CARS 2019
COMPUTER ASSISTED RADIOMETRY AND SURGERY
33rd International Congress and Exhibition

Main Themes
- Medical Imaging
- Computed Maxillofacial Imaging
- Image Processing and Visualization
- Multidisciplinary Computational Anatomy
- E-Health and IHE
- Computer Aided Diagnosis
- Computer Assisted Radiation Therapy
- Image and Model Guided Therapy
- Personalized Medicine
- Surgical Navigation
- Surgical Robotics and Instrumentation
- Surgical Simulation and Education
- Computer Assisted Orthopaedic and Spinal Surgery
- Computer Assisted Head and Neck, and ENT Surgery
- Image Guided Neurosurgery
- Minimally Invasive Cardiovascular and Thoracoabdominal Surgery
- Information Processing in Computer-Assisted Intervention
- Digital Operating Room
- Human-Machine Interface
- Pathology Informatics
- Machine Intelligence
- Integrated Patient Care
- Tumor Boards
- Innovative Clinical Investigations

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Ramin Shahidi, PhD (US)
Akinobu Shimizu, PhD (JP)
Hiroyuki Yoshida, PhD (US)

June 18–21, 2019
Rennes, France

www.cars-int.org
www.cars2019.org
### CARS 2019 Program Overview

**CARS 2019 Content**

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<td>Poster Session</td>
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<td>10th International Conference on Information Processing in Computer-Assisted Interventions (IPCAI) and 23rd Annual Conference of the International Society for Computer Aided Surgery (ISCAS)</td>
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<td>Computer Science and Artificial Intelligence</td>
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<td>Artifical Intelligence for Medical Imaging</td>
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<td>Reception</td>
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<td>18:45</td>
<td>Panel Discussion: Artificial Intelligence in the Future of Radiology and Surgery</td>
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<td>19:00</td>
<td>Poster Presentation</td>
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**Additional Sessions and Workshops**

- CAD-AI / ISCAS Joint Session on Artificial Intelligence in Computer-aided Diagnosis and Image-guided Therapy
- Workshop on Digital Image Processing (DIP)
- YIP/Young Investigators Networking Session (YINS)
- Innovations in Surgery
- Artificial Intelligence for Medical Imaging
- Image analysis (1)
- Image Analysis (2)
- Spatial Support, Prediction
- Motion & Shape Tracking and Analysis for Image-guided Therapy
- Image-guided Orthopedic Interventions
- Deep Learning for Image Processing

**Technical Sessions**

- FUT-1: Tutorial AR/VR, Perceptual Capabilities and Constraints in AR/VR for the visualization of 3D biomedical image data
- FUT-2: Tutorial Image (UI): Deep learning and computer vision for real-time procedure annotation
- FUT-3: Advanced Deep Learning for Medical Imaging Data
- FUT-4: Tutorial DL-1: Applied Deep Learning for Medical Scientists working with Image Data
- FUT-5: Hands-on Tutorial on advanced Deep Learning for Medical Imaging

**Other Sessions**

- Modeling and simulation
- Medical procedures: analysis and evaluation
- Data fusion and augmented reality
- Poster session
- Robotics and mechanisms
- Image processing and navigation
- Navigation and intervention planning

**Conference Details**

- June 18–21, 2019 | Le Couvent des Jacobins Rennes, France
POSTER SESSION INSTRUCTIONS
A poster author or coauthor is required to stand by the poster during the scheduled poster sessions to answer questions from attendees. Schedules depend on the conference track (see poster list).

Presenters who have not placed their poster(s) on their assigned board by 30 minutes prior to the session on the day of the presentation will be considered a “no show.”

CAR/CARS Poster session ……… Thursday-Friday 10:00–11:15
ISCAS Poster session ……… Monday-Friday 12:00–13:00
IPCAI Poster session ……… Monday-Friday 10:00–11:30
Poster session ……… Monday-Friday 08:30–09:30
Poster session ……… Monday-Friday 09:30–10:30
Poster session ……… Monday-Friday 10:00–11:00
Poster session ……… Friday-Sunday 08:00–09:00
Poster session ……… Sunday-Monday 08:00–09:00

Recording Policy
Conference, workshops, tutorials, and poster sessions: Presenters give right to CARS 2019 to record presentations including slides content, audio, and video and possibly to make them available on-line. A consent form will be signed when uploading the files in the speaker check-in room. Any other recording of any kind is prohibited without prior written consent of the presenter or instructor. Attendees may not capture or use materials presented in any meeting/ course room or in course notes on display without written permission.

No-Smoking Policy
Smoking, including e-cigarettes, is not permitted at any CARS 2019 event.

Updated program information are available at www.cars2019.org/schedule.

No liability can be accepted for any errors. The program is subject to alteration.

The Rennes Tourism Office is located in the conference center at the same level.

CARS 2019 is committed to providing a harassment- and discrimination-free experience for everyone at our events, an experience that embraces the richness of diversity where participants may exchange ideas, learn, network, and socialize in the company of colleagues in an environment of mutual respect.

CARS 2019 does not tolerate harassment of event participants, attendees, exhibitors, speakers, volunteers, contractors, service providers, venue staff, or CARS 2019 staff. This Code of Conduct applies to all CARS 2019 meeting-related events, including those sponsored by other organizations but hosted by CARS 2019, in public or private facilities.

Sustainability
CARS 2019 is making a special effort toward sustainability. Different actions are conducted in this direction. Food is mostly organic and coming from local producers. Food waste will be donated to associations. Electronic program is available this year and printed programs will be available only for those who would like to have a copy. We were not able to avoid printed proceedings this year. No bags, please bring your own. Tickets for public transportation are made freely available to each attendee. Please follow our efforts.

Reporting of Unethical or Inappropriate Behavior
At CARS 2019, contact any CARS Staff with concerns or questions for thorough follow-up. If you feel in immediate danger, please dial the local emergency number for police intervention (112). CARS 2019 has established a confidential reporting system for staff and all meeting participants to raise concerns about possible unethical or inappropriate behavior within our community. Complaints may be filed by sending an email at onombudsperson@cars2019.org

For updated information, please register to the CARS 2019 newsletter on the CARS 2019 website or follow us on Facebook and Twitter.

HOURS
Registration desk will be located at the entrance of the Couvent des Jacobins, Conference Center. The registration desk will be open on:

17 June, Monday .................................. 07:30–19:00
18 June, Tuesday .................................. 07:30–19:00
19 June, Wednesday .................................. 07:30–19:00
20 June, Thursday .................................. 07:30–19:00
21 June, Friday .................................. 07:30–18:00

Exhibition-Opening Hours
Exhibition-Opening Hours ............................................07:00–19:00
19 June, Wednesday .................................. 08:00–20:00
20 June, Thursday .................................. 08:00–20:00
21 June, Friday .................................. 08:00–17:00

CONFERENCE REGISTRATION
Includes admission to all conference sessions, plenaries, panels, and poster sessions, receptions, lunches, coffee breaks, 3 day free public transport.

TUTORIAL REGISTRATION
Tutorials are priced separately. Tutorial-only registration includes your selected tutorial(s), tutorial notes, and coffee breaks. Course prices include applicable taxes. Onsite, please go to the registration desk after picking up your badge.

Access
CARS booths will be available at your arrival at the Rennes airport and railway station to welcome you at your arrival.

Opening hours:
17 June, Monday .................................. 17:30–19:00

Currency & ATMs
The Euro is the official currency of France. You can pay everywhere with cash or bank card.

Rennes, the Capital of Brittany
Rennes’ history can be traced back for over two thousand years, with the Redones, a Gaelic tribe who founded their chief feasting on the confluence of the Ille and Vilaine rivers. Conquered by the Romans in 52 B.C., the area was removed from Roman dominance.

During the Roman Empire, Rennes and the remainder of the modern day region of Brittany were the last bulwark of the Roman Empire against the invading Frankish tribes led by Clovis I, the first King of the Franks, deamed by Charles de Gaulle as “the first king of what would become France.”

However, by the 5th century, the Bretons migrating from modern day Wales and Cornwall had occupied the western portion of the peninsula, giving it the name Brittany, while the Franks occupied the eastern portion. To ease tension between the two, the Breton March was created, a region between the two which included Rennes. In 651, Rennes had been absorbed into the Brittany with the remainder of the Breton March doing so over the course of the 9th century.

During the Medieval period, Brittany enjoyed a relatively large degree of autonomy as a feudal duchy, ruled by a Duke or Duchess. Often, the Duchy of Brittany found itself on opposing sides in French-English conflicts. This autonomy, however, came to an end with the “Mad War” of 1445, in which the Duchy of Brittany, allied with the Kingdom of England, waged war against France. The war ended in 1448, and one year later, Duchess Anne of Brittany was engaged to King Charles VII of France in Rennes, making the merger of the two families and the end of Brittany as an independent state.

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Rennes and Brittany continued to thrive under the rule of the French monarchs, ending with the French Revolution. During this tumultuous century, many of Rennes architectural landmarks including the Palace of Commerce, Opera and the Fine Arts Museum were constructed, with large modifications made to existing buildings such as the City Hall and Parliament of Brittany giving Rennes its imperial splendour. Although heavily bombarded by both sides during World War II, Rennes survived and in the eight decades since, has been one of the fastest growing cities in France, known for its livability, distinct culture, and technological innovation.

Our Venue – Le Couvent des Jacobins
Le Couvent des Jacobins was a Dominican convent in the centre of Rennes founded in 1369 on the patronage of John of Montfort, or John XI Duke of Brittany, situated in Place Sainte-Anne, near the heart of downtown Rennes, the location originally lay outside Rennes medieval walls. The convent quickly became part of the fabric of Rennes’ religious life, which culminated with the celebration of Duchess Anne of Brittany’s engagement to King Charles VII, uniting Brittany and France.

However, Le Couvent des Jacobins’ days were numbered as a religious institution from the French Revolution arrived in 1789 and with it, the seizure of church properties by the state. By 1793, the buildings were assigned to the French army, in whose possession they would remain for over two centuries.

In 1991, Le Couvent des Jacobins received official classification as a historic building, and in 2002, it became the property of the City of Rennes, who transformed it into the contemporary conference centre that we see today.

June 18–21, 2019 | Le Couvent des Jacobins, Rennes, France
3:20 Welcome/Openning for IPCAI 2019
Program Chairs: Raphael Schnitz, Kanako Harada, Elias Chen

8:40 Short Podium Presentation 1: Interventional Imaging
Session Chair: Heike Haehler, PhD (DE)
Toward Interoperative Use of Ambient Mass Spectrometry Imaging for Cardiac Tissue
E. Bla, D. Tomay, A. Sandh, J. Rude, M. Kaufmann, G. Bieeler, Queen’s University (CA) [SS-1-01]

9:00 Towards Localizing Diagnostic Ultrasound Using Voxel-based Learning and Adversarial Training

11:50 Implicit Domain Adaptation with Conditional Generative Adversarial Networks for Depth Prediction in Endoscopy
J. Yang, J. Knoop, D. Ahn, Z. Chen, H. Li, C. Ouyang, Imperial College London (GB) [I.6-8-32]

11:55 Estimation of Tissue Oxygen Saturation Based on Image to Image Translation
Q. Li, J. Liu, N. Chan, D. Elson, Imperial College London (GB) [I.6-6-22]

13:30 Short Podium Presentation 3: Surgical Navigation
Session Chair: Manha Khorasani, PhD (CA)
Interactive Filtering Frameworks (IFFs): Spatially-Aware Surgical Data Visualization

Pedicle Screw Navigation using Surface Registration on the Microsoft HoloLens
F. Leibetam, E. Rout, M. van Ginneken, A. Scamanina, R. Shaffer, J. Shneider, M. Freisch, P. Forsatt, Bigdata, Imperial College London (CA) [A1-2-29]

Automatic tissue classification in mechanical models: a novel approach to intraoperative integration of structured light scanning
B. van Assing, A. Jouret, R. Millet, M. Kuz, Queen’s University (CA) [A1-3-19]

A Novel Gaze-supported Multimodal Human Computer Interaction for Ultrasound Guidance
H. Zhu, S. Salamoni, R. Rohling, University of British Columbia (CA) [A1-4-23]

Deep Neural Maps for Unsupervised Visualization of High Grade Cancer in Prostate Biopsies
A. Lajtw, M. Postma, S. Aziz, A. Tom, P. Xu, J. Koo, K. Prins, P. Gerson, D. Adelberg, T. Tanaka, University of British Columbia (CA) [A1-5-59]

11:55 A Pick-Ing StereoCam Camera with Visual-Motor Aligned Control for the da Vinci Surgical System: A Preliminary Study
A. Arsham, A. El-Mashad, S. Mathur, S. Salamoni, University of British Columbia (CA) [A1-6-78]

12:00 Lunch Break and Poster Session I
La Nef Tuesday, June 18th 2019 17:30–19:00

Keynote Addresses

Fostering a Strong Ecosystem For Artificial Intelligence In Medical Imaging
Fueled by the ever-increasing amount of data generated by the healthcare system, applications for artificial intelligence in healthcare, especially within diagnostic imaging, are rapidly proliferating. Currently, no well-defined framework exists for determining how great ideas for AI algorithms in healthcare will advance from development to integrated clinical practice. Healthcare stakeholders including physicians, patients, medical societies, hospital systems, software developers, the health information technology industry and government-regulatory agencies all comprise a community that will need to function as an ecosystem system in order for AI algorithms to be deployed, monitored, and improved in widespread clinical practice. Radiologists can play an important role in promoting this AI ecosystem by delineating structured AI use cases for diagnostic imaging and standardizing data elements and workflow integration interfaces. By developing structured AI use cases based on the needs of the physician community, radiologists and radiology specialty societies can assist developers in creating the tools that will advance the practice of medicine. If these use cases specify how datasets for algorithm training, testing and validation can be developed as well as specifying parameters for clinical integration and pathways for assessing algorithm performance in clinical practice, the likelihood of bringing safe and effective algorithms to clinical practice will increase dramatically. The development of an active AI ecosystem will facilitate the development and deployment of AI tools for healthcare that will help physicians solve medicine's important problems.

Bibb Allen Jr., MD, FACP
Chief Medical Officer
American College of Radiology
Data Science Institute
Diagnostic Radiology
Grandview Medical Center
Birmingham, Alabama USA

Sir Michael Brady, FRS, FRSE, FRadic, Membre Etranger de l’Academie des Sciences
Emeritus Professor of Oncological Imaging, University of Oxford, GB
Founder Chairman: Perspective Diagnostics, ScreenPoint Medical
Founder Director: Mirada Medical, Vapara Health Technologies, Chairman: Optellum

Quantitative and Intelligent Imaging for Clinical Decision Support
A number of important developments in CARS will be discussed primarily by reference to innovations in some of the medical imaging analysis companies of which I am a Founder. First, image analysis can be quantified, each pixel measuring a physical quantity. We first illustrate this by quantitative MRI of the liver, measuring proton density fat fraction, iron content, and fibrosis (units of time). This is applied to iron-loading fatty liver disease, steatosis-patients (NASH), and therapeutic interventions, both measuring the anti-NASH drugs and supporting liver surgery. Then, we show how breast density may be measured and applied to estimate v-ray dose in mammography. Second, image analysis can be intelligent based on methods developed in AI and Machine Learning. We illustrate this both in MRI analysis of the liver and in a decision support system for mammography. We show how the combination of all radiologists working with Trampara decision support software can out perform either working individually. Finally, we discuss some of the strengths and limitations of machine learning applied to medical imaging.

La Nef Wednesday, June 19th 2019 17:30–20:00

Keynote Lectures:
Fostering a Strong Ecosystem For Artificial Intelligence In Medical Imaging
Bibb Allen Jr., MD, FACP
Chief Medical Officer, American College of Radiology, Data Science Institute, Diagnostic Radiology, Grandview Medical Center, Birmingham, Alabama USA

Quantitative and Intelligent Imaging for Clinical Decision Support
Sir Michael Brady, FRS, FRSE, FRadic, Membre Etranger de l’Academie des Sciences
Emeritus Professor of Oncological Imaging, University of Oxford, GB
Founder Chairman: Perspective Diagnostics, ScreenPoint Medical
Founder Director: Mirada Medical, Vapara Health Technologies, Chairman: Optellum

Room La Nef

8:30 Artificial Intelligence for Medical Imaging
Session Chairs: Leonard Berliner, MD (US), Eric vanSonnenberg, MD (US), Hubertus Feusner, MD (DE), Pierre Janin, PhD (FR)

10:30 Artificial Intelligence for Imaging for Surgery and Radiology
Session Chairs: Krishan Kanodia, MD (US), Giuseppe Esposito, MD (US)

13:30 Innovations in Surgery
Session Chairs: Hubertus Feusner, MD (DE), Leonard Berlinger, MD (US)

10:30 Artificial Intelligence in Nuclear Medicine
Invited Speaker: Bibb Allen, Jr., MD, ACR’s Data Science Institute (USA)

11:00 Artificial Intelligence in nuclear medicine
Invited Speaker: Giuseppe Esposito, MD, George-town Univ. Medical Center, Washington, DC (US)

11:15 Detection and grading of sarcoids in computed tomography as an accidental finding using deep learning
Invited Speaker: Leo-Jonkwo Joko, PhD, The Hebrew University of Jerusalem (IL)

11:30 Early interation of Lung Cancer through Artificial Intelligence
Invited Speaker: Michael Brady, PhD, University of Oxford (GB)

11:45 Assessment of surgical skills by using surgical navigation in robot-assisted partial nephrectomy

10:00 Coffee Break

10:30 Artificial Intelligence in Imaging for Surgery and Radiology
Session Chairs: Krishan Kanodia, MD (US), Giuseppe Esposito, MD (US)

10:30 Screening cancer patients: Artificial intelligence in radiology: A Path for the Democratization of AI in Radiological Practice
Keynote Speaker: Bibb Allen, Jr., MD, ACR’s Data Science Institute (USA)

11:00 Artificial intelligence in nuclear medicine
Invited Speaker: Giuseppe Esposito, MD, Georgewon Univ. Medical Center, Washington, DC (US)

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15:00 Intra-arterial CT imaging during liver ablation treatment as an adjunct for accurate targeting and therapy monitoring – a feasibility study
G. Christoupoulou, E. Lin, R. Arzoumanian, C. Okere, Siemens Medical Solutions USA Inc., Hoffmann Estates, IL, The Univ. of Texas MD Anderson Cancer Center, Houston, TX (US) [230]

15:15 A platform for irreversible electroporation treatment planning
E. Penna-Bel, A. Acierno, M. A. Gonzalez-Balerdi, Univ. Pompeu Fabra, Barcelona (ES) [604]

15:30 Coffee Break

16:00 Panel Discussion: Artificial Intelligence in the Future of Radiology and Surgery
Chairs: Leonard Berlinger, MD (US), Eric vanSonnenberg, MD (US), Hubertus Feusner, MD (DE)

Introduction to Panel Discussion
Leonard Berlinger, MD, New York-Brooklyn-Brooklyn Methodist Methodist Hosp., Weill Cornell Medical College, Brooklyn, NY (US)

Participants: Ambassador Stephanie, PhD (US), Kristina Kanodia, MD, PhD (US), Maxsun Itu, MD (JP), Giuseppe Esposito, MD (US), Leo-Jonkwo, PhD (IL), Michel Brady, PhD (GB), Bibb Allen, Jr., MD (US), Pierre Janin, PhD (FR), Dirk Wilhelm, MD (DE), Richard Satava, MD (US)

17:00 End of Session

18:00 CARS 2019 Exhibition Opening Ceremony
CARS Computer Assisted Radiology and Surgery

Wednesday, June 19, 2019  8:00 – 12:30

**Salle du Choëur**

8:00 21st IFCARS / SPIE / ISCAS Joint Workshop on the Digital Operating Room (DOR)

**Chairs:** Yoshinori Murakap, MD (JP), Pierre Janin, PhD (FR), Helmut Lemke, PhD (DE)

Smart Cyber Operating Theater (SCOT) realized through Internet of Things (IoT)

**Invited Speaker:** Yoshinori Murakap, MD, PhD, Tokyo Women’s Medical University (JP)

**ORNET and beyond: AI and machine learning in the OR of the future**

**Invited Speaker:** Thomas Neumuth, PhD, ESGA Institute (IC)

The BiomecProxie-Project: democratizing Artificial Intelligence for the collaborative OR

**Invited Speaker:** Olaf Schmar, MD, M. Hendriks, H. Heesink, Klinikum rechts der Tuur of Technical Univ. of Munich (DE) [181]

**GATOR:** Connecting Integrated Operating Room Solutions Based on the IEEE 11073 SOC and ORN Standards

**Chair:** J. Neumann, S. Franke, M. Rockstroh, M. Kasparick, T. Neumuth, Unv. of Leipzig; Tokyo Women’s Medical Univ.; Univ. of Aichi (JP) [19-00049]

Extending BFMN 2.0 for Intraoperative Workflow Modeling with IEEE 11073 SOC for Description and Orchestration of Interoperable, Networked Medical Devices

**Chair:** J. Neumann, S. Franke, M. Rockstroh, M. Kasparick, T. Neumuth, Unv. of Leipzig; Univ. of Aichi (JP) [19-00049]

Assisted Annotation of Surgical Videos Using Deep Learning

**Chair:** G. Lecoeur, M. Rappl, M. Nolte, G. Laugw, P. Jannin, AT-Ecocod, Cesson-Sevigné, Unv. of Rennes 1 (FR) [19-00052]

Software assisted warning systems for endoscopic surgery – A Deep Learning based approach

**Chair:** G. Praz, S. Crist, G. Syrak, OOFIT/FRM, Grupo, Leipzig (DE) [84]

Glaucoma surgery in Standard Smart Cyber Operating Theater (SCOT): initial experience of 5 cases

**Chair:** M. Giebel, T. Götz, J. Oester, M. Moraj, H. Kopp, Shibaura Univ. School of Medicine, Matsubara, Tokyo Women’s Medical University (JP) [62]

10:00 Coffee Break

10:15 4th ISCAS / CAD-AI / IFCARS Joint Symposium on Multidisciplinary Computational Anatomy (MCA)

**Chairs:** Makoto Hashizume, MD (JP), Hirunori Yoshida, PhD (US)

**Results of the national Japanese project on multi-disciplinary computational anatomy**

**Invited Speaker:** Kazutoshi Mitani, PhD, National Institute of Advanced Industrial Science and Technology (AIST), Japan

**Nasal airflow simulation with LVQ validated LB code calculated from CBCT data sets to identify surgically relevant landmarks**

**Invited Speaker:** M. Berger, S. Streck, M. Mili, A. Michle, W. Schatz, D. Dinaj, F. Kral, M. Kramer, W. Freysinger, Magenget Center Innsbruck; Medical Univ. of Innsbruck; Kardinal Schwaben Hosp., Schwaz; O. Pinaja (AT) [85]

**Statistical intensity model of lung vessels in a CT volume using B-VAR**

**Invited Speaker:** Tom Aerts, S. Jumu, L. Van, P. Van, A. Senft, A. Center, University of Tokyo and Agriculture Technology, Kagane, Tokyohwa Univ. (JP) [76]

**Multiple Aneurysms AnXony Challenges 2019 (MATCH) – Phase II: Rupture Risk Assessment**

**Chair:** T. Suwa, A. Shibata, J. Uchiyama, S. Hata, University of Tokyo and Agriculture Technology, Kagane, Tokyo University (JP) [76]

**Flow-Splitting-Based Computation of Outlet Boundary Conditions for Improved Cervical Arterial Simulation in Multiple Intracranial Aneurysms**

**Chair:** S. Sasafuki, S. Ok, T. Uchiyama, B. Yoon, P. Bang, Univ.-On-Guernika Urukde Magaler (MAD) [19-00042]

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**Salle du Choëur**

11:30 2nd Workshop on Digital Space Medicine (DSM)

**Chairs:** Mario A. Dyke, PhD (NL), Krishna Kanopa, MD (IN)

**Medical care and hospitalization in extreme environments like Antarctica or space**

**Invited Speaker:** Paul Laurent, Service medical TAAF / IPH (French national space agency, France)

**Space Missions Simulation Facilities and Opportunities – Developing ideas and technologies**

**Invited Speaker:** Agata Kudlicki, Agzik-Astronaut Training Center (POL)

**Examples of Technology transfer – how to get involved**

**Invited Speaker:** Arvand Pooje, ESTEC, European Space Agency (UK)

**Human Space Flight and Space Medicine – Exploration: Change of Paradigms**

**Invited Speaker:** Uwe Budde, ESA, European Space Agency (DE)

12:30 Lunch Break

13:30 Special Focus Session: ERC: Europe got talents

**Chair:** Nassir Navab, PhD (DE)

**Geometric Statistics for Computational Anatomy**

**Invited Speaker:** Yasir Rehman, INRIA, Sophia-Antipolis (FR)

**Optical thermoseismic: image-guided cancer thermal therapy using light**

**Invited Speaker:** Dan Eben, Imperial College London (GB)

**QuantISPR: Making Sense in Surgery using Near-Infrared Optical Imaging**

**Invited Speaker:** Sylvain Guesa, Université de Strasbourg (FR)

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**Salle du Choëur**

14:45 CMI Poster Session

**Session Chairs:** Christos Angelopoulos, DDS, PhD (US), Yoshitaka Hayakawa, PhD (JP)

Poster # 099 – 107

15:30 Coffee Break

16:00 Surgical Navigation

**Session Chairs:** Jörn Hotz, Katsumi, DDS, PhD (JP), Noreen Morgan (UK)

Future of Digital and Medical Navigation

**Invited Speaker:** Yoshitaka Hayakawa, PhD, Kitami Institute of Technology, Hokkaido (JP)

Development of an application to evaluate the maxilla positioning after computer assisted orthognathic surgery

**Invited Speaker:** Y. Sun, X. Hu, Y. Du, V. Barnoya, C. Politis, Univ. Hosp. Louven, KU Leuven (BE) [75]

Automated intralial radiographic projection classification using convolutional neural network

**Invited Speaker:** V. Ruyssen, C. Polleux, ETH Zurich, Switzerland (CH) [141]

Intraoperative navigation in orbit reconstruction

**Invited Speaker:** A. Baumann, Medizin. Univ. of Vienna (AT) [362]

Accuracy of Low Dose Imaging Protocols of CBCT in Assessment of Peri-implant Bone Deficits

**Invited Speaker:** N. Almog, W. Abudarfe, F. Aboulfadi, M. Ashmawy, Mansoura Univ.; Am Shams Univ., Cairo (EG) [172]

A dynamic tracking control of the robotically assisted dental implant surgical system

**Invited Speaker:** C. Oka, Z. Chen, Z. Lai, H. Chang, Zhejiang Univ. (CN) [216]

17:45 End of Session

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18:00 2019 CARS Exhibition Opening Ceremony

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**CARS 2019 – 33rd International Congress and Exhibition**

June 18–21, 2019 | Le Couvent des Jacobins Rennes, France

**International Foundation for Computer Assisted Radiology and Surgery – IFCARS**

www.ifcars.org

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Important aspects of these dramatically evolving methodologies and tools are:

1. **Modeling of human organ systems, pathologies and clinical processes** from scientific-based evidence; medical guidelines and data mining

2. **Analysis and abstraction of models** from data and information gathered from specific patients to generate knowledge models of patient-specific situations and appropriate treatment protocols

3. **Improved accuracy of diagnostic and optimal therapy through simulation** as well as knowledge and decision management

4. **Higher quality of therapy** by means of real-time integration of information in patient-specific models and therapeutic processes

5. **Validation processes of clinical decisions on patient-specific and innovation levels as well as appropriate representations in prioritizations**

**Patients** and the health care system are the beneficiaries of this development through improved quality of health care at a socially acceptable cost. IFCARS with its associated CARS congress and journals are key actors in this translational process.

The Foundation aims at supporting all measures promoting this development, in particular, the communication and circulation of information in the field of computer assisted medicine and the study of its medical, social and ethical effects on our society.

The purpose of the Foundation is particularly realized in:

- **Events of all kinds, e.g. conference, seminars, think tank focus discussions, training and further education as well as the preparation of appropriate publications**

- **Support of interdisciplinary and international activities relating to the research and development of innovative public health concepts, particularly through system development and efficient implementation and evaluation.**

- **Promotion of national and international cooperation in science and medicine, particularly in research, development and educational activities**

Key parts of the CARS congresses which address advanced methods and tools for a patient specific medicine have been initiated by IFCARS. Their inclusion in the International Journal of CARS is also promoted by IFCARS. In order to ascertain a scientific-based foundation for a modern medicine and specifically for computer assisted radiology and surgery, IFCARS is actively pursuing research and developing projects with other institutions with similar aims.

In order to accelerate the transfer of research results of CARS into clinical practice, IFCARS is also taking a leading role as an enabler of ICT supported clinical trials and studies.

Finally, to increase awareness and the application of these new possibilities of a computer assisted medicine in a ecologically responsible way, IFCARS will establish a membership and award system to promote this historic transition of medicine.
11:15 CAD-AI / ISCAS Joint Session on Artificial Intelligence in Computer-aided Diagnosis and Image-guided Therapy
Invited Speaker: Hiroyuki Yoshida, PhD, Tsinghua University, Beijing (CN)

Tuesday June 18, 2019  8:00 – 12:30
Poster Session

Thursday June 20, 2019  8:00 – 12:30
Posters & Free guided tour of the historical city of Rennes Thursday June 22nd 19:15-20:45

Explore Rennes, the capital of Brittany, from a new perspective with this guided tour of the city, spanning centuries of history. Discover Rennes’ medieval character with its colourful half-timbered houses and imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaises. Watch it give way to the imposing defensive gates, the Portes Mordelaise...
Room La Ref

13:30 Mixed reality for Surgical Simulation, Training and Education
Session Chairs: Carla Pugh, MD, PhD (US), Roy Eagleson, PhD (CA)

Source-detector trajectory optimization for 4-D CBCT

A comparison of conventional and deep learning methods of image segmentation on aortic dissection

Liver Tissue Segmentation In Multiphase CT Scans using 3D Convolutional Neural Networks
P. Durisch, V. Nakhal, V. Nobel, F. Holtz, P. Posavec, Nouvel Hospital Civil, Strasbourg, France [19-00099]

Training and Education
13:30 Mixed reality for Surgical Simulation, Training and Education
Session Chairs: Carla Pugh, MD, PhD (US), Roy Eagleson, PhD (CA)

14:35 ISCAS General Assembly
15:30 Coffee Break

16:00 Computational Methods for Image-guided Therapy
Session Chairs: Parni Moussavi, MD, PhD (CA), Simon Crow, MD (CA)

MultiAtlas Neonatal Brain MRI Segmentation via Patch-based Deep Approaches
Inverted Speaker: François Rousséaux, PhD, LatMIF11011 INSERM, Brest [FRE]

A comparison of conventional and deep learning methods of image segmentation on aortic dissection

Segmentation-based registration of ultrasound volumes

Liver Tissue Segmentation In Multiphase CT Scans using 3D Convolutional Neural Networks
P. Durisch, V. Nakhal, V. Nobel, F. Holtz, P. Posavec, Nouvel Hospital Civil, Strasbourg, France [19-00099]

Tissue classification of esophagus resected tissue based on hyperspectral data
I. Cetin, S. E. Petersen, O. Camara, M. A. Gonzalez Ballester, K. Lekadir, Univ. Pompeu Fabra, Barcelona, Spain [19-00104]

Identification of abnormalities in the cardiac估值用の深層学習における組織学的なアプローチ
C. Van, S. E. Petersen, D. Ma, G. Gonzalez Ballester, K. Lekadir, Univ. Pompeu Fabra, Barcelona, Spain [19-00104]

Segmentation-based registration of ultrasound volumes

A radiomics approach for differentiation of pseudocavitation from cavitation on lung cancer tumors
M. Pozzi-Maseri, R. J. Ferreira, M. Konigsson-Santos, Y. Kikuchi, M. Falcao, F. E. Garcia Cipriano, A. Todorovic Fabro, H. Yoshida, Univ. of São Paulo, São Carlos, Brazil [BR] [19-00106]

MultiAtlas Neonatal Brain MRI Segmentation via Patch-based Deep Approaches
Inverted Speaker: François Rousséaux, PhD, LatMIF11011 INSERM, Brest [FRE]

Segmentation-based registration of ultrasound volumes

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Room La Nef

8:15 Image-guided Neuro-interventions and Applications
Session Chairs: Sandrine de Ribaupierre, MD (CA), Thomas Lange, PhD (ND)
Endoscopic endonasal approach in Smart Cyber Operation Theater (SCOT): preliminary application
T. Gavrilova, A. Nagai, T. Itoh, T. Fujii, T. Nakamura, H. Kongo, J. Okamoto, Y. Muraoka, Shinohata School of Medicine, Matsushima Campus: Tokai University School of Medical Dentistry (JP) [64]

Structural Lighted Spine for Morphometric Analysis in Craniosynostosis Reconstruction Surgery

Projection-mapping navigation with image deformation tracking for brain surgeries
T. Falgout, T. Yoshida, J. Itoh, J. Kitao, Tokyo Medical and Dental University, The Univ. of Tokyo (JP) [274]
The development of non-contact user interface of a surgical navigation system based on Kinect depth camera and a phantom experiment for zygomatic implantation
G. Kim, C. Chen, X. Ren, Y. Xie, Wang, Shenzhen Jia Tong Univ., Jiahong Univ. (CHN) [003-047]

Road to Recherche

8:40 CAR / CAD-AI Joint Session on Deep Learning and GAN in Medical Imaging
Session Chairs: Hiroki Yoshida, PhD (JP), Pierre Jannin, PhD (FR)
The Challenge for All in Medical Imaging in China
T. Liu, Y. Zhang, MD, PhD, The First Hospital of Jinan, Jinan, China (CN) [19-00008]
Recent progress in Medical Image Processing and Deep Learning Invited Speaker: D. Louis Collins, PhD, McGill University, Montreal, Québec (CA)

Enhancing bronchovascular tree with intra-operative data using multiple-variant GANs
O. A. Elkassem, C. Sánchez, A. Bomma, Autonomous University of Barcelona (ES) (SO)
Supervised Deep Generative Adversarial Networks for Deformable Image Registration
Z. M. Ojo, A. Jinuah, UCL (UK) [152]
CyclicGAN for style transfer in x-ray angiography
O. Tsering, M. Martin, L. Dong, École de technologie supérieure, Montreál, QC (CA) [003-02100]
Generative adversarial learning-based electronic screening system for CT colostography
K. Tashima, J. Nappi, H. Iwamori, H. Yotsuyanagi, National Institute of Technology, Otsuka (JP), Massachusetts General Hospital, Boston, MA (US) [129]
Generative adversarial learning-based prediction of survival of patients with intestinal cancer
J. T. D. Duarte, C. Watier, J. Nappi, H. Iwamori, H. Yotsuyanagi, Massachusetts General Hospital / Harvard Medical School, Boston, MA (US) [19-00007]
10:00 Coffee Break and Poster Session

10:30 ISCAS Poster session 2
Session Chairs: Kusano Mori, PhD (JP), Cristian A. Linte, PhD (US)
Poster # 061 – 83
11:15 Workflow Analysis and Modeling for Image-guided Therapy
Session Chairs: Cristian A. Linte, PhD (US), Caroline Essert, PhD (FR)
Predicting the quality of surgical exposure using spatial and procedural features from laparoscopic interventions
A. Della, C. Roh, S. Min, Y. Park, A. Han, Ulsan University Hospital, Ulsan Medical Center (KOR) [142]
Spatially augmented reality system with real-time methods for soft tissue deformation compensation
S. Yang, H. Kim, T. Kim, Taejon University of Science and Technology (KOR) [142]
Introducing a novel deep learning framework for multi-modality surgical image registration
A. Elkassem, S. Zhang, M. S. T. Tuncali, U. of Texas (US) [19-00007]
Recognizing surgical actions of Robot-Assisted Partial Nephrectomy
Y. Ishihara, Y. Nakamura, H. Nakamura, Kindai Univ., Kinki Univ., Kansai Medical (JP) [14]
Automatic annotation of surgical activities using virtual-reality environments
A. Han, A. N. N. Pradip, S. Y. Hong, Hongik University, Korea (KOR) [19-00007]

11:30 Visualization and Augmented Reality
Session Chairs: Marc Kertesz, MD, PhD, ULB, UCL, UZ Leuven (BE), Cristian A. Linte, PhD (US)
Combining Position-Based and Dynamic Gradient Vector Flow for Mitral Valve Surgery
L. Tardia, I. Zissel, J. Geiger, S. Sundgren, V. Falk, A. Heimann, Fraunhofer MEVIS, Bremen, Chirurgische Universitätskrankenhaus zu Hannover (DE) (SO)
Surface deformation analysis of deaerated lungs using model-based shape matching
M. Nasak, T. Takuma, T. Chen-Yoshikawa, H. Date, Tatsuya, Kyusyu Univ., Kyushu University, Higashiku, Fukuoka (JP) [114]
A novel method for reducing large motion artifacts of DSA based on deep learning
M. Tachibana, J. J. Näppi, T. Hironaka, H. Yoshida, National Inst. of Technology, Oshima (JP), Keio University Hospital, Fukuoka (JP) [114]
A new method for reducing large motion artifacts of DSA based on deep learning
M. Tachibana, J. J. Näppi, T. Hironaka, H. Yoshida, National Inst. of Technology, Oshima (JP), Keio University Hospital, Fukuoka (JP) [114]

12:00 Lunch Break

13:00 Interventional Robotics for Orthopedics
Session Chairs: Kevin Cheung, PhD (US), Tamots Umi, PhD (CA)
New horizons in orthopedic surgery: Past, present and future perspectives Invited Speaker: Pedro Alvarez Diaz, MD, PhD, International University of Catalonia, Barcelona (ES)
PostBody: robotically-assisted ankle rehabilitation system for home use for children with cerebral palsy
Early Experience with Force-Space Navigated Robots for Glenoid Implantation during Total Shoulder Arthroplasty
C. Smith, U. of Florida, Florida, St. Joseph’s Health Care, London (CA) [003-117]
A comparative analysis of intensive 3D-2D registration for intraoperative use in pedicle screw insertion surgery
H. Estafanias, C. Anglès, P. Day, J. A. Hodgkin, Univ. of Bristol, University of Cambridge, VA, BC, EU of Clinical, Beja (CA) [003-007]

13:40 Image-guided Orthopedic Interventions
Session Chairs: Amber Simpson, PhD (US), Pedro Alvarez Diaz, MD, PhD (CA)
3D reconstruction of the knee bone surface using markertless 3D ultrasound
M. Nakao, Y. Kowakawa, G. Chastain, E. Chastain, S. Krull, B. Matt, Univ. of British Columbia, Vancouver, BC, EU of Clinical, Beja (CA) [003-007]

16:00 Motion & Shape Tracking and Analysis for Image-guided Therapy
Session Chairs: Erik C.S. Chen, PhD (CA), Gabor Fichtinger, PhD (CA)
Combining Position-Based and Dynamic Gradient Vector Flow for Mitral Valve Surgery
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15:30 Coffee Break

16:00 Decision Support, Prediction
Session Chairs: Amber Simpson, PhD (US), Eric Beckmon, BS (US)
Ultrasound imaging and Supervoxel ultrasound for Medicine Invited Speaker: Michel Tournier, PhD, INERIM/ESPC Paris (FR)
Position-based modeling of lesion displacement in Ultrasound guided breast biopsies
E. Tagliaferri, D. Dillaba, M. Fagnoni, C. Teng, F. Florin, Un. of Verona (IT) [003-007]
Can one predict brain disease based on cardiac imaging data? A proof-of-concept study
M. S. Almeida, J. A. Costa, E. Braga, L. E. Prates, L. M. C. B. Lopes, Universidade Federal Fluminense (BR) [003-007]
Validation of the larynx cancer model regarding treatment decision
M. Ulbudun, A. Hiko, A. Guler, M. Acar, I. U. Kemen, A. Dietz, Universitetsklinikum Leipzig (DE) [003-007]
 Morphology-based estimation of disease duration in multiple sclerosis patients using 21-weighted MRI datasets
N. Studholme, A. Raichesh D.L.A, L. Traboulsee, P. Florin, Univ. of Calgary, AL, Univ. of British Columbia, Vancouver, BC, CA (CA) [003-007]
Gimpanzeo: Learning environmental approaches for cerebrovascular aneurysm assessment
F. A. Cardoso, D. Lücke, F. F. M. Stalnacke, H. Schrader, P. Brijn, G. von Voigtl, J. C. Rebol, George Mason Unv., Fairfax, VA (US), Leiden Univ. (NL) [003-007]
17:30 CARS Closing Ceremony
Chair: Pierre Jannin, PhD (FR), Kusano Mori, PhD (JP), Hînuyô Yoshida, PhD (US), Holzlet U. Leme, (US)
18:00 CARS 2019 Farewell Party
Poster Session | Poster Presentation Times

**Poster Presentation Times**

3:30 pm – 5:00 pm: Poster session following the scheduled poster sessions to answer questions from attendees.

**Poster Presentation Authors**

Authors will present each of their poster presentations for an hour in the poster display area.

**Poster Presentation Attendants**

Attendees will be able to visit the poster display area during the scheduled poster sessions.

**Poster Presentation Evaluations**

Attendees will be able to evaluate the poster presentations.

**Poster Presentation Awards**

An award will be given to the best poster presentation.
2074 A targeting system for distal locking of intramedullary nails based on electromagnetic navigation
X. Chen, T. Gao, W. Qian, Sun. Shanghia Jiao Tong Univ. (CN) [119 (10)]
2075 Zea stripe and zebra mapping assessment for bariatric surgery
Y. Tawiluchi, M. Hata, H. Hyoki, H. Tada, M. Kato, Y. Hori, Toyota Technological Institute, Nagoya University, Nagokura (JP) [168 (34)]
061 Acoustic emission integration for ultrasonic guidance: a feasibility study for needle based clinical procedures
062 Band markers for three-dimensional pose tracking of catheters using single-view fluoroscopy
D. Lee, Korea Inst. of Science and Technology (KR) [215]
063 Evaluation of an augmented reality guidance system for laparoscopic liver ablations
K. Canga, R. Sheller, K. Liu, W. Fother, S. L. Wan, Children’s National Medical Center, Washington, DC, USA Technologies Inc., College Park, MD (US) [115 (56)]
064 Workflow assessment as a preclinical development test: surgical process models of three-tech
iques for minimally invasive cochlear implantation
S. Miller, L. A. Kats, J. Gai, S. Taschuer, M. Klage, S. John, T. Rui, T. Leaner, T. Odstrait, N. Maguire, Lubbock, UT. Hannover Medical School (DE) [19-00302]
065 Femur fracture classification from X-ray images with few-shot learning: A preliminary study
C. Cao, J. Yang, Y. Kim, Y. S. Kim, Hansung Univ., CT Information Technology Research Center, Seoul (KR) [111]
066 Proposal for self-evolving CAD system that uses DBN
K. Abe, H. Yoko, N. Sawai, Kanagawa Inst. of Technology, National Cancer Center Hosp. East, China International Univ. of Health and Welfare, Tokyo (JP) [35]
067 Quantification of the diagnosis of depression through application of image recognition technology
071 Intelligent assistance in minimally-invasive surgery
J. Torrents-Barrena, R. López-Velazco, G. Piella, Leibniz Univ. Hannover; Hannover Medical School (DE) [194]
077 Three-dimensional laparoscopic vision improves forceps motion more in the depth direction than in the horizontal direction.
080 Intrinsically introducing surgical landscape guidance for intelligent minimally invasive surgery
J. C. Noufranet, R. Block, T. Wittenberg, P. Elsner, T. Neumann, Fraunhofer Institute for Telecommunications, Berlin; Innovation Center Computer Assisted Surgery, Lippstadt; Frankfurt Institute for Integrated Circuits Ei, Erlangen (DE) [119 (1)]
073 Clinical Usability Testing of TTTS Fetal Surgery
Kyushu Univ., Fukuoka; Kagoshima Univ. (JP) [194]
078 New objective skill assessment system for the laparoscopic cholecystectomy model and evaluation of validity
M. Usuku, M. Tomiyama, M. Hashimoto, H. Ito, M. Iho, Kyushu Univ., Fukuoka; Kagoshima Univ. (JP) [104]
075 Clinical Usability Testing of TTTS Fetal Surgery Planning and Simulation Framework
J. Tomore Barretto, R. López-Velazco, G. Fieda, R. Masquerier, B. Vakounina, A. Grachev, E. Elsour, M. Corea, M. A. González-Balseiro, Univ. Pompeu Fabra, Barcelona; Univ. of Barcelona (ES) [119]
089 Automated differential diagnosis of benign and malignant breast lesions on the mammograms
A. Kosche, E. Gusmeister, D. Papek, I. Klossnik, O. Papkevsky, Mari State Univ., Oncology Clinic of Mari El Republic; Kazan Federal University, Yonkeol; Ob; Kazan State Medical University (RU) [115 (66)]
086 Evaluation of an augmented reality guidance system for laparoscopic surgical interventions
K. Claraz, R. Sheller, K. Liu, W. Fother, S. L. Wan, Children’s National Medical Center, Washington, DC, USA Technologies Inc., College Park, MD (US) [115 (56)]
087 Heterogeneity of longitudinal brain imaging pheno-
types in Alzheimer’s disease based on unsuper-
vised clustering of brain marker profiles
P. Martii, J. O. Salmri, P. Paali, Univ. Pompeu Fabra, Barcelona (ES); German Center for Neurodegenerative Diseases, Bonn (DE) [116 (70)]
088 Subtype classification of trio negative breast cancers by using dynamic feature and miRNA
W. Nida, T. Urushima, Kumamoto Univ. (JP) [117]
089 Automated differential diagnosis of benign and malignant breast lesions on the mammograms
A. Kosche, E. Gusmeister, D. Papek, I. Klossnik, O. Papkevsky, Mari State Univ., Oncology Clinic of Mari El Republic; Kazan Federal University, Yonkeol; Ob; Kazan State Medical University (RU) [115 (66)]
090 Improved classification of pulmonary nodules in CT images using multiple deep convolutional generative adversarial networks
Y. Onishi, A. Teramoto, M. Toyofuku, T. Tsukamoto, K. Saito, H. Toyama, K. Imaizumi, H. Fujita, Fujita Health Univ., School of Medicine, Toyko, Gifu Univ. (JP) [137]
091 Towards automatic lesion classification in the upper aerodigestive tract using 3D and deep transfer learning methods
M. Schaller, N. Gerstl, S. Labas, V. Vögler, C. Bietz, A. Schäfer, Hamburg Univ. of Technology, Ludwigs- Maximilians-Univ. München, Univ. Medical Center Hamburg-Eppendorf (DE) [35]
092 Detection of lung nodules and supraopharyngeal head and neck lesions in high-resolution CT scans
K. Kapoor, M. Kharma, George Washington Univ., Washington, DC (US) [206]
093 Discrimination of the invasive of lung adenocarci-
noma in computed tomography image using homology method
K. Rabaw, S. Tomerini, H. Nunami, M. Kizuki, H. Yamamoto, O. Honda, M. Yamanaka, N. Tomiyama, Osaka Univ. (US) [81]
094 Deep generative model-based unsupervised detection of inappropriate images in a chest X-ray dataset
T. Nakao, S. Hanaka, Y. Nireuma, M. Miura, T. Takakaga, S. Toy, T. Watanabe, T. Yoshinaka, N. Yoshikawa, O. Abe, The Univ. of Tokyo Graduate School of Medical; The Univ. of Tokyo (JP) [80]
095 Improvement of classification performance of pulmonary nodules in CT images using multiple deep convolutional generative adversarial networks
Y. Onishi, A. Teramoto, M. Toyofuku, T. Tsukamoto, K. Saito, H. Toyama, K. Imaizumi, H. Fujita, Fujita Health Univ., School of Medicine, Toyko, Gifu Univ. (JP) [137]
096 Computer aided diagnosis of cirrhosis and hepa-
tocellular carcinoma using multi-phase abdomen CT of Tokyo Hosp. (JP) [92]
097 Improved method of an automated detection of gastric cancer using CNN and feature based false positive reduction
K. Enomoto, A. Teramoto, T. Shibata, K. Saito, H. Toyama, K. Ichimori, H. Fujita, Fujita Health Univ., School of Medicine, Toyko, Gifu Univ. (JP) [137]
098 Automated malignancy analysis of microscopic lung images using a deep convolutional neural net-
work and generative adversarial networks
A. Teramoto, A. Yamada, Y. Kiriyama, T. Tsukamoto, K. Saito, H. Toyama, K. Ichimori, H. Fujita, Fujita Health Univ., School of Medicine, Toyko, Gifu Univ. (JP) [137]
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103 Clinical accuracy of computer guided osteotomes in titanium screws drilling in mandible fractures
H. Abu Elwafa, W. Abouseiba, M. Abd Elhamid, M. Isaac, K. ElMallhy, Manouwa Univ., Delhi Univ for Science and Technology, Gamasia, Ministry of Health and Population, Manouwa (EG) [115 (54)]
104 Automatic Three-Dimensional Cephalometric Anotation System Using Three-Dimensional Consul-
tional Neural Networks
105 Clinical accuracy of computer guided osteotomes in titanium screws drilling in mandible fractures
H. Abu Elwafa, W. Abouseiba, M. Abd Elhamid, M. Isaac, K. ElMallhy, Manouwa Univ., Delhi Univ for Science and Technology, Gamasia, Ministry of Health and Population, Manouwa (EG) [115 (54)]
106 Non-invasive computer-assisted dental implant surgery based on optical tracking and 3D printing
TUT1: Tutorial AR/VR: Perceptual Capacities and Constraints in AR/VR for the visualization of 3D biomedical image data
June 18, 8:30–12:30
Roy Eagleston, PhD; Georges Hattab, PhD

The use of AR and VR modalities for visualization of 3D biomedical image data is feasible thanks to a growing number of hardware and software solutions. As the technical challenges and development hurdles subside, it is increasingly important to consider the special capacities and constraints of the human perceptual, motor, and cognitive systems. From a systems design perspective, empirical research into the human-computer interface performance should inform the development process. We will present essential design notions including, but not limited to, task-oriented design, lateral and vertical transformations, and user interface design principles. Generally, this can take the form of “development guidelines” or alternatives, as anti-patterns which alert the designer to the principles that should not be violated. For the purpose of this tutorial, we plan a practical or hands-on session. Given different visualization tasks, participants will work in small groups to create appropriate visualizations. We anticipate that this could lead to an exploration of the design space. In turn, we could indicate what might benefit from adjustment or be better suited to the task at hand. This tutorial will be a forum for Scientific and Engineering developments in this area, as well as for two talks which overview these different aspects of the field.

TUT2: Tutorial SlicerIGT: Deep learning and computer vision for real-time procedure annotation
June 18, Tuesday 13:30–17:30
Tamas Ungi, PhD; Savita M. Fujii, PhD; Xavier Pascal, PhD; Gabriele Fichtinger, PhD

SlicerIGT is an established open-source platform for navigation of interventional medical procedures. It has been used to implement experimental and clinical research systems in many specialties from ultrasound-guided injections to brain surgery. The platform supports real-time communication with most tracking, imaging, and sensor devices. It also supports communication with major commercial navigation systems to experiment with additional features for existing procedures. A series of SlicerIGT tutorials have been presented in the past years, focusing on a different topic each year. This year, the topic is computer vision and deep learning for real-time annotation of surgical events. This new feature of SlicerIGT enables detection of tools and gestures in video streams. Video-based data collection can be applied on tools that are not traditionally tracked by optical or electromagnetic sensors. This new feature of SlicerIGT significantly expands the potential applications that can be built on the platform, both in intervention navigation and in simulation-based training. The tutorial consists of two sessions. First, invited speakers give an overview of open-source resources and talk about their vision for the future applications of these research tools. In the second session, the audience will build a working surgical simulation software on their laptops, using devices provided by the presenters. Participants will gain hands-on experience in the basics of intervention navigation technology, as well as an introduction to advanced real-time image processing algorithms.

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TUT3: Tutorial DL-1: Applied Deep Learning for Medical Scientists working with Image Data
June 18, Tuesday 8:30–12:30
Daniel Lückehe, PhD; Gabriele von Voigt, PhD

In this tutorial, we would like to show medical scientists how to use methods from the field of deep learning as tools to solve problems in their decisions processes. The tutorial will be designed for about 3 hours. As it is impossible to show all aspects in this amount of time, we will focus on the following points:

- Introduction to the field of Deep Learning (DL) and neural network implementations with Tensorflow
- Hands-on examples for three types of Deep Neural Networks (DNNs) which are especially relevant for the medical field:
  1. To classify images
    - Basic: Convolutional Neural Networks (CNNs) – Advantages: Deep Neural Networks (DNNs)
    - Advanced: Convolutional Neural Networks (CNNs) – Advantages: Deeper Networks
  2. To segment images
    - U-Net from Convolutional Networks for Biomedical Image Segmentation
    - Additionally, an outlook to further methods and network architectures like Recurrent Neural Networks to classify time-series will be given.

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TUT4: Advanced Deep Learning for Medical Imaging Data
June 18, Tuesday 13:30–17:30
John S.H. Baxter, PhD

This tutorial will focus on the following points:

1) Introduction to complex loss functions and how they relate to the underlying medical imaging problem: Interpret output activation functions and develop loss functions accordingly. Introduction of adversarial networks in the context of loss functions and 2) Introduce GANs and discuss mode collapse.

First Session: Advanced Loss Functions
- Refresher – final activation layer, loss functions, optimization details
- Refresher – creating activation layers and loss functions in Keras / Tensorflow
- Advanced activation functions and associated losses
  - Example – Modifying cross-entropy / logistic loss function
  - Example – Using a CRF as a final layer with associated loss added to U-Net

Second Session: Adversarial Loss Functions
- Motivation – Learning losses rather than inferring them
- Adversarial optimization – gradient freeness and alternating min-max
- Adversarial losses for image generation
  - Example – MNIST digit generator
  - Image de-noising with adversarial networks
  - Adversarial losses for image reconstruction
  - Example – CT from sub-sampled C

Third Session: Invited Speaker
Invited talk on advanced topics in Deep Learning.

TUT5: Hands-on tutorial on advanced Deep Learning for Medical Imaging
June 21, Friday 13:30–17:30
Nicola Riske, PhD

Deep Learning is reshaping the healthcare industry and continues to establish itself as the de facto tool for numerous medical applications. This hands-on workshop explores the usage of Deep Learning in Medical Imaging starting from basic Image Classification (Part 1) to advanced Data Augmentation and Segmentation with Generative Adversarial Networks (Part 2). Technical requirements: Important: participants need to bring their own laptop!

Part 1: Image Classification using the MedNIST dataset
Get a hands-on practical introduction to deep learning for radiology and medical imaging. You’ll learn to:

- Collect, format, and standardize medical image data
- Architect and train a convolutional neural network (CNN) on a dataset
- Use the trained model to classify new medical images

Upon completion, you’ll be able to apply CNNs to classify images in a medical imaging dataset.

Prequisites: Basic experience with Python

Part 2: Data Augmentation and Segmentation with Generative Networks for Medical Imaging

A generative adversarial network (GAN) is a pair of deep neural networks: a generator that creates new examples based on the training data provided and a discriminator that attempts to distinguish between genuine and simulated data. As both networks improve together, the examples created become increasingly realistic. This technology is promising for healthcare, because it can augment smaller datasets for training of traditional networks. You’ll learn to:

- Generate synthetic brain MRIs
- Apply GANs for segmentation
- Use GANs for data augmentation to improve accuracy

Upon completion, you’ll be able to apply GANs to medical imaging use cases.

Prequisites: Experience with CNNs

Sponsored by Movidia
15:30 Poster session

Statistical shape model of vascular structures with abdominal aortic aneurysm
C. Dupuy, C. Bischel-Grivel, A. Aïadi, B. Luquet, la Rochelle, ANSYS France (FR)

Preliminary testing of a robotic system for the surgical treatment of pressure sores
A. Aïadi, G. Dardenne, A. Guezou-Philippe, A. Salhi, B. Borotikar, J. Troccaz, V. Burdin; University Hospital Brest, IMASCAP (FR)

Improved prostate cancer radiotherapy planning with decreased dose in a rectal sub-region highly predictive for toxicity
P. Baksic, H. Courtecuisse, M. Chabanas, B. Bayle, H. Courtecuisse, Université de Strasbourg, Université Hospital Brest, Université de Poitiers, IMASCAP (FR)

Tumor heterogeneity estimation from DSC-MRI and histology data by linking macro- and micro-information in a quantitative way
Y. Yui, G. Sadzekizen, K. Braham, I. Vignon-Clementel, O. Drado; INRIA Paris, Université Hospital of Hildesheim (FR-GE)

Improved cancer prostatic radiotherapy planning with decreased dose in a rectal sub-region highly predictive for toxicity
O. Aziza, C. Lahiri, A. Barabas, B. Houzet, A. Larjert, E. Mykona, N. Perichon, N. Delaby, P. Haigon, R. de Ourisson; Université de Rennes 1 (FR)

Experimental test bench for the hysteroscopic study of coronary arteries: bifurca-
tion, stent, aneurysm
M. Legazge, R. Coppet, A. Genc, S. Fistel, J. Choyoun, University Grenoble Alps, Un-
iversité Saône Mont Blanc, Université Claude Bernard, Lyon (FR)

Percutaneous endovascular closure of a traumatic aortic pseudoaneurysm
J. Gammon, L. Meynell, B. Bayle, A. Sang, University of Strasbourg (FR)

Development of a finite element model of prostate validated by a realistic phantom
M. Chery, G. Chapron, S. Vons; University Grenoble Alps (FR)

FEM-based confidence assessment of non-regular registration
P. Bakic, H. Courtecuisse, M. Chabanas, B. Bayle, University of Strasbourg, University Grenoble Alps (FR)

Surgical navigation of thoracic surgery: real-time tracking, stent, aneurysm
J. Garnon, L. Meynell, B. Bayle, H. Courtecuisse, Université de Strasbourg, Un-
iversité Hospital Brest, Université de Poitiers, IMASCAP (FR)

Simulation for preoperative planning, balloon inflation for tibial plateau fracture
A. Ben-Alia, V. Mangeret, P. Haigon, E. Flecher, University Hospital of Strasbourg, Université Hospital Grenoble Alpes, UMR 5255 (FR)

An experimental protocol on Attentional Attitudes in Classic and Robot-Assisted Laparoscopy
F. Premel-Balact, V. Luquet, A. Montariol, S. Vons; University Grenoble Alps (FR)

An Experimental Protocol on Attentional Attitudes in Classic and Robot-Assisted Laparoscopy
F. Premel-Balact, V. Luquet, A. Montariol, S. Vons; University Grenoble Alps (FR)

Potential of global vision system for training laparoscopic surgical skills
S. Ujjan, R. Kafel, H. Fridman, S. Vons; University Grenoble Alps (FR)

Mixed Reality Experiment for Hernioplasty Treatment
C. Lohou, M. Bourrier, Emile-Gaëtan-Deschamps, Université Clermont Auvergne, Centre Hospitalier Emile-Plaix, J. Payet, X. Voisin (FR)

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