to detect breast cancer in two-dimensional synthesized mammograms and full-field digital mammograms**

M. Tan, M. Al-Shabi, W. Y. Chan, L. Thomas, K. H. Ng, Monash Univ. Malaysia, Selangor; Univ. of Malaya, Kuala Lumpur (MY) [CAD-LE-22]

#### **Breast cancer detection in digital mammography with convolutional neural network: retrospective study in Belgium**

S. Mahmoudi, X. Lessage, F. Giudice, S. Murgu, Univ. of Mons; CHR de Mons (BE) [CAD-LE-43]

*Tuesday, June 22, 2021*

### **8:50-10:10 CAD-AI in Head and Neck, and Others**

**Session Chairs: Hiroshi Fujita, PhD (JP), Ruey-Feng Chang, PhD (TW)**

#### **Aorta-aware GAN for non-contrast to artery contrasted CT translation and its application to abdominal aortic aneurysm detection**

T. Hu, M. Oda, Y. Hayashi, Z. Lu, K. K. Kumamaru, T. Akashi, S. Aoki, K. Mori, Nagoya Univ.; Juntendo Univ. Hosp., Tokyo (JP) [CAD-LE-21-00059]

**A deep learning scheme for predicting the cognitive status of patients with small vessel disease and mild cognitive impairment**

S. Atnafu, C. Marzi, E. Salvadori, A. Poggesi, A. Giorgio, N. De Stefano, M. Mascalchi, L. Pantoni, S. Diciotti, Univ. of Bologna; Univ. of Florence; Univ. of Siena; Univ. of Milan (IT) [CAD-LE-30]

**Leukoplakia Lesion Classification in Larynx Contact Endoscopy – Narrow Band Imaging: Preliminary Results of a Manual versus an Automatic Approach**

N. Esmaeili, A. Illanes, A. Boese, N. Davaris, C. Arens, N. Navab, M. Friebe, Otto-von-Guericke Univ., Magdeburg; Technical Univ. Munich; Magdeburg Univ. Hosp. (DE) [CAD-LE-24]

**Deep Convolution Neural Network for Laryngeal Cancer Classification on Contact Endoscopy - Narrow Band Imaging via Transfer Learning**

N. Esmaeili, E. Sharaf, E. J. Gomes Ataide, N. Davaris, C. Arens, M. Friebe, Otto-von-Guericke Univ., Magdeburg; Magdeburg Univ. Hosp. (DE) [CAD-LE-45]

**Artificial intelligence coronary calcium scoring in low dose chest CT – Ready to go?**

A. Luger, C. Schwabl, L. Gruber, G. Feuchtner, T. Sonnweber, S. Sahanic, A. Pizzini, A. Boehm, J. Löffler-Ragg, I. Tancevski, M. Joannidis, R. Kirchmair, E. Wöll, G. Weiss, E. Gizewski, G. Widmann, Innsbruck Medical Univ.; Zams Hospital (AT) [CAD-LE-75]

**Bayesian approach for hotspot extraction from a bone scintigram**

M. Hara, A. Saito, J. Kawabe, S. Higashiyama, H. Daisaki, A. Shimizu, Tokyo Univ. of Agriculture and Technology; Osaka City Univ.; Gunma Prefectural College of Health Sciences, Maebashi (JP) [CAD-LE-20]

**Parametric identification of prostate shape using the superellipses and its correlation with pathology**

Y. Onodera, N. Koizumi, Y. Shigenari, R. Igarashi, Y. Nishiyama, S. Shoji, The Univ. of Electro-Communications, Chofu; Tokai University, Isehara (JP) [CAD-LE-63]

*Tuesday, June 22, 2021*

**10:10-11:00 CAD-AI Poster Session**

**Session Chairs:** Akinobu Shimizu, PhD (JP), Martin Fiebich, PhD (DE)

**029 Improvement of dementia classification accuracy for brain SPECT volumes using the attention mechanism**

N. Matsumoto, A. Saito, M. Fukasawa, T. Iizuka, A. Shimizu, Tokyo Univ. of Agriculture and Technology; Fukujuji Hospital, Tokyo (JP) [CAD-PO-5]

**030 Computerized Prediction Method for Low-Grade Gliomas with 1p/19q Codeletion in Brain MRI Images Using 3-dimensional Attention Branch Networks**

D. Tanaka, A. Hizukuri, R. Nakayama, Ritsumeikan University, Kusatsu Shiga (JP) [CAD-PO-51]

**031 Deep learning-based prediction of clinical outcomes in diffuse large B-cell lymphoma (DLBCL) from a baseline 18F-FDG PET scan**

X. Gao, P. Liu, G. Zheng, Shanghai Jiao Tong University (CN) [CAD-PO-57]

**032 Investigation of a High-resolution Method for Detecting Large-intestine Regions from Plain Abdominal CT Images**

K. Abe, H. Takeo, S. Nawano, Y. Nagai, Kanagawa Institute of Technology; International Univ. of Health and Welfare, Tokyo; National Cancer Center Hospital East, Chiba (JP) [CAD-PO-2]

**033 Detection of bone metastases on FDG-PET/CT images by using two-step anomaly detection**

H. Yamaguchi, M. Nemoto, H. Kaida, Y. Kimura, T. Nagaoka, T. Yamada, K. Hanaoka, K. Kitajima, T. Tsuchitani, K. Ishii, Kindai University, Wakayama; Kindai University, Osaka; Hyogo College of Medicine (JP) [CAD-PO-61]

**034 Spine MRI texture analysis and prediction of osteoporotic vertebral fracture**

M. Nogueira-Barbosa, J. da Silva Ramos, J. Gomes Maciel, A. Juci Traina, P. Mazzoncini de Azevedo-Marques, Univ. of Sao Paulo, Sao Carlos; Univ. of Sao Paulo, Ribeirao Preto (BR) [CAD-PO-102]

**035 Benign and malignant non-cystic breast lesion differentiation on the ultrasound image**

I. Egoshin, D. Pasynkov, A. Kolchev, I. Kliouchkin, O. Pasynkova, A. Shefer, Mari State Univ.; Kazan Federal Univ., Yoshkar-Ola; Kazan State Medical Univ., Kazan (RU) [CAD-PO-12]

**036 The Relative Importance of Fine Needle Aspirate Diagnostic Attributes in Machine Learning Classification of Breast Cancer**

S. Raju, UIC College of Medicine at Rockford (US) [CAD-PO-33]

*Tuesday, June 22, 2021*

**11:00-11:15 Invited Lecture on CAD-AI**

**Session Chair:** Hiroyuki Yoshida, PhD (US)

**Crowd-sourcing-based ground truth for deep learning**

**Invited Lecture:** T. Deserno, Technical Univ. Braunschweig and Hannover Medical School (DE) [CAD-IS-0223]

Tuesday, June 22, 2021

**11:15-12:10 CAD-AI in Lung**

**Session Chair:** Yoshiharu Ohno, MD, PhD (JP)

**Machine Learning for Lung CT Texture Analysis in Connective Tissue Disease: Capability for Disease Severity and Therapeutic Effect Evaluations**

Y. Ohno, K. Aoyagi, D. Takenaka, T. Yoshikawa, Y. Fujisawa, N. Sugihara, H. Hattori, K. Murayama, H. Toyama, Fujita Health Univ. School of Medicine, Toyoake; Canon Medical Systems Corporation, Otawara; Hyogo Cancer Center, Akashi (JP) [CAD-LE-29]

**Computer-aided diagnosis of x-ray thorax diseases using deep convolutional neural network with graph attention mechanism**

Y.-W. Lee, S. K. Huang, R. F. Chang, National Taiwan Univ., Taipei (TW) [CAD-LE-10]

**Developing a Computer-aided Diagnosis System by 3-D SE-ResNeXt for Lung Nodule Classification on Low-dose Computed Tomography**

Y.S. Huang, S. Z. Huang, T. C. Lin, R. F. Chang, National Taiwan Univ., Taipei (TW) [CAD-LE-8]

**3D Axial-Attention for Lung Nodule Classification**

M. Tan, M. Al-Shabi, K. Shak, Monash Univ., Selangor (MY) [CAD-LE-21-00003]

**Feasibility Study of MRI and Multimodality CT/MRI Radiomics for Lung Nodule Classification**

P. Azevedo-Marques, A. Jatobá, M. Koenigkam-Santos, D. Wada, M. Oliveira, Univ. Federal de Alagoas, Maceió; Univ. of Sao Paulo, Ribeirao Preto (BR) [CAD-LE-86]

Tuesday, June 22, 2021

**12:10-13:00 CAD-AI in Colon**

**Session Chairs:** Paulo M. Azevedo-Marques, PhD (BR), Kunio Doi, PhD (US)

**Self-supervised 3D-ResNet-GAN for electronic cleansing in dual-energy CT colonography**

R. Tachibana, J. Näppi, T. Hironaka, H. Yoshida, National Institute of Technology, Yamaguchi (JP); Massachusetts General Hospital, Boston (US) [CAD-LE-73]

**Weakly unsupervised contrastive unpaired learning for virtual bowel cleansing in computer-assisted diagnosis for laxative-free CT colonography**

J. Näppi, H. Yoshida, Massachusetts General Hospital, Boston, MA (US) [CAD-LE-79]

**Experimental evaluation of loss functions in YOLO-v3 training for the perforation detection and localization in colonoscopic videos**

K. Jiang, H. Itoh, M. Oda, T. Okumura, Y. Mori, M. Misawa, T. Hayashi, S. E. Kudo, K. Mori, Nagoya Univ.; Showa Univ. Northern Yokohama Hospital (JP) [CAD-LE-96]

**Binary Polyp-Size Classification based on Deep-Learning Estimation of Spatial Information**

H. Itoh, M. Oda, K. Jiang, Y. Mori, M. Misawa, S.-E. Kudo, K. Imai, S. Ito, K. Hotta, K. Mori, Nagoya Univ.; Northern Yokohama Hosp.; Shizuoka Cancer Center (JP) [CAD-LE-21-00057]

Tuesday, June 22, 2021

**13:00-13:50 CAD-AI in COVID-19**

**Session Chairs:** Paulo M. Azevedo-Marques, PhD (BR), Janne J. Näppi, PhD (US), Hiroyuki Yoshida, PhD (US)

**Computer-aided prediction of COVID-19 progression using unsupervised deep learning of chest CT images**

H. Yoshida, T. Uemura, J. Näppi, C. Watari, T. Hironaka, T. Kamiya, Harvard Medical School, Boston, MA (US); Kyushu Inst. of Technology, Kitakyushu (JP) [CAD-LE-28]

**Computer assisted pneumonia quantification in COVID-19: data from the CovILD study**

G. Widmann, A. Luger, C. Schwabl, T. Sonnweber, S. Sahanic, A. Pizzini, A. Böhm, J. Löffler-Ragg, I. Tancevski, G. Feuchtnner, M. Johannidis, R. Kirchmair, E. Wöll, G. Weiss, E. Gizewski, Medical University of Innsbruck (AT) [CAD-LE-60]

**Predicting interstitial and covid-19 diseases on chest X-ray using a convolutional neural network with transfer learning**

P. Azevedo-Marques, L. L. Lima, J. C. Nather Jr, M. Koenigkam-Santos, L. Peron, K. L. Fontes Lopes, C. Machado, F. Sarmiento-Neto, D. Wada, M. Koenigkam-Santos, Univ. of Sao Paulo, Ribeirao Preto (BR) [CAD-LE-84]

**Deep Convolutional Neural Networks (CNN) for COVID-19 classification in chest X-ray images with Explainable Artificial Intelligence (XAI)**

X. Lessage, S. Mahmoudi, S. A. Mahmoudi, S. Laraba, O. Debauche, M. A. Belarbi, University of Mons (BE) [CAD-LE-42]



Tuesday, June 22, 2021

**14:00-15:00 Industrial Presentations**  
**Moderators: Dirk Wilhelm, MD, Jana Steger, MSc**

---

## **IPCAI 2021 - 12th International Conference on Information Processing in Computer-Assisted Interventions**

**General Chairs:** Lena Maier-Hein, PhD (DE), Tim Salcudean, PhD (CA), Stefanie Speidel, PhD (DE)

**Program Chairs:** Alfred Franz, PhD (DE), Orcun Goksel, PhD (CH)

---

*Tuesday, June 22, 2021*

**15:00-15:15 Welcome**

### **15:15-15:45 Session S1: Machine Learning in Surgical Data Science**

**Session Chair:** Anirban Mukhopadhyay, PhD (DE)

#### **Simulation-to-Real domain adaptation with teacher-student learning for endoscopic instrument segmentation**

M. Sahu, A. Mukhopadhyay, S. Zachow, Zuse Inst. Berlin; Technical Univ. of Darmstadt (DE) [IPCAI-04]

#### **Multi-Task Temporal Convolutional Networks for Joint Recognition of Surgical Phases and Steps in Gastric Bypass Procedures**

S. Ramesh, D. Dall'Alba, C. Gonzalez, T. Yu, P. Mascagni, D. Mutter, J. Marescaux, P. Fiorini, N. Padoy, Univ. of Verona; Fondazione Policlinico Univ. Agostino Gemelli IRCCS, Rome (IT); Univ. of Strasbourg; Univ. Hosp. of Strasbourg; IRCAD Strasbourg (FR) [IPCAI-26]

#### **Domain Adaptation and Self-Supervised Learning for Surgical Margin Detection**

A.M.L. Santilli, A. Jamzad, A. Sedghi, M. Kaufmann, K. Logan, J. Wallis, K. Y. M. Ren, N. Janssen, S. Merchant, J. Engel, D. McKay, S. Varma, A. Wang, G. Fichtinger, J. Rudan, P. Mousavi, Queen's Univ., Kingston, ON (CA) [IPCAI-33]

### **15:45-16:15 Session S2: Imaging**

**Session Chair:** Stefanie Speidel, PhD (DE)

#### **Metabolomics Patterns of Breast Cancer Tumors Using Mass Spectrometry Imaging**

R. Theriault, M. Kaufmann, K. Y. M. Ren, S. Varma, R.E. Ellis, Queen's Univ., Kingston, ON (CA) [IPCAI-08]

#### **Tattoo tomography: Freehand 3D photoacoustic image reconstruction with an optical pattern**

N. Holzwarth, M. Schellenberg, J. Groehl, K. Dreher, J.-H. Nölke, A. Seitel, M. D. Tizabi, B. P. Müller, L. Maier-Hein, German Cancer Research Center; Univ. Hospital Heidelberg (DE) [IPCAI-32]

#### **Speed-of-Sound Imaging using Diverging Waves**

R. Rau, D. Schweizer, V. Vishnevskiy, O. Goksel, ETH Zurich (CH); Uppsala Univ. (SE) [IPCAI-37]

### **16:15-16:45 Session S3: Interventional Planning**

**Session Chair:** Nicola Rieke, PhD (US)

#### **Automatic Cortical Target Point Localisation in MRI for Transcranial Magnetic Stimulation via a Multi-Resolution Convolutional Neural Network**

J.S.H. Baxter, E. Maguet, Q. A. Bui, S. Croci, A. Delmas, J.-P. Lefaucheur, L. Bredoux, P. Jannin, Univ. de Rennes 1; SYNEIKA, Rennes; Paris Est Créteil Univ. (FR) [IPCAI-13]

#### **Automatic Identification of Sweet Spots from MERs for Electrodes Implantation in STN-DBS**

L. Xiao, C. Li, Y. Wang, W. Si, D. Zhang, H. Lin, X. Cai, P.-A. Heng, China Univ. of Petroleum; Shenzhen Inst. of Advanced Technology; Shenzhen Second People's Hosp. (CN); The Chinese Univ. of Hong Kong (HK) [IPCAI-15]

#### **Patient-specific Prediction of SEEG Electrode Bending for Stereotactic Neurosurgical Planning**

A. Granados, Y. Han, O. Lucena, V. Vakharia, R. Rodionov, S. B. Vos, A. Miserocchi, A. W. McEvoy, J. Duncan, R. Sparks, S. Ourselin, King's College; National Hosp. of Neurology and Neurosurgery; UCL, London (GB) [IPCAI-30]

**16:45-17:30 Breaks and Posters (S1-3)**

### **17:30-18:10 Session S4: Machine Learning in Ultrasound**

**Session Chair:** Alexander Seitel, PhD (DE)

#### **Time-Aware Deep Neural Networks for Needle Tip Localization in 2D Ultrasound**

C. Mwikirize, I. Hacihaliloglu, J.L. Noshier, A. Katumba, S. Imanirakiza, A. Kimbowa, Rutgers, The State Univ. of New Jersey (US); Makerere Univ., Kampala (UG) [IPCAI-14]

**Vessel Segmentation for Automatic Registration of Untracked Laparoscopic Ultrasound to CT of the Liver**  
N. M. Brown, J. Ramalinho, M. Allam, B. Davidson, Y. Hu, M.J. Clarkson, University College London (GB)  
[IPCAI-23]

**Learning Ultrasound Rendering from Cross-Sectional Model Slices for Simulated Training**  
L. Zhang, T. Portenier, O. Goksel, ETH Zurich (CH); Uppsala Univ. (SE) [IPCAI-24]

**Leveraging Voxel-wise Segmentation Uncertainty to Improve Reliability in Assessment of Paediatric Dysplasia of the Hip**  
A. Kannan, A.J. Hodgson, K. Mulpuri, R. Abugharbieh, Univ. of British Columbia; British Columbia Children's Hosp., Vancouver, BC (CA) [IPCAI-51]

**18:10-18:50 Session S5: Prostate Interventions**  
**Session Chair:** Purang Abolmaesumi, PhD (CA)

**Towards Targeted Ultrasound-guided Prostate Biopsy by Incorporating Model and Label Uncertainty in Cancer Detection**  
G. Javadi, S. Bayat, S. Samadi, A. Sedghi, S. Sojoudi, A. Hurtado-coll, S. Chang, P. Black, P. Mousavi, P. Abolmaesumi, Univ. of British Columbia; Vancouver, BC; Queen's Univ., Kingston, ON (CA) [IPCAI-17]

**Preclinical Evaluation of a Marker-less, Real-time, Augmented Reality Guidance System for Robot Assisted Radical Prostatectomy**  
M. Kalia, A. Avinash, N. Navab, S. Salcudean, Univ. of British Columbia, Vancouver, BC (CA); TU Munich (DE) [IPCAI-40]

**Centre-specific autonomous treatment plans for prostate brachytherapy using cGANs**  
T.A. Aleef, I. Spadinger, M. Peacock, S. Salcudean, S. Mahdavi, Univ. of British Columbia, Vancouver, BC; BC Cancer Agency (CA) [IPCAI-43]

**An Office-Based MR System for Prostate Biopsy**  
S. Chiragzada, E. Hellman, D. Michael, R. Narayanan, A. Nacev, D. Kumar, Promaxo, Oakland (CA) [IPCAI-48]

**18:50-19:30 Breaks and Posters (S4-5)**

**19:30-20:30 Panel Discussion**

**Moderator:** Parvin Mousavi, PhD (CA); Alice Santilli, MSc Student (CA)  
**Panelists:** Shekoofeh Azizi (AI Researcher at Google), Purang Abolmaesumi (Professor of Medical Imaging, Image Guided Therapy and Applied Machine Learning at UBC), David Pichora (President & CEO Kingston Health Sciences Centre), Lena Maier-Hein (Professor of Computer-assisted Medical Interventions at DKFZ), Hedyeh Rafei-Tari (Principal Research Scientist at Johnson & Johnson)

**20:30-21:15 Meet & Greet**

**21:15 Open-ended Social Event**

---

*Wednesday, June 23, 2021*

**15:00-15:45 Long Abstract Session**  
**Session Chair:** Matthew Clarkson, PhD (UK), Keno März, PhD (DE)

**Pose optimization of X-ray protective shields for staff radiation exposure minimization**  
A. Krebs, C. Rolland, J. J. Verde, N. Padoy  
University of Strasbourg, CNRS, IHU Strasbourg (FR) [IPCAI-53]

**Superpixel Tracking: Configurable Polynomial-Time Semantic Segmentation for Endoscope Video**  
W.-Y. Hong, C.-S. Shih  
National Taiwan University (Taipei, TW). [IPCAI-54]

**CholecSeg8k: A Semantic Segmentation Dataset for Laparoscopic Cholecystectomy Based on Cholec80**  
W.-Y. Hong, C.-L. Kao, Y.-H. Kuo, J.-R. Wang, W.-L. Chang, C.-S. Shih  
National Taiwan University (Taipei, TW). [IPCAI-55]

**Colonoscopic 3D Reconstruction by Tubular Non-Rigid Structure-from-Motion**  
A. Sengupta, A. Bartoli  
Université Clermont Auvergne (FR). [IPCAI-56]

**Learning 3D Medical Image Patch Descriptors with Triplet Loss**  
N. Loiseau-Witon, R. Kechichian, S. Valette, A. Bartoli  
CREATIS (FR); Université Clermont Auvergne (FR). [IPCAI-57]

**SliderAutoscooperM: Multi-modal Tracking of Skeletal Structures and Implants**  
B. Akhbari, A. Morton, L. Welte, J. Beveridge, J.-C. Fillion-Robin, M. Rainbow, B. Paniagua, J. Crisco  
Brown University (US); Queen's University (Kingston, CA); Cleveland Clinic (US); Kitware (US). [IPCAI-59]

**Automation of Internal Limiting Membrane Peeling Task with Deep Reinforcement Learning**

M. Kanehara, S. A. H. Perez, S. Omata, F. Arai, K. Sugimoto, F. Araki, K. Totsuka, T. Shiraya, T. Ueta, M. Takao, K. Harada, M. Mitsuishi  
The University of Tokyo (JP); Kumamoto University (JP); The University of Tokyo Hospital (JP). [IPCAI-62]

**Image Recognition Applied to a Robotic Platform for Mouse Dissection**

T. Inoue, M. Mitsuishi, K. Harada  
The University of Tokyo (JP). [IPCAI-63]

**15:45-16:15 Breaks and Posters (Long Abstracts)**

**16:15-16:55 Session S6: Machine Learning in Computer Assisted Interventions**

**Session Chair:** Ka-Wai Kwok, PhD (HK)

**Deep Learning to Segment Pelvic Bones: Large-scale CT Datasets and Baseline Models**

P. Liu, H. Han, Y. Du, H. Zhu, Y. Li, F. Gu, H. Xiao, J. Li, C. Zhao, L. Xiao, X. Wu, S.K. Zhou, Chinese Academy of Sciences; Beijing Electronics Science&Technology Inst.; Beijing Jishuitan Hosp.; Univ. of Science and Technology of China, Hefei (CN); George Mason Univ., Virginia (US) [IPCAI-07]

**Against Spatial-Temporal Discrepancy: Contrastive Learning based Network for Surgical Workflow Recognition**

F. Jia, T. Xia, Shenzhen Inst. of Advanced Technology (CN) [IPCAI-28]

**Real-to-Virtual Domain Transfer-based Depth Estimation for Real-time 3D Annotation in Transnasal Surgery: A Study of Annotation Accuracy and Stability**

H. S. Tong, Y. L. Ng, Z. Liu, J.D.L. Ho, C. Chan, J.Y.K. Chan, K.-W. Kwok, The Univ. of Hong Kong; The Chinese Univ. of Hong Kong (HK); Imperial College London (GB) [IPCAI-41]

**Computer-assisted contralateral side comparison using flat panel technology**

S. Thomas, L. Kausch, H. Kunze, M. Privalov, A. Klein, J. Siad El Barbari, C. M. Vicario, J. Franke, K.H. Maier-Hein, German Cancer Research Center, Heidelberg; Siemens Healthineers; BG Trauma Center Ludwigshafen; Friedrich-Alexander-Univ. Erlangen-Nürnberg (DE) [IPCAI-42]

**16:55 Session S7: Surgical Robotics**

**Session Chair:** Omid Mohareri, PhD (US)

**Cross-modal self-supervised representation learning for gesture and skill recognition in robotic surgery**

J. Y. Wu, A. Tamhane, P. Kazanzides, M. Unberath, Johns Hopkins Univ.; Baltimore; MD (US) [IPCAI-21]

**Autonomous Pick-And-Place Using the dVRK**

C. D'Ettorre, A. Stilli, G. Dwyer, M. Tran, D. Stoyanov, University College London (GB) [IPCAI-35]

**An Intuitive Surgical Handle Design for Robotic Neurosurgery**

E. Dimitrakakis, L. Lindenroth, G. Dwyer, H. Aylmore, N. Dorward, H. Marcus, D. Stoyanov, University College London; National Hosp. for Neurology and Neurosurgery, London (GB) [IPCAI-44]

**Mask then Classify: Multi-Instance Segmentation for Surgical Instruments**

T. Kurmann, P. Márquez Neila, M. Allan, S. Wolf, R. Sznitman, Univ. of Bern; Univ. Hosp. of Bern (CH); Intuitive Surgical (US) [IPCAI-49]

**17:35 Breaks and Posters (S6-7)**

**18:15 Session S8: Training and Simulation**

**Session Chair:** Ingerid Reinersten, PhD (NO)

**Comparison of Augmented Reality-based and Conventional Training for ECMO Cannulation**

J. Wolf, V. Wolfer, M. Halbe, F. Maisano, L. Quentin, M. Meboldt, ETH Zurich; Univ. Hosp. Zurich; Univ. of Zurich (CH) [IPCAI-12]

**Automatic extraction of the mitral valve chordae geometry for biomechanical simulation**

D. Panicheva, P.-F. Villard, P. Hammer, D. Perrin, M.-O. Berger, Inria; LORIA (FR); Harvard School of Engineering and Applied Sciences; Harvard Medical School (US) [IPCAI-18]

**Automatic Triangulated Mesh Generation of Pulmonary Airways from 3DCTs for Computational Fluid Dynamics**

M. Lauria, K. Singhrai, B. Stiehl, D. Low, J. Goldin, I. Barjaktarevic, A.P. Santhanam, UCLA (US) [IPCAI-19]

**18:45 Session 9: Tracking and Localization**

**Session Chair:** Phillippe Cattin, PhD (CH)

**Predictive online 3D target tracking with population-based generative networks for image-guided radiotherapy**

L. Vazquez Romaguera, T. Mezheritsky, W. Tanguay, S. Kadoury, École Polytechnique de Montreal; Univ. of Montreal, QC (CA) [IPCAI-02]

**CycleGAN for Interpretable Online EMT Compensation**

H.J. Krumb, D. Das, R. Chadda, A. Mukhopadhyay, TU Darmstadt (DE); Indian Inst. of Technology, Varanasi (IN) [IPCAI-09]

**Monocular Markerless Tool-in-Hand-Tracking for Surgery**

J. Hein, M. Seibold, F. Bogo, M. Farshad, M. Pollefeys, P. Fürnstahl, N. Navab, ETH Zurich; Balgrist Univ. Hosp. Zurich; Microsoft; Univ. of Zurich (CH); TU Munich (DE) [IPCAI-11]

**Fast and Robust Localization of Surgical Array using Kalman Filter**

M. Ashikuzzaman, N. Jafarpisheh, S. Rottoo, P. Brisson, H. Rivaz, Concordia Univ., Montreal, QC; THINK Surgical Inc. (CA) [IPCAI-31]

**Automating Periodontal Bone Loss Measurement via Dental Landmark Localisation**

R.P. Danks, S.D. Bano, A. Orishko, H. J. Tan, F. Moreno Sancho, F. D'Aiuto, D. Stoyanov, University College London (GB) [IPCAI-46]

**19:35 Breaks and Posters (S8-9)**

**20:15 Awards and Closing**

**21:00 Post-IPCAI Social Event**

---

**25<sup>th</sup> Annual Conference of the International Society for Computer Aided Surgery (ISCAS)**

**Chairs:** Kensaku Mori, PhD (JP), Cristian A. Linte, PhD (US)

*Wednesday, June 23, 2021*

**7:55 Morning Reception**

**Dirk Wilhelm, MD**

**8:00-9:00 Surgical Robotics and Instrumentation**

**Session Chairs:** Kevin Cleary, PhD (US), Tim C. Lüth, PhD (DE)

**Developing an MRI-compatible concentric tube robot for intracerebral hemorrhage evacuation in the bore of the magnet**

K. Cleary, Y. Chen, I. Godage, S. Sengupta, D. Sigounas, C. Kellner, K. Sharma, C. Oluigbo, A. Carpenter, Univ. of Arkansas, Fayetteville, AR; DePaul Univ., Chicago, IL; Vanderbilt Univ., Nashville, TN; Mount Sinai Hosp., New York, NY; George Washington Univ., Children's National Hosp.; Georgetown Univ., Washington, DC (US) [ISCAS-LE-37]

**Active Positioning Arm with high RCM Changeability using Parallel Sliding Mechanism for Minimally Invasive Surgery**

Y. Yi, B. S. Cheon, S. Cho, D. S. Kwon, Korea Advanced Institute of Science and Technology, Daejeon (KR) [ISCAS-LE-91]

**Force-guided autonomous robotic ultrasound scanning control method for soft uncertain environment**

G. Ning, J. Chen, X. Zhang, H. Liao, Tsinghua Univ., Beijing (CN) [ISCAS-LE-21-00014]

**Toward autonomous robotic prostate biopsy: a pilot study**

B. Maris, C. Tenga, R. Vicario, L. Palladino, N. Murr, M. De Piccoli, A. Calanca, S. Puliatti, S. Micali, P. Fiorini, Univ. of Verona; Univ. of Modena and Reggio Emilia (IT) [ISCAS-LE-21-00041]

**Design of a novel tendon-driven manipulator structure based on monolithic compliant rolling-contact joint for minimally invasive surgery**

D. Zhang, Y. Sun, T. C. Lueth, Technical Univ. of Munich (DE) [ISCAS-LE-21-00044]

*Wednesday, June 23, 2021*

**9:00-10:00 Catheter Needle-based Image-guided Interventions**

**Session Chairs:** Petra Mela, PhD (DE), Michael Friebe, PhD (DE)

**Soft tissue needle punctures - a study using acoustic emission and force**

A. Illanes, M. Sabieleish, K. Heryan, A. Boese, M. Friebe, Otto-von-Guericke Univ., Magdeburg (DE); AGH Univ. of Science and Technology, Kraków (PL) [ISCAS-LE-48]

**3D cryo-balloon catheter orientation reconstruction based on automatically detected structures in 2D x-ray fluoroscopy**

D. Bertsche, T. Dahme, W. Rottbauer, V. Rasche, I. Vernikouskaya, Ulm Univ. Medical Center (DE) [ISCAS-LE-3]

**Needle puncture analysis using audio excitations during tissue insertions**

M. Sabieleish, K. Heryan, A. Boese, M. Friebe, A. Illanes, Otto-von-Guericke Univ., Magdeburg (DE); AGH Univ. of Science and Technology, Kraków (PL) [ISCAS-LE-66]

**Development of an electromagnetic catheter tracking system using TMR sensor for superselective intra-arterial chemotherapy**

R. Nagano, K. Hara, A. Ishijima, N. Tomii, K. Nakagawa, Y. Akagi, M. Yamazaki, H. Tsukahara, E. Kobayashi, T. Ohya, I. Sakuma, The Univ. of Tokyo; Yokohama City Univ. (JP) [ISCAS-LE-35]

**Passive Needle Tracking Using Phase Imaging for MR-guided Interventions**

A. Mahran, P. Moreira, K. Tuncali, J. Tokuda, Brigham and Women's Hospital, Boston, MA (US) [ISCAS-LE-83]

*Wednesday, June 23, 2021*

**10:00-11:00 ISCAS Poster Session**

**Session Chairs:** Kensaku Mori, PhD (JP), Cristian A. Linte, PhD (US)

**019 Surgical procedure simulation dataset for surgical robot development: An example of canine spay surgery**

P. Suteecharuwat, N. Kubuki, Y. Ran, K. Nagase, Y. Hayakawa, Kitami Inst. of Technology, Hokkaido (JP) [ISCAS-PO-21]

**020 Multi-modality phantom for accuracy verification of image-based navigation tools**

D. Bertsche, A. Reinelt, T. Speidel, P. Metze, K. Stumpf, V. Rasche, I. Vernikouskaya, Ulm Univ. Medical Center (DE) [ISCAS-PO-25]

**021 Towards machine learning-based tissue differentiation using an ultrasonic aspirator**

N. Bockelmann, D. Kessler, M. Matthiae, J. Kren, M. M. Bonsanto, S. Buschschlüter, F. Ernst, Univ. of Lübeck; Söring GmbH, Quickborn; Univ. Hosp. Schleswig-Holstein, Lübeck (DE) [ISCAS-PO-27]

**022 Real-time bone fragment navigation for open cranial vault remodeling**

D. García-Mato, M. García-Sevilla, S. Ochandiano, J. Pascau, Univ. Carlos III de Madrid, Leganés; Inst. de Investigación Sanitaria Gregorio Marañón, Madrid (ES) [ISCAS-PO-31]

**023 Smartphone-based augmented reality system for needle insertion guidance in sacral nerve stimulation**

R. Moreta-Martinez, M. García-Sevilla, D. García-Mato, A. Pose-Díez-de-la-Lastra, I. Rubio-Pérez, J. Pascau, Univ. Carlos III de Madrid, Leganés; Hosp. Univ. La Paz, Madrid (ES) [ISCAS-PO-47]

**024 Ergonomic design and validation of an intraoperative system to measure plantar pressure distribution in supine position**

J. Grossman, K. Hara, S. H. Chang, T. Matsumoto, I. Sakuma, E. Kobayashi, Univ. of Tokyo, Bunkyo City; Univ. of Tokyo (JP) [ISCAS-PO-49]

**025 Intraoperative Feedback for Laparoscopic Access with Surgical Audio Guidance**

M. Spiller, T. Suehn, N. Esmaeili, A. Boese, M. Friebe, A. Illanes, Otto-von-Guericke University, Magdeburg (DE) [ISCAS-PO-78]

**026 Non-rigid Cutaneous tissue deformation estimation with iterative RANSAC and TPS from digital images over semi-ambiguous artificial markings**

C. Shi, D. P. DeMeo, E. L. Larson, J. M. Galeotti, B. T. Carroll, Carnegie Mellon Univ., Pittsburgh, PA; Univ. Hospitals, Cleveland, OH (US) [ISCAS-PO-92]

**027 Three-dimensional surgical plan printing for assisting liver surgery**

K. Mori, Y. Hayashi, T. Igami, Y. Nakamura, Nagoya University; National Institute of Technology, Tomakomai (JP) [ISCAS-PO-101]

**028 Automatic detection of procedural knowledge in surgical texts**

M. Bombieri, M. Rospocher, D. Dall'Alba, P. Fiorini, Univ. of Verona (IT) [ISCAS-PO-21-00039]

*Wednesday, June 23, 2021*

**11:00-12:10 Surgical Workflow Modeling, Simulation and Education**

**Session Chairs:** Stefanie Speidel, PhD (DE), Hubertus Feussner, MD (DE)

**Design of a human-machine interface between sterile and non-sterile environment of the OR for the usage of a robotic circulating nurse**

C. Müller, L. Bernhard, D. Ostler, D. Wilhelm, Klinikum rechts der Isar der Technischen Universität München (DE) [ISCAS-LE-44]

**Image guided decision making for the suspension of patient specific scaphoid replacement**

P. Honigmann, M. Haefeli, J. G. Oonk, G. J. Strijkers, J. G. Dobbe, S. D. Strackee, G. J. Streekstra, Kantonsspital Baselland, Liestal (CH); Amsterdam UMC (NL) [ISCAS-LE-68]

**Real-time Automated Performance Metrics For Mastoidectomy Surgical Simulation**

E. Simpson, S. Agrawal, H. Ladak, Western University, London, ON (CA) [ISCAS-LE-82]

**Real-time deformation simulation of hollow organs based on XPBD with small time steps and air mesh for surgical simulation**

S. Li, Y. Hayashi, M. Oda, K. Misawa, K. Mori, Nagoya University, Aichi Cancer Center, Nagoya (JP) [ISCAS-LE-94]

**Model-based surgery – evaluation of preoperative characteristics**

T. Vogel, M. Berlet, D. Ostler, M. Kranzfelder, H. Feussner, D. Wilhelm, Klinikum rechts der Isar der Technischen Universität München (DE) [ISCAS-LE-103]

**Surgical workflow recognition with 3DCNN for Sleeve Gastrectomy**

B. Zhang, A. Ghanem, A. Simes, H. Choi, A. Yoo, C-SATS, Johnson & Johnson, Seattle, WA (US) [ISCAS-LE-21-00013]

*Wednesday, June 23, 2021*

**12:10-13:10 Augmented / Virtual / Mixed Reality and Multi-dimensional Visualization**

**Session Chairs:** Marta Kersten-Oertel, PhD (CA), Ulrich Eck, PhD (DE)

**Augmented reality for improved PSI placement in pelvic tumour resections**

M. García-Sevilla, R. Moreta-Martínez, D. García-Mato, A. Pose-Díez-de-la-Lastra, R. Pérez-Mañanes, J. Calvo-Haro, J. Pascau, Univ. Carlos III de Madrid, Leganés; Inst. de Investigación Sanitaria Gregorio Marañón, Madrid (ES) [ISCAS-LE-18]

**Combining augmented reality and 3D printing to improve orthopedic oncological surgeries**

A. Pose Díez de la Lastra, R. Moreta Martínez, J. A. Calvo Haro, L. Mediavilla Santos, R. Pérez Mañanes, J. Pascau, Univ. Carlos III de Madrid, Leganés; Inst. de Investigación Sanitaria Gregorio Marañón, Madrid (ES) [ISCAS-LE-41]

**Towards holographic navigation for paediatric nephron sparing Wilms tumour surgery: a technical feasibility study**

Q. Eyck, M. Fitski, L. van der Steeg, M. Wijnen, Princess Máxima Centre, Utrecht (NL) [ISCAS-LE-72]

**Augmented Reality Based Autostereoscopic Surgical Visualization System for Telesurgery**

T. Huang, R. Li, Y. Li, X. Zhang, H. Liao, Tsinghua Univ., Beijing (CN) [ISCAS-LE-21-00036]

**Distance and Force Visualisations for Improved Simulation of Intracranial Aneurysm Clipping**

M. Allgaier, B. Neyazi, B. Preim, S. Saalfeld, Otto-von-Guericke-Univ., Magdeburg (DE) [ISCAS-LE-21-00023]

---

*Wednesday, June 23, 2021*

**14:00-15:00 Industrial Presentations**

**Moderators:** Dirk Wilhelm, MD, Regine Hartwig, MSc

---

*Wednesday, June 23, 2021*

**15:00-16:10 Endoscopic / Laparoscopic / Video-based Applications**

**Session Chairs:** Cristian A. Linte, PhD (US), Markus H. Wirth, MD (DE)

**Blood vessel regions segmentation from laparoscopic videos using fully convolutional networks with multi field of view input**

K. Mori, S. Morimitsu, S. Yamamoto, T. Ozawa, T. Kitasaka, Y. Hayashi, M. Oda, M. Ito, N. Takeshita, K. Misawa, Nagoya Univ.; Aichi Inst. of Technology, Toyota; National Cancer Center Hosp. East, Chiba; Aichi Cancer Center Hosp., Nagoya (JP) [ISCAS-LE-53]

**Comparison of different spectral cameras for image-guided surgery**

E. Wisotzky, B. Kossack, R. Mühle, W. Markgraf, A. Hilsmann, P. Eisert, Fraunhofer Heinrich-Hertz-Institute, Berlin; TU Dresden (DE) [ISCAS-LE-85]

**Spatial Information Considered Module based on Attention Mechanism for Self-Supervised Depth Estimation from Laparoscopic Image Pairs**

W. Li, Y. Hayashi, M. Oda, T. Kitasaka, K. Misawa, K. Mori, Nagoya Univ.; Aichi Inst. of Technology, Toyota; Aichi Cancer Center Hosp., Nagoya (JP) [ISCAS-LE-95]

**Magnetic nanoparticle detector for laparoscopic surgery: assessment of detection sensitivity**

M. Horstman - van de Loosdrecht, L. Molenaar, E. Krooshoop, B. ten Haken, J. Meijerink, L. Alic, I. Broeders, Univ. of Twente, Enschede; Radboud Univ. Medical Center, Nijmegen; Meander Medical Center, Amersfoort (NL) [ISCAS-LE-98]

**Intelligent optical diagnosis and treatment system for automated image-guided laser ablation of tumors**

Y. Li, Y. Fan, C. Hu, F. Mao, X. Zhang, H. Liao, Tsinghua Univ., Beijing (CN) [ISCAS-LE-21-00048]

**Design of a force-measuring setup for colorectal compression anastomosis and first ex-vivo results**

J. Steger, I. Patzke, M. Berlet, S. Ficht, M. Eblenkamp, P. Mela, Klinikum rechts der Isar der Technischen Univ. München; Technical Univ. of Munich (DE) [ISCAS-LE-21-00056]

Wednesday, June 23, 2021

## 16:10-17:20 Orthopedic, Neuro, and Oral & Maxillofacial Minimally Invasive Surgery Applications

**Session Chairs:** Uldis Bite, MD (US), Pierre Jannin, PhD (FR)

### Identification of implant type from total knee arthroplasty images based on machine learning

T. Yamazaki, M. Kishino, F. Itami, T. Tomita, K. Sugamoto, Saitama Institute of Technology; Osaka University, Suita (JP) [ISCAS-LE-62]

### Integrated multi-modality image-guided navigation for neurosurgery: Open-source software platform using state-of-the-art clinical hardware

J. Shapey, T. Dowrick, R. Delaunay, E. C. Mackle, S. Thompson, M. Janatka, R. Guichard, A. Georgoulas, D. Perez-Suarez, R. Bradford, S. R. Saeed, S. Ourselin, M. J. Clarkson, T. Vercauteren, King's College London; University College London; UCL Ear Institute; National Hosp. for Neurology and Neurosurgery, London (GB) [ISCAS-LE-21-00019]

### Single Image Camera Localisation for Minimally Invasive Orthopedic Surgery

A. Banach, M. Strydom, A. Jaiprakash, G. Carneiro, A. Eriksson, R. Crawford, A. McFadyen, Queensland Univ. of Technology, Brisbane; Univ. of Adelaide; Univ. of Queensland, St. Lucia (AU) [ISCAS-LE-21-00017]

### Evaluating Intra and Inter Reliability of a Web-Based Facial Analysis Tool for Rhinoplasty

O. Topsakal, M. I. Akbas, B. S. Smith, M. Perez, E. C. Guden, M. M. Celikoyar, Florida Polytechnic Univ., Lakeland, FL; Embry-Riddle Aeronautical Univ., Daytona Beach, FL (US); Istanbul Univ. Florence Nightingale Hosp. (TR) [ISCAS-LE-21-00055]

### Adapting the Listening Time for Micro-Electrode Recordings in Deep Brain Stimulation Interventions

T. Martin, G. Gilmore, C. Haegelen, P. Jannin, J. Baxter, Univ. de Rennes 1; Hopital Pontchaillou CHU Rennes (FR); Univ. of Western Ontario, London (CA) [ISCAS-LE-21-00029]

### Planning acetabular fracture reduction using a patient-specific biomechanical model: a prospective and comparative clinical study

M. Boudissa, B. Noblet, G. Bahl, H. Oliveri, M. Herteleer, J. Tonetti, M. Chabanas, Univ. Hosp. Grenoble Alpes; Univ. of Grenoble Alpes, La Tronche; Michallon Hospital, Grenoble (FR); KU Leuven (BE) [ISCAS-LE-21-00025]

---

## CARS – Computer Assisted Radiology and Surgery 35th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS)

**Chairs:** Dirk Wilhelm, MD (DE), Heinz U. Lemke, PhD (DE)

Wednesday, June 23, 2021

### 17:20-18:40 Workshop on the Hospital of the Future and the Digital Operating Room (CARS-HOF/DOR)

**Chairs:** Dirk Wilhelm, MD (DE), Heinz U. Lemke, PhD (DE)

### Task allocation using wearable devices for managing mixed human robot teams within the OR wing

L. Bernhard, D. Wilhelm, Klinikum rechts der Isar der Technischen Univ. München (DE) [CARS-HOF/DOR-LE-19]

### Effective operating room (OR) utilization by performing low-complex surgical procedures during the 2020 corona pandemic

M. Kranzfelder, T. Vogel, D. Schippers, B. Aldarweesh, I. Pergolini, M. Stollreiter, K. Wagner, D. Wilhelm, H. Friess, Klinikum rechts der Isar der Technischen Univ. München (DE) [CARS-HOF/DOR-LE-21-00018]

### The Hospital of the Future

L. Bernhard, C. Amato, L. McCanne, R. Yang, D. Ostler, O. Ratib, D. Wilhelm, Klinikum rechts der Isar der Technischen Univ. München (DE); Cannon Design, Los Angeles (US); Univ. Hospital of Geneva (CH) [CARS-HOF/DOR-LE-21-00053]

### Technology and Global Surgery: "Materials and Methods" to Achieve the United Nations Healthcare-Related Sustainable Development Goals for 2030

R. Andrews, NASA Ames Research Center, Los Gatos, CA (US) [CARS-HOF/DOR-LE-39]

### Innovation Design for Image Guided Therapies with Disruption in Mind — novel methodology for Exploration, Evaluation and Impact Generation

M. Friebe, Otto-von-Guericke-University, Magdeburg (DE) [CARS-HOF/DOR-LE-32]

### The Healthcare System of the Future

D. Wilhelm, D. Ostler, C. Amato, L. Bernhard, O. Ratib, Klinikum rechts der Isar der Technischen Univ. München (DE); CannonDesign, Los Angeles, CA (US); Univ. of Geneva (CH) [CARS-HOF/DOR-LE-59]

## **Facing COVID-19 - Development of a comprehensive Telemedical Diagnostic Framework**

J. J. Fuchtmann, R. J. Krumpolz, M. W. Berlet, D. Ostler, H. Feussner, D. Wilhelm, Klinikum rechts der Isar der Technischen Univ. München (DE) [CARS-HOF/DOR-LE-21-00063]

### **Discussion**

---

Thursday, June 24, 2021

#### **7:55 Morning Reception**

**Dirk Wilhelm, MD**

#### **8:00-9:30 CAR/CARS Poster Session**

**Session Chairs: Mario Cypko, PhD (DE), Michael Kranzfelder, MD (DE)**

##### **001 Can radiological technologists create training data for automatically segmenting the mammary gland region in non-dense breasts?**

M. Yamamuro, Y. Asai, N. Hashimoto, N. Yasuda, Y. Ozaki, S. Nin, K. Ishii, T. Yamada, M. Nemoto, Y. Kimura, H. Handa, H. Yoshida, K. Abe, M. Tada, H. Habe, T. Nagaoka, Y. Lee, Kindai Univ. Hosp., Osaka; Kyoto Prefectural Police Headquarters; Kindai Univ. Osaka; Kindai Univ., Kinokawa; Niigata Univ. (JP) [CAR-PO-23]

##### **002 Deep learning for automatic quantification of AVN of the femoral head on 3D MRI in patients eligible for joint preserving surgery: A pilot study**

A. Ruckli, F. Schmaranzer, T. Lerch, A. Boschung, S. Steppacher, J. Burger, M. Tannast, K. Siebenrock, N. Gerber, K. Gerber, Univ. of Bern; Inselspital, Bern; Kantonsspital Fribourg (CH) [CAR-PO-26]

##### **003 AI-assisted RoI extraction software tool for radiotherapy simulation**

A. Kimura, Ashikaga Institute of Technology (JP) [CAR-PO-34]

##### **004 Remote interventional support for emergency care application "mobile ultrasound"**

M. Kranzfelder, M. Gharba, T. Vogel, H. Feussner, D. Wilhelm, H. Friess, J. Eichinger, D. Ostler, Klinikum rechts der Isar der Technischen Univ. München; Huawei Technologies Duesseldorf GmbH, Munich (DE) [CAR-PO-0-46]

##### **005 Improvement of a navigation system for brain tumor surgical procedures based on intraoperative ultrasound imaging**

C. Chalopin, J. G. Cabal Aragon, D. Lindner, S. Arnold, A. Schmitgen, Univ. Leipzig; Univ. Hosp. Leipzig; Localite GmbH, Sankt Augustin (DE) [CAR-PO-21-00015]

##### **006 Automatic Facial Nerve Segmentation from CT using Deep Learning**

B. S. Jeoun, S. J. Lee, M. H. Choi, J. Y. Yoo, T. H. Yong, S. E. Choi, S. Y. Chun, S. Yang, J. Kim, W. J. Yi, Seoul National Univ. (KR) [CAR-PO-17]

##### **007 entropy guided refinement strategy for knee cartilage segmentation: data from the osteoarthritis initiative**

Z. Li, G. Zheng, Shanghai Jiaotong University (CN) [CAR-PO-97]

##### **008 Intestine segmentation combining Watershed transformation and machine learning-based distance map estimation**

H. Oda, Y. Hayashi, T. Kitasaka, Y. Tamada, A. Takimoto, A. Hinoki, H. Uchida, K. Suzuki, H. Itoh, M. Oda, K. Mori, Nagoya Univ.; Aichi Institute of Technology, Toyota (JP) [CAR-PO-4]

##### **009 Automatic shoulder bone segmentation from CT arthrograms based on deep learning**

H. Hess, M. A. Zumstein, L. Dommer, M. Schär, A. Hayoz, G. Zeng, A. Ruckli, J. Burger, N. Gerber, K. Gerber, Univ. of Bern (CH) [CAR-PO-81]

##### **010 Finite element model validation for the presurgical treatment planning of mandibular angle fractures**

M. Maintz, S. Herrmann, N. Sharma, F. M. Thieringer, Univ. of Applied Sciences and Arts Northwestern Switzerland, Muttenz; Univ. of Basel (CH); CADFEM Medical GmbH, Grafing bei München (DE) [CAR-PO-87]

##### **011 Automatic segmentation and measurement of femoral head necrosis in CT images**

J. Shen, F. Cao, P. Chen, J. Guo, H. Ge, S. Cai, X. Xiong, Guangdong Univ. of Technology, Guangzhou; 1st Affiliated Hosp. Guangzhou Univ. of Chinese Medicine; Guangzhou Hosp. of Chinese and Western Medicine (CN) [CAR-PO-74]

##### **012 A Deep Cascaded Segmentation of Obstructive Sleep Apnea Relevant Organs from Sagittal Spine MRI**

T. Ivanovska, A. Daboul, O. Kalentev, N. Hosten, R. Biffar, H. Völzke, F. Wörgötter, Georg-August-Univ., Göttingen; Universitätsmedizin Greifswald; Max-Planck-Inst., Göttingen; Ernst-Moritz-Arndt-Univ., Greifswald (DE) [CAR-PO-20-00712]

##### **013 Ultrasound Fibrosis Diagnostic System Utilizing U-Net and CORALNet**

R. Saito, N. Koizumi, Y. Nishiyama, T. Imaizumi, K. Kusahara, S. Yagasaki, N. Matsumoto, R. Masuzaki, T. Takahashi, M. Ogawa, The Univ. of Electro-Communications; Nihon Univ. Hosp., Tokyo (JP) [CAR-PO-21-00054]

##### **014 Gated convolution network for spine CT inpainting**

R. Wang, G. Zheng, Y. Zhao, Shanghai Jiao Tong University (CN) [CAR-PO-93]



**015 3D modeling in Hand Surgery – a comparison of data quality from multi sliced CT (MSCT) and cone beam CT (CBCT) using different software**

P. Honigsmann, N. Sharma, P. Brantner, F. Thieringer, M. Haefeli, Kantonsspital Baselland, Liestal; Univ. Basel; Univ. Hosp. Basel (CH); Amsterdam UMC (NL) [CAR-PO-69]

**016 Computer-aided planning of personalized biopsy of brain tumor based on multi-modality fusion**

Y. Zhao, G. Zheng, Shanghai Jiao Tong University (CN) [CARS-PO-67]

**017 Semantic segmentation for tooth type using DeepLab v3 with adversarial training**

A. Hizukuri, D. Hayashi, R. Nakayama, K. Murata, Ritsumeikan University, Shiga ; TAKARA TELESYSTEMS Corp., Osaka (JP) [CARS-PO-55]

**018 Computer-aided Diagnosis Method for Radiographic Bone Loss and Periodontitis Stage based on Deep Learning: A Multi-device Study**

S.- J. Lee, H. J. Chang, S. Yang, T. H. Yong, J. Kim, W. J. Yi, Seoul National University (KR) [CARS-PO-54]

---

**CARS – Computer Assisted Radiology and Surgery  
35th International Congress and Exhibition on Computer Assisted Radiology  
and Surgery (CARS)**

**Chairs: Dirk Wilhelm, MD (DE), Heinz U. Lemke, PhD (DE)**

*Thursday, June 24, 2021*

**14<sup>th</sup> CARS Clinical Day**

**9:30-19:30 Interactive Live Sessions**

**Chairs: Dirk Wilhelm, MD (DE), Leonard Berliner, MD (US), Hubertus Feussner, MD (DE)**

*Thursday, June 24, 2021*

**Live Transmissions from robotic surgeries**

**Hello from Research Labs@MRI**

**Featuring: Neurosurgery, Orthopaedics, Urology, Visceral Surgery, Ophthalmology**

**Partners: Brainlab, Franka Emika, Karl Storz, Stryker, Medtronic, Siemens**

8:45-9:00 **Robotics @ MRI/TUM - Surgineering in practice**

9:00-9:15 **Munich School of Robotics and Machine Intelligence**

9:15-9:30 **Robotic Partial Nephrectomy**

9:30-10:10 **Robotic Knee Replacement**

10:10-10:30 **Medical Engineering at the Klinikum rechts der Isar/The MITI Group**

10:30-11:00 **Robotic Platform for Research and Clinical Application**

11:00-11:15 **Robotic Camera Guidance/ICG/Image guided Surgery**

11:15-11:30 **3D printed Implants at the point of care**

11:30-12:00 **The Munic Eye Robot**

12:00-12:30 **Surgery 4.0 - Shaping the Future Today**

12:30-13:00 **Robotic Innovation**

13:00-14:30 **All-in-one Solution for Neurosurgery**

14:30-14:45 **Image Guided Robotic Applications**

14:45-15:00 **Chair for Medical Materials and Implants**

15:00-16:30 **DICOM WG 24 - Integrating Imaging and Workflow Data**

16:30-17:15 **Hybrid Robotic Intervention Suite**

17:15-17:30 **Medical Engineering/Robotic Nursing System**

17:30-18:00 **Applications for the Smart Hospital**

18:00-18:20 **Computer Aided Medical Procedures**

18:20-18:40 **Institute of Micro Technology and Medical Device Technology**

18:40-19:00 **German Aerospace Center**

19:00-19:30 **The Past, the Present and the Future of the Clinical Day**

Leonard Berliner, MD (US), Eric vanSonnenberg, MD (US)

*Thursday, June 24, 2021*

**15:00-16:30 IHE Surgery / DICOM WG 24 Workshop**

**Session Chairs:** Ron Schilling, PhD (US), Oliver Burgert, PhD (DE)

**Integrating Imaging and Workflow Data**

---

*Thursday, June 24, 2021*

**19:30 Social Event**

---

*Friday, June 25, 2021*

**9:00-11:00 CARS 2021 Virtual Breakfast Lounge**

**Socialise with other CARS participants informally at**

[www.tinyurl.com/cars21wonder](http://www.tinyurl.com/cars21wonder)

*Friday, June 25, 2021*

**11:00-12:30 IJCARS Forum on Scholarly Publishing and Communication**

Heinz U. Lemke, PhD (DE), Dirk Wilhelm, MD (DE)

**Panel Participants:** Mario Cypko, Sebastian Feger, Hugo Herrero, Philipp Hirsch, Petra Mela, Curt Scheid, Albrecht Schmidt, Daniel Ostler

*Friday, June 25, 2021*

**12:30 CARS Closing Remarks**

Dirk Wilhelm, MD (DE)

**13 Open ended CARS 2021 Virtual Lounge**

Continue your conversation and socialise with other CARS participants informally at

[www.tinyurl.com/cars21wonder](http://www.tinyurl.com/cars21wonder)

---



# Picture Loop-X

Mobile Imaging Robot

Scan the code to see how Loop-X can fit perfectly into your operating room.  
[brainlab.com/loop-x](https://brainlab.com/loop-x)



© 2020 Brainlab AG. IOR\_AD\_EN\_Loop-X\_Feb21\_Rev3. Loop-X is a registered trademark of Brainlab AG or an affiliated company, see [www.brainlab.com/trademarks](https://www.brainlab.com/trademarks) for details.



# 75+ years of healthcare innovation



**\$14.4**  
billion in global  
sales in 2020



**10,452**  
patents owned  
globally in 2020



**\$984**  
million spent on  
R&D in 2020



**43,000**  
employees  
worldwide  
in 2020



**40**  
straight years of  
sales growth  
leading up to 2020



**S&P**  
**500**  
included in the  
S&P 500 Index

Visit [stryker.com](https://www.stryker.com) or  
[careers.stryker.com](https://careers.stryker.com)

