CARS 2019
COMPUTER ASSISTED
RADIOLOGY 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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Hiroyuki Yoshida, PhD (US)

June 18–21, 2019
Rennes, France

www.cars-int.org
www.cars2019.org
CARS 2019 Content

General Information

10th CARS Clinical Day

Artificial Intelligence for Medical Imaging
Artificial Intelligence in Imaging for Surgery and Radiology
Innovations in Surgery
Panel Discussion: Artificial Intelligence in the Future of Radiology and Surgery

10th International Conference on Information Processing in Computer-Assisted Interventions (IPCAI)

SP 1: Interventional Imaging
SP 2: Surgical Planning and Simulation, System and Software
SP 3: Tracking and Navigation
SP 4: Augmented Reality, Advanced Intraoperative Visualization, and User Interface
SP 5: Image segmentation by Machine Learning

11th International Congress and Exhibition on Computer Assisted Radiology (CARS)

Image-guided Therapy
Deep Learning for Image Processing
Image Registration and its Applications
Image Segmentation by Machine Learning
Image Segmentation by Machine Learning II
Image Segmentation: Other Innovative Approaches
CARS/CAD-AI Joint Session on Deep Learning in Medical Imaging
Visualisation and Augmented Reality
Image Analysis I
Image Analysis II
Image Support, Prediction

Computer Assisted Radiology and Surgery (CARS)

2nd Workshop on Digital Space Medicine (DSM)
Deep Learning in Breast, Eye, Brain, and MSK
Deep Learning in Abdomen
CAD-AI / ISCAS Joint Session on Artificial Intelligence in Computer-aided Diagnosis and Image-guided Therapy
CAD-AI / ISCAS Joint Session on Artificial Intelligence in Computer-aided Diagnosis and Image-guided Therapy II
Special Focus Session I: Free Europe and the Millennials

20th Annual Conference of the International Society for Computer Aided Surgery (ISCAS)

Surgical Robotics & Instrumentation
CAR / CAD-AI Joint Session on Artificial Intelligence in Computer-aided Diagnosis and Image-guided Therapy
Mixed reality for Surgical Simulation, Training and Education
Computational Methods for Image-guided Therapy
Image-guided NeuroInterventions and Applications
Remote Prototyping Applications in Image-guided Therapy
Workflow Analysis and Modeling for Image-guided Therapy
Interventional Robotics for Orthopaedics
Image-guided Orthopedic Interventions
Motion & Shape Tracking and Analysis for Image-guided Therapy

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

2nd Young Investigators Networking Session (YINS)

22nd Annual Conference of the International Society for Computer Aided Surgery (ISCAS)

Deep Learning in Lung 1
Deep Learning in Lung 2
Radiology 1
Radiology 2
Deep Learning in Breast, Eye, Brain, and MSK

25th Computed Maxillofacial Imaging Congress (CMI)

Poster Sessions
Poster Sessions / Poster Presentation Times

Table of Contents

FU1: Tutorial AR/VR: Perceptual Capacities and Constraints in AR/VR for the visualization of 3D biomedical image data
FU2: Tutorial SlicerIGT: Image Segmentation by Machine Learning
FU3: Tutorial Advanced Deep Learning for Medical Imaging
FU4: Tutorial DL-1: Applied Deep Learning for Medical Scientists working with Image Data
FU5: Hands-on Tutorial on advanced Deep Learning for Medical Imaging

5th Workshop on Modeling and simulation
Modelling and simulation
Medical procedures: analysis and evaluation
Data fusion and augmented reality
Poster session
Robotics and mechanism
Image processing and navigation
Navigation and Interventional Planning

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CARS 2019 – 33rd International Congress and Exhibition

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

**Program**

**Onsite Services Internet Access**
Complimentary wireless access available; instructions will be posted on site.

**Food and Beverage Services Coffee Breaks**
Complimentary coffee will be served each day of the conference.
Monday–Friday 08:00–08:30
Wednesday–Friday 07:30–08:00
Monday–Friday 10:00–10:30
Monday–Friday 15:30–16:00

**HOSTED LUNCHEONS**
CARS 2019 hosted luncheons are included in registration packets for all registrants including students.
Monday–Friday 12:30–13:00

**LOCATIONS**
Monday–Wednesday Galerie and Courte
Thursday–Friday Exhibition space Halle 0

**Author / Presenter Information**

**SPEAKER CHECK-IN AND PREVIEW ROOM**
Room Salle 7
Tuesday–Thursday 11:00–12:00
Friday 07:30–17:00

All presenters must stop by Speaker Check-In to upload their files at least two hours before their scheduled talk. Authors are not able to present using their own devices. All conference rooms have a laptop, projector, screen, lapel microphone, and laser pointer.

**LONG ORAL PRESENTATION INSTRUCTIONS**
Each regular and invited oral presentation is allotted a 15-minute slot; regular talks must not exceed 12 minutes, leaving 2-3 minutes for questions.

Timing will be strictly enforced to ensure a smooth transition between speakers. As a rule of thumb, you should have one slide per minute of talk time. The session chair will introduce each speaker and title of the talk.

**POSTER SESSION INSTRUCTIONS**
A poster author or coauthor is required to stand by the poster during the scheduled poster session to answer questions from attendees. Schedules depend on the conference track (see poster list).

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

**CAR/CARS**
Poster session Thursday–Friday 10:00–11:15

**ISCAS**
Poster session Thursday–Friday 10:00–11:15

**ICPAI**
Poster session Tuesday 12:00–13:30
Poster session Tuesday 15:00–17:00
Poster session Wednesday 12:30–13:30
Poster session Wednesday 15:30–17:30

**CAD-AI**
Poster session Thursday 10:00–11:15

**CMI**
Authors will present main findings of their paper in a 5-minute presentation in the corresponding CMI interactive session.
Poster session Wednesday 14:45–15:30

**Recording Policy**
Conferences, workshops, tutorials, and poster sessions: Presenters give right to CARS 2019 to record presentations including videos, content, audio and video and possibly to make them available online. 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.**

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

**CARS 2019 has achieved 32 CPD credits for full attendance in accordance with the CPD Scheme of the Royal College of Radiologists (UK).**
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.**

**General Information**

**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**
Friday 19 June 2019 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, luncheons, 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 Redone, a Gallic tribe who founded their chief leadership on the confluence of the Ille and Vilaine rivers. Conquered by the Romans in 52 B.C., the town was renamed Redon, the city of the Redones, who maintained the name Rennes. Parts of the ancient Gallo-Roman city wall can still be seen today.

During the Fall of 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 Franks tribes led by Clovis I, the first King of the Franks, led 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 eastern portion of the peninsula, giving it the name Brittany, while the Franks occupied the eastern portion. To ease tensions between the two, the Breton March was created, a region between the two which included Rennes. In 651, Rennes had been absorbed into the Breton 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 Franco-English conflicts. This autonomy, however, came to an end with the “Mad War” of 1485, in which the Duchy of Brittany, allied with the Kingdom of England, waged war against France. The war ended in 1488, 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.

Rennes and Brittany continued to thrive under the rule of the French monarchy, 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 it its imperial splendor. 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, now 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 Anne of Brittany’s engagement to King Charles VIII, uniting Brittany and France.

However, Le Couvent des Jacobins’ days were numbered as a religious institution as 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.

**POSTER SESSION | FRIDAY | THURSDAY | WEDNESDAY | TUESDAY | GENERAL INFORMATION**
Surgical Planning and Simulation, System and Software

J. Weitz, S. Speidel, NCT Dresden (DE) [SS-5-61]
T. Tsang, University of British Columbia (CA) [SS-4-43]
M. Jafari, H. Girgis, N. Van Woudenberg, Z. Liao, R. Rohling, K. Gin, P. Abolmaesumi,
Point-of-care Ultrasound Using Multi-task Learning and Adversarial Training
Institute, (CA) [SS-3-35]
Planning
Dynamic, Patient-Specific Mitral Valve Modelling for Percutaneous Valve Repair
A. Mukhopadhyay, TU Darmstadt (DE) [SS-2-27]
J. Fauser, I. Stenin, Markus Bauer, W.-H. Hsu, J. Kristin, T. Klenzner, J. Schipper,
Applied Sciences Mannheim (DE) [SS-1-02]

10:00 Coffee Break and Poster Session

13:30 Short Podium Presentation 3: Surgical Data Science
Session Chair: Nicola Rene, PhD (DE)

Weakly Supervised Method for Spatio-Temporal Tool Tracking in Laparoscopic
C. Nienye, O. Motter, J. Marascu, N. Padoy, University of Strasbourg (FR) [SSD-1-29]

Teacher/Student Approach for Semi-Supervised Surgical Phase Recognition
T. Yu, D. Mutter, J. Marascu, N. Padoy, University of Strasbourg (FR) [SSD-2-32]

Objective Assessment of Intraoperative Technical Skill in Capsulorhexis with
Temporal Neural Networks
University (US) [SSD-4-63]

Virtual Design with Soft-Tissue Support for Face Detection in the Operating Room
T. Lausevelt, S. Smajlagic, A. Gasz, N. Padoy, CAMMA (FR) [SSD-4-64]

Active Learning using Deep Bayesian Networks for Surgical Workflow Analysis
Dresden (DE) [SSD-5-68]

Video-based Surgical Skill Assessment using Deep Neural Networks
J. Fornek, S.T. Mees, A. Speidel, NCT Dresden (DE) [SSD-6-69]

14:15 Short Podium Presentation 4: Interventional Robotics, Evaluation and Validation
Session Chair: Amir Simpser, PhD (CA)

Design Optimization of a Contact-Aided Continuum Robot for Endovascular Treatments Based on Anatomical Constraints
L. Ros Freixedes, A. Gao, N. Liu, G.Y. Yang, Imperial College London (GB) [II-1-03]

Promising Study of An RNN Based Active Interventional Robot System (AIRS) in Retinal Micronalysis
C. L. Lepore, M. O'Brien, J. Marascu, N. Padoy, Johns Hopkins University (US) [II-2-09]

Leveraging RSP and PET Images for Prognosis of Multiple Myeloma at Diagnosis
L. Morvan, A. Collins, B. Seigerer, A. Bartoli, H. Hostettler, J. Marascu, Johns Hopkins
University (US) [II-3-24]

An In vitro Porcine Cadaver and Evaluation Methodology to Measure Soft-Body Laparoscopic Liver Registration Accuracy with an Extended algorithm that
Handles Collisions
R. Shams, F. Picot, S. Cheynys, C. Menard, J.-F. Carrier, F. Leblond, S. Kadoury, Polytech -
Montréal (CA) [II-4-63]

Full Auto and User-Aided Good 40-MHz Construction from Free-breathing 2D Acquisitions Applied on Liver Images
L. Vaquer-Romaguera, N. Olofsson, R. Plantefeve, E. Lugez, J. De Giese, S. Kadoury,
Ecole Polytéchnique de Montréal (CA) [II-5-65]

15:00 IPCAI Awards 1
Session Chairs: Elis Cher, PhD (CN), Kanako Harada (JP), Raphael Simpser (CH)
15:00 Coffee Break and Poster Session 2

08:00 Selected Podium Presentation 1: Interventional Imaging, Surgical Planning and Simulation, System and Software, Tracking and Navigation
Session Chairs: Hipolito Reist, PhD (NO), Toby Collins, PhD (FR)
6 Audience-Selected Presentations (20 minutes each)
10:00 Coffee Break and Poster Session

10:30 Selected Podium Presentation 2: Augmented Reality, Advanced Image-Guided Intervention and User Interface, Surgical Data Science, Interventional Robotics, Evaluation and Validation
Session Chairs: Doral Stoyanov, PhD (GB), Mathias Chabanon, PhD (FR)
6 Audience-Selected Presentations (20 minutes each)
12:30 Lunch Break and Poster Session 3

13:30 Short Presentation: Long Abstracts
Session Chair: Cristian A. Lima, PhD (US)

Localizing Destructive Surgical Tools in X-ray for Image-based Navigation
C. Gao, M. Olofsson, R. Taylor, M. Armand, Johns Hopkins University (US) [LA-1-01]
Evaluation of Segmentation Quality for Planning of Tumor Treating Fields in Brain Tumors
R. Shams, Z. Rosenberg, Université Laval (CA) [LA-2-02]

Psychophysiological Data and Computer Vision to Assess Cognitive Load and Team Dynamics in Cardiac Surgery
P. De, D. Huffman, K. Eassar, L. Zell, M. Zaitan, Harvard Medical School (US) [LA-3-03]

Unity and VTK for MR Image Medical Analysis – an Initial Clinical Evaluation
G. Kalso, S. Chakraborty, S. Chatterjia, T. Schleib, T. Peters, J. Simpson, A. Gorner, King’s College London (GB) [LA-4-04]

FM Navigation of a Human Spectroscopy Needle for Prostate Cancer Confirmation: Preliminary ex-vivo Study In 3D Slicer
R. Stams, F. Picot, S. Cheynys, C. Menard, J.-F. Carrier, F. Leblond, S. Kadoury, Polytech-
Montréal (CA) [LA-4-63]

Combining Visual Cues and Interactions for 3D-2D Registration in Liver Laparoscopy
Y. Lopez, E. Togli, L. Collet, B. Roy, E. Bus, E. Barti, Université Clermont-
Auvergne (FR) [LA-5-04]

Novel Instrument Design for Electromagnetic Navigation Bronchoscopy

Prediction of Laparoscopic Procedure Duration Using Unbalanced, Multimodal Sensor Data
S. Bodenstedt, M. Wagner, L. Mündlermann, H. Kenngott, B. Müller-Stich, S. Torger Mees,
J. Weitz, S. Speidel, NCT Dresden (DE) [LA-5-61]

10:00 Coffee Break and Poster Session 2
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 integration into clinical practice. Healthcare stakeholders including physicians, patients, medical societies, hospital systems, software developers, the health information technology industry and governmental 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 validation 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.

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, such as measuring a physical quantity. We first illustrate this by quantifying MRI of the liver, measuring proton density fat fraction, iron content, and iron concentration (units of time). This is applied to (in)organic fatty liver disease, steatosis-paties (NASi), and therapeutical interventions, both measuring the effect of anti-NASH drugs and supporting liver surgeons. Then, we show how breast density may be measured and applied to estimate x-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 Transpara decision support software can outperform either working individually. Finally, we discuss some of the strengths and limitations of machine learning applied to medical imaging.

Welcome Pierre Jannin, PhD President CARS 2019

17:30 CARS Opening Ceremony

Room Le Réfectoire

8:30 Artificial Intelligence for Medical Imaging

Session Chairs: Leonard Berliner, MD (US), Eric vanDongen, MD (US), Hubertus Feussner, MD (DE)

8:30 Preparing students and practitioners for artificial intelligence: imperatives in medical education

Invited Speaker: Eric vanDongen, MD, Univ. of Arizona College of Medicine, Phoenix, AZ (US)

8:45 Radiomics and radiogenomics: clinical applications

Invited Speaker: Amber Simpson, PhD, Memorial Sloan Kettering Cancer Center, New York, NY (US)

9:00 Artificial intelligence in medical imaging: perspective from the NIH

Invited Speaker: Kristina Kandarpa, PhD, National Institutes of Health, Bethesda, MD (US)

9:15 Lagarcia video image analysis: automated annotation with artificial intelligence

Invited Speaker: Masamichi Itô, MD, National Cancer Center East, Kawasaki, JP

9:30 The impact of nozzle placement error and prooerang in prostate focal cryosaturation: a simulation study

P. Morelu, K. Tuncal, C. Tenaure, J. Tokuda, Brigham and Women’s Hosp., Harvard Medical School, Boston, MA (US) [19-0004]

9:45 A comparison of the pituitary spine deformation and Finite Element Modeling for Brain Shift Compensation using Sparse Features that were Automatically Generated from 3D Interoperating Ultrasound


10:00 Coffee Break

10:10 Artificial Intelligence Imaging for Surgery and Radiology

Session Chairs: Kristina Kandarpa, MD (US), Giuseppe Esposito, MD (US)

10:10 Shining light on cancer: Artificial intelligence in radiology: A Path for the Democratization of AI in Radiological Practice

Keynote Speaker: Lilly Allen, Jr., MD, ACGS Data Science Institute (USA)

11:00 Artificial intelligence in nuclear medicine

Invited Speaker: Giuseppe Esposito, MD, Georgetown Univ. Medical Center, Washington, DC (US)

11:15 Detection and grading of sarcoidosis in computed tomography as an accidental finding using deep learning

Invited Speaker: Leo Jojnkowski, PhD, The Hebrew University of Jerusalem (IL)

11:30 Early interception 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


12:05 GFPI-accelerated blood vessel enhancement from free-breathing angiography using robust principal component analysis


12:15 Panel Discussion

12:30 Lunch Break
**CARS 2019 – 33rd International Congress and Exhibition**

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

**CARS Computer Assisted Radiology and Surgery**

### Salle du Choeur

**8:00**

**21st IFCARS / SPI / ISCAS Joint Workshop on the Digital Operating Room (DOR)**

**Chair:** Yoshifumi Maruyagai, MD (JP), Pierre Jannin, PhD (FR), Helmut Lermke, PhD (DE)

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

**Invited Speaker:** Yoshifumi Maruyagai, MD, PhD, Tokyo Women's Medical University (JP)

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

**Invited Speaker:** Thomas Neuhart, PhD, EACG Institute (DE)

**The Bonniey-Project; democratizing Artificial Intelligence for the collaborative OR**

**Chair:** O. Schlecker, M. Schmied, D. Wilhelm, H. Fließ, Heinrich-Heine-University of Düsseldorf (DE) [517]

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

**Chair:** M. Berger, M. Rockstroh, E. Schröder, Y. Yoshida, J. Okamoto, K. Masamune, Y. Morikawa, T. Neuhart, Univ. of Leipzig; Tokyo Women's Medical University; DENSIO Wave Incorporating, Achete (LP) [19-00040]

**Assisted Annotation of Surgical Videos Using Deep Learning**

**Chair:** G. Lecuix, M. Nagy, M. Notte, L. Linhart, J. Perin; R. DeRoover, C. Geessinck-Selfson, Univ. of Reims I (FR) [19-00052]

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

**Chair:** G. Schober, G. Dörfler, KOPFZENTRUM Gruppe, Leipzig (DE) [19-00060]

**10:00 Coffee Break**

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

**Chair:** Makoto Hashizume, MD (JP), Hironori Yoshida, PhD (US)

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

**Invited Speaker:** Kazutoshi Mori, PhD, Nagoya University (JP)

**Nasal airflow simulation with LVQ validated LB code calculated from CBCT data**

**Chair:** M. Berger, S. Erckel, M. Pilleri, A. Mehler, W. Reichel, D. Delago, F. Kro, M. Kienzler, W. Freymann, Medical Center Innsbruck; Medical and Technical University of Innsbruck; Krems (AT) [19-00066]

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

**Chair:** T. Saeki, A. Sokka, J. Urso, K. Haukka, A. Auhu, A. Auhu, University of Turku and Agriculture and Forestry, Kotka; Takaoka Univ. (JP) [20-00076]

**Multiple Aneuryns Anotoly Challenge 2019 (MATCH) – Phase II: Rupture Risk Assessment**

E. Wang, S. Völt, G. Jürgens, S. Pfaff, A. W. Berghauser, J. Kahan-Andreatta, J. Bruning, L. Burgermeister, A. Vang, T. Liang, C. Wei, T. Li, S. Li, G. Zoppo, B. Col, Ole von Gierke University Medical School (DE) [19-00042]

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

S. Saalfrink, S. Völ, G. Burghardt, P. Prein, P. Berag, Ole von Gierke University Medical School (DE) [19-00080]

**12:30 Lunch Break**

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

**Chair:** Nassif Kadi, PhD (DE)

**Geometric Statistics for Computational Anatomy**

**Invited Speaker:** Manuel Fenn, INRIA, Sophia-Antipolis (FR)

**Molecular photonic imaging during ultrafast-guided interventions**

**Invited Speaker:** Adriaan Droogmans, University College of London (GB)

**COMBOICP: Computational biophotonics in endoscopy**

**Invited Speaker:** Laura Mazzini, Mazzini, Firenze, Firenze (IT)

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

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

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

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

**15:30 Coffee Break**

### 16:00 Surgical Navigation

**Session Chairs:** Jörgi Katsakou, DDS, PhD (US), Yoshitaka Hayakawa, PhD (JP)

**Poster **008 – 107**

**16:30**

**17:45 End of Session**

**18:00 CARS 2019 Exhibition Opening Ceremony**

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**Note:** 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 adoption of models from data and information gathered** from specific patients to generate knowledge models of patient-specific situations and appropriate treatment processes.
3. **Improved accuracy of diagnosis and optimal therapy through simulation** as well as knowledge and decision management.
4. **Higher quality of therapy by means of fast integrated transmission of information** in patient-specific models and therapeutic processes.
5. **Validation processes of clinical decisions on patient-specific and** appropriate levels as well as appropriate representations in visualizations.

Patients, physicians and the health care systems 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 creation and communication 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 realised by:

- **Events of all kinds**, e.g. conferences, 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 subsequent 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 provided by IFCARS. In order to augment a scientific-based foundation for a modern medicine and specifically for computer assisted radiology and surgery, IFCARS is primarily providing 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 clinically meaningful way, IFCARS will establish a membership and award system to promote this historic transition of medicine.

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

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

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**POSTERSESSION | FRIDAY | THURSDAY | WEDNESDAY | TUESDAY | GENERAL INFORMATION**

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

[www.ifcars.org](http://www.ifcars.org)
13:30 Mixed reality for Surgical Simulation, Training and Education
Session Chairs: Carla Pugh, MD, PhD (CA), Simon Drouin, PhD (CA)
Use of Sensor-Based Metrics to improve Mastery Learning During Simulation
Invited Speaker: Carla Pugh, MD, PhD (CA)
Orthopaedic residents basis skills learning with virtual reality arthoscopy simulator: a large national prospective study
P. Wallgren, H. Thorneaux, H. Commen, E. Bernard, F. Sirven, Hosp. de Nancy, Univ. de Lorraine, France
Anxiety Reduction System for Glioma Patients undergoing Awake Surgery using Virtual Reality
Salle du Choeur

13:45 Image Segmentation by Machine Learning (1)
Session Chairs: Guoyan Zheng, PhD, CN, Florent Laisy, PhD (FR)
Probabilistic Deep Vesselwise Dilated Residual Networks for Whole Heart Segmentation
Invited Speaker: Guoyan Zheng, PhD, Shanghai Jiao Tong University (CN)
Evaluation of rupture and excitation fully convolutional networks for multi-organ segmentation
Segmentation of Organs at Risk in Head and Neck Radiation Therapy with 3D Convolutional Networks
MultiAtlas Neonatal Brain Segmentation from patch-based deep approaches
A comparison of conventional and deep learning methods of image segmentation on acute disc herniation
C. Zhao, T. Li, T. Tomita, X. Zhao, J. P. Verhep, G. Yang, Y. Chen, P. Haynor, Amyu, University Hospital, Paris, France.
Liver Tissue Segmentation in Multiphase CT Scans using Cascade convolutional Neural Networks
P. Oudekerk, V. Ajinal, V. Nobel, M. Holz, P. Ponsau, Nouvel Hospital Civil, Strasbourg, Univ. of Strasbourg, March (FR) [19-00058]
Cardiovascular segmentation via FCN for SEER trajectory planning
S. Sadiq, M. Scoula, D. Scoura, F. Cardinale, G. Basile, E. de Mont, Policlinico di Milano, Milano, Italy.
Organ Segmentation of the Colon via GRASS, University de Cagliari, Cagliari (IT) [19-00075]
15:00 Coffee Break

16:00 Image Segmentation: Other Innovative Approaches
Session Chairs: D. Louis Collins, PhD (CA), Su Ruan, PhD (FR)
MD+Machine: Machine Learning for Computer Aided Diagnosis and Interventions in Prostate Cancer
Invited Speaker: Piero Moussavi, PhD, King’s University, Ontario (CA)
Automated Segmentation of Oriented Branching Structures through Dilatation Shells
Capsule Networks for Mother’s Wind Segmentation in TTTFS Fetal Imaging
M. Cerny, J. Ferreira-Brunini, L. Lopez-Villamarin, S. Peter, D. Grabherr, E. Bakhit, M. A. Gonzalez-Ballester, Unives. de Palermo, Palermo, Italy.
User-dependent variational in modal variance segmentation and its impact on CFD computed hemodynamic parameters
17:15 Exhibition Tour
18:00 YINS and Job Fair

Salle du Choeur

13:30 Deep Learning in Lung 2
Session Chairs: Paul A. Alzaidi-Maquire, PhD (BR), Stoj Kido, MD, PhD (JP)
Detecting lung lesions based on deep learning for constructing medically-meaningful TB descriptors
V. Vekatapati, V. Lauchert, A. Tarasov, E. Snethk, A. Gabriel, A. Rosenthal, United Inst. of Informatics Problems, Scientific and Practical Center for Pulmonology and Tuberculosis, Moscow, Russia
Convolutional neural network for 3D CVs: Utility for differentiation of malignant from benign pulmonary nodules
Y. Ohno, Y. Iiyoshi, K. Ayagi, Y. Kishita, S. Seki, Y. Ueno, Y. Tsuchiya, Kobe Univ. Graduate School of Medicine (JP)
Improving lung cancer prediction with a deep learning nodules malignancy classifier
Lung nodal classification using deep local-global networks
Machine learning based lung cancer diagnosis using post-contrast T1-weighted and T2-weighted magnetic resonance imaging
P. Alzaidi-Maquire, V. Francisco, D. Wada, J. R. Ferreira Junior, A. Fabro, F. Cipriano, L. Ferreira, S. Gattaz, M. Konigkam-Santos, Univ. de São Paulo, São Carlos, Univ. of São Paulo Medical School, Ribeirão Preto (BR)
A radionics approach for differentiation of pseudocoevolution on caudation on lung cancer tumours
P. Alzaidi-Maquire, J. R. Ferreira Junior, M. Konigkam-Santos, Y. Kikuchi, M. Faleiros, F. E. Garcia Cenina, A. Konigkam-Fabris, H. Yoshida, Univ. of São Paulo, São Carlos, Univ. of São Paulo Medical School, Ribeirão Preto (BR).
Harvard Medical School, Boston, MA (US)
Identifying alterations in the cardiac anxiety in atrial fibrillation: a radionics approach
C. I. C. Peter, J. T. Petersen, C. M. Magalhães, E. K. Hakstol, Univ. Ercil, Pontevedra Física, Barcelona, Spain.
15:30 Coffee Break

14:30 Radiomics 1
Session Chairs: Akinobi Shimizu, PhD (JP), Janner N. Nipaisi, PhD (US)
Digital chest x-ray evaluation with deep learning in the diagnosis of lung cancer using the deep convolutional neural network
S. Yamabe, A. Saito, M. Fukasawa, T. Iizuka, A. Shimizu, Tokyo Univ. of Agriculture and Technology (JP)
Retinal OCT disease classification with variational autoencoder regularization
Pulmonary functional tuberculosis classification using convolutional neural networks and deep learning
S. Yamabe, A. Saito, M. Fukasawa, T. Iizuka, A. Shimizu, Tokyo Univ. of Agriculture and Technology, Kogakkyo Hosp., Kiyosu (JP)
Detection of hip fractures on digital pelvic radiographs using a deep convolutional neural network
T. Makawalla, R. Mukhrani, S. Katarsagaya, H. Hayashi, Tokyo Univ., Omida, Univ. of Occupational and Environmental Health School of Medicine, Kawasaki (JP)
16:30 Deep Learning in Breast, Eye, Brain, Musculoskeletal
Session Chairs: Horiuchi Fugita, PhD (JP), Rusy Feng Chang (TH)
Computer-aided diagnosis for breast ultrasound using 3D convolutional neural network
R. F. Chang, Y. S. Huang, C. H. Hsu, National Taiwan Univ. (Taipei, TW)
Detection of breast cancer histology imaging using convolutions oriented by three deep convolutional networks
J. Ndogo, S. Mathiyudh, M. A. Ofoche, Temru Univ. Ekiti, Univ. of Mora (BR)
Optimal computer-aided detection classification of multiple retinal diseases using DenseNet
K. Mori, C. Wang, M. Oda, Y. Ichinose, Nagoya Univ.; Nagoya University Graduate School of Medicine (JP)
Retinal OCT disease classification with variational autoencoder regularization
M. H. Law, S. W. L. Chan, C. C. K. Chan, Int. Ophthalmology, Hannover, Hannover (DE)
3D deep learning algorithm for deep vein thrombosis score calculation of deep venous thrombosis
Y. Yamada, A. Saito, M. Fukasawa, T. Iizuka, A. Shimizu, Tokyo Univ. of Agriculture and Technology, Kogakkyo Hosp., Kiyosu (JP)
19:00 Dinner and Social Program

17:00 Meet the Experts Session
Poster Session / Poster Presentation Times

A. J. Stewart, S. Sebastyan, M. Kunz, D. Redfearn, Bantane Hosp., Nagoya; Gifu Univ. (JP) [140]

Poster Session / Poster Presentation Times

026 Model-based Registration of Deaeration Deformation in MR Imaging for Anatomical and Functional MRI Analysis of Thoracic Aorta

July 15, Wednesday 10:30 – 11:45

029 First approach to analyse the body fluid status

M. Yamamuro, Y. Asai, N. Yasuda, K. Yamada, K. Sasaki, Tokyo Women's Medical Univ., Toyoake; Gifu Univ. (JP) [19-00046]

Poster Session

006 Image noise characteristic of deep learning-supported dual-energy computed tomography

Poster Session

031 Computerized volumetric breast density measurements based on anatomical knowledge on digital mammograms

S. Ohashi, A. Okada, Y. Hirose, T. Yasui, Y. Shibamoto, Nagoya Univ. (JP) [130]

Poster Session

001 Image quality of low tube voltage on 2nd generation 400 kV medical X-ray source

Poster Session

004 Deep learning-based dual-energy computed tomography for improving image quality and reducing dose in pediatric dual-source CT angiography for partial nephrectomy

Poster Session

008 Reference misalignment detection and correction for analyzing postmortem CT images

Poster Session

009 Artifact reduction for analyzing postmortem CT images

Poster Session

017 3D printed model-based simulation of laparoscopic surgery for the descending colon with an anal fistula: an anatomical aortic aneurysm: A new surgical technique

Poster Session

036 Preliminary Study on Extraction of Blood Vessels from Venous Ultrasound Imaging for Automatic Diagnosis of Liver Cirrhosis

Poster Session

030 Development of Automatic Assessment Method for Irregularity Detection in Computer-assisted ENT-surgery

Poster Session

044 Design and Clinical Test of a Passive Ultrasound Probe Holder Mechanism for Ultrasonic-Guided Radiation Therapy

Poster Session

045 Regional-surface-based registration for image-guidance in robotic-assisted urology

Poster Session

040 Segmentation of aorta dissection CT images using fully convolutional networks

Poster Session

039 Detection of Spinal Ultrasound Landmarks Using Convolutional Neural Network

Poster Session

043 Endoscopic vs. volumetric OCT imaging of the anal verge: direct comparison with a minimally invasive coacher surgeon

Poster Session

042 Deep learning-based Digital Subtraction Angiography Imaging for Nuclear Medicine

Poster Session

035 Deep Learning-based Digital Subtraction Angiography Imaging for Nuclear Medicine

Poster Session

041 Design of a New C-arm Positioning System for Computer-assisted ENT-surgery

Poster Session

038 Detection of Spinal ultrasound landmarks using Convolutional Neural Network

Poster Session

037 Development of Surgical Navigation System using optical biopsy probe: A feasibility study

Poster Session

028 Effects of super resolution processing using deep learning on MR images using convolutional neural networks

Poster Session

025 Investigation of the accuracy of reference misalignment detection in post-mortem CT images

Poster Session

027 Ultrasound-image-guided robotic system for pelvic organs surgery toward realization of AI surgery

Poster Session

022 Robotic-Ultrasound-Guided Radiation Therapy

Poster Session

015 Deep Learning-based Digital Subtraction Angiography Imaging for Nuclear Medicine

Poster Session

019 3D Deep Learning approach to predict breast tumor response to chemotherapy using two DCE-MRI sequences

Poster Session

018 Tumor growth response to chemotherapy using two DCE-MRI sequences

Poster Session

014 Automated unmarked guidewire navigation: An application to a remote-controlled vascular intervention robotic system

Poster Session

013 Design of a new interactive tool for tele-education in ENT surgery using mixed-reality technology

Poster Session

011 3D printed model-based simulation of laparoscopic surgery for the descending colon with an anal fistula: an anatomical aortic aneurysm: A new surgical technique

Poster Session

012 Augmented reality-assisted venipuncture with marker-based scenario

Poster Session

010 Deep learning-based dual-energy computed tomography: a feasibility study

Poster Session

007 Anatomical keypoints localization in 3D CT scans using Deep Learning

Poster Session

005 Anatomical keypoints localization in 3D CT scans using Deep Learning

Poster Session

003 Anatomical keypoints localization in 3D CT scans using Deep Learning

Poster Session

002 Image quality of flat panel detector (FPD) in the low tube voltage range for CT imaging: A phantom study

Poster Session

001 Image quality of flat panel detector (FPD) in the low tube voltage range for CT imaging: A phantom study

Poster Session

000 Image quality of flat panel detector (FPD) in the low tube voltage range for CT imaging: A phantom study

Poster Session
074 A targeting system for distal locking of intramedullary nails based on electromagnetic navigation
X. Chen, Y. Gao, W. Qian, Sun. Shanghai Jiao Tong Univ. (CN)[19-00133]

075 Zebrina stereo and sharp mapping assistance for femoral nailing
Y. Tachiishi, W. Miwa, H. Kugoh, K. Kobayashi, H. Tada, M. Kato, Y. Sato, Toyota Toyotomi Hospital; Metal Osteoarticular Laboratory Clinic, Tokai, Nagoya Univ. (JP) [19-00102]

076 Printing of contour-adapted bone scaffolds based on calcium phosphate cements
S. Hoitink, T. Schreiterer, R. Stolzer, Dresden University of Technology (DE) [19-00108]

080 Introducing surgical landscape guidance for J. Torrents-Barrena, R. López-Velazco, G. Piella, Kobe Univ. Graduate School of Medicine (JP) [39]
Y. Yamazaki, S. Kanaji, G. Takiguchi, M. Yamamoto, the horizontal direction.
S. Holtzhausen, S. Heinemann, R. Stelzer, Dresden University of Technology (DE) [39]


082 Band markers for three-dimensional pose tracking of catheters using single-view fluoroscopy D. Lee, Korea Inst. of Science and Technology, Seoul (KR) [212]


084 Workflow assessment as a preclinical development tool: surgical process models of three technologies for minimally invasive carcinoma radiographs using Deep Convolutional Neural Networks H. Fujita, Fujita Health Univ., Toyoake; Gifu Univ. (JP); K. Saito, H. Toyama, K. Imaizumi, H. Fujita, Fujita Health Univ.; National Cancer Center Hosp. East, Chiba; The Univ. of Tokyo Graduate School of Medicine; The Univ. of Tokyo (JP) [19-00205]


086 Quantification of the diagnosis of depression through application of image recognition technology Y. Maki, K. Abe, H. Takeshita, Y. Nakao, Kagawa Univ., National Cancer Center Hosp. East, Chiba; (JP) [19-00210]

087 Heterogeneity of longitudinal brain imaging phenotypes in Alzheimer’s disease based on unsupervised clustering of blood marker profiles M. Martí Juan, G. Sanroma, G. Piella, Univ. Pompeu Fabra, Barcelona (ES); German Center for Neurodegenerative Diseases, Bonn (DE) [19-00211]

088 Subtype classification of triple negative breast cancers by using semantic feature and mRMR N. Wu, T. Ichinose, Kumamoto Univ. (JP) [19-00212]

089 Automated differential diagnosis of benign and malignant breast lesions on the mammograms A. Illanes, N. Esmaeili, F. Renna, J. Oliveira, M. Coimbra, Inselspital, Bern; University of Bern (CH) [19-00213]

090 Towards automatic lesion classification in the upper aerodigestive tract using OCT and deep transfer learning methods M. Schlaefer, N. Gesaret, S. Labus, V. Völcker, C. Bietz, A. Schlaefer, Hamburg University of Technology; Ludwig-Maximilians-Universitat, Munich; Univ. Medical Center Hamburg-Eppendorf (DE) [19-00214]

091 Towards automatic lesion classification in the upper aerodigestive tract using DCT and deep transfer learning methods M. Schlaefer, N. Gesaret, S. Labus, V. Völcker, C. Bietz, A. Schlaefer, Hamburg University of Technology; Ludwig-Maximilians-Universitat, Munich; Univ. Medical Center Hamburg-Eppendorf (DE) [19-00214]

092 Detection of lung nodules and supraopharyngeal head and neck lesions in high-resolution CT scans K. Kapon, M. Khameh, George Washington Univ., Washington, DC (US) [19-00215]


094 Deep generative model-based unsupervised detection of infiltration in a chest X-ray dataset T. Nakao, S. Hanawa, Y. Nenno, M. Murata, T. Takenaga, S. Ito, T. Watadani, T. Yatokohji, H. Iwashita, O. Abe, The Univ. of Tokyo Graduate School of Medicine; The Univ. of Tokyo (JP) [19-00217]


096 Computer aided diagnosis of cirrhosis and hepatocellular carcinoma using multi-phase abdomen CT H. Fujita, Fujita Health Univ.; National Cancer Center Hosp. East, Chiba; The Univ. of Tokyo Graduate School of Medicine; The Univ. of Tokyo (JP) [19-00221]

097 Improved method of an automated detection of gastric cancer using FCN and feature based false positive reduction K. Einomoto, A. Teramoto, T. Shibata, K. Sato, H. Fujita, Fujita Health Univ.; National Cancer Center Hosp. East, Chiba; School of Medicine, Tochigi (JP) [19-00222]


099 Optimization of the BMD measurement procedure in photo-stimulated phosphor (PSP) digital intraoral imaging systems A. Kamiyama, W. Moriyama, E. Miki, T. Hayashi, Aichi Univ. School of Dentistry, Gifu; Media Corp. Ltd, Tokyo (JP) [19-00224]


101 Web-based platform of visualizing and planning for orthognathic surgery S. Y. Won, S. Lee, J. P. Kim, M. H. Chiu, W. J. Yoo, National Univ. (KR) [39]

102 Image quality of cone beam CT under different exposure parameters Z. Zhang, F. Wang, K. Xie, L. Zhang, Peiking Unp. School and Hosp. of Stomatology, Tongji Univ., Beijing (CN) [39]

103 High-quality 3D modeling and its VR animation of skull and jaw using an algorithm of structure from motion H. Yaakawa, K. Nagasu, N. Esup, R. Hayashi, K. Mikuski, Kitami Inst. of Technology (JP) [19-00230]


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
Ray Eagleson, PhD; Georgios 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 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 Uogi, PhD; Sonia M. Fujii, PhD; Xavier Paccot, PhD; Gabor 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 commercial medical 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. The 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 integration of advanced real-time image processing algorithms.

TUT3: Tutorial DL1: Applied Deep Learning for Medical Scientists working with Image Data
June 18, Tuesday 8:30–12:30
Daniel Lückeke, PhD; Gabrielle 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 3–4 hours. As it is impossible to show all aspects in this amount of time, we will focus on the following points:

1. Introduction to the field of Deep Learning (DL) and neural network implementations with Tensorflow.
2. 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)
      - Advanced: Deep Neural Networks (ResNets)
   - 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.
   - 3. 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.

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; 2) Interpret output activation functions and develop losses accordingly, introduce 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 / loss class balancing
  - 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 freezing and alternating min-max
- Adversarial losses for image generation
  - Example – MNIST digit generator
- Illustrate implementation of adversarial training with Cross Entropy and adversarial loss
- Adversarial losses for image reconstruction
  - Example – CT from sub-sampled C

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

TUTS: Hands-on tutorial on advanced Deep Learning for Medical Imaging
June 21, Friday 13:30–17:30
Nicola Rickle, 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 I) to advanced Data Augmentation and Segmentation with Generative Adversarial Networks (Part II). 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 how 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.

Prerequisites: 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.

Prerequisites: Experience with CNNs
Sponsored by NVIDIA
15:30 Poster session

Statistical shape model of vascular structures with abdominal aortic aneurysm
M. Dupuis, C. Bishof-David, A. Asebi, A. Locatelli, M. Giguere, J.-L. Dillenseger, D. Kornprobst, University Grenoble Alpes, France

Preliminary parametric 3D modelling with stenOSS: A preliminary reliability study
M. Doménil, G. Darbente, A. Guazzo-Philippe, H. Letikstein, C. Leherv, E. Stévol, Université Hospital Brest, University of Western Brittany (FR)

Extended field-of-view of the knee bone surface using ultrasound
M. Nasan, V. Merhav, G. Darbente, C. Chabo, E. Stévol, University of Western Brittany, University Hospital Brest, University of Strasbourg, ANSYS France (FR)

Towards a patient-specific simulation of the balloon angioplasty treatment
M. B. Al-Chej, D. Cupo, A. Bel-Brunon, W. Ye, A. Kaladji, P. Haigron, University of Rennes 1, Université de Montpellier, ANSYS France (FR)

Nervous System Exploration Using Tractography To Enhance Pénic Surgery
C. Muler, A. Gériaux, P. Khorga, U. Poirier, A. Véchta, D. Botru, D. Guerrier, T. Bellier, P. Gérard, D. Bouladet, I. Blesch, C. Geamari, Université Paris-Descartes, Necker Hospital, Université Paris-Sud (FR)

Transcutaneous Ulrine Biopsy: Robotic Comanipulation
N. Tajeddine, M. A. Viola, R. Dalliant, Sorbonne Université, Univ Paris 06 (FR)

Surface imaging for patient positioning in radiotherapy
S. Nacir, J. Bert, D. Sename, H. Fannit, University of Western Brittany, Hamad Medical Corporation Doha, PECLCT center Doha (QA)

Orientation1vability of concentric tube robots deployed in natural orifices
Q. Payon, K. Rabasinoa, N. Andread, P. Renaud, Université de Rennes, Université Lyon, ANSYS France (FR)

Computer Assisted Early Diabetic Retinopathy Detection from Retinal Fundus images Using Transfer Learning Model
B. Kumar, S. Kumar, N. Jaswan Gupta, MNIT Allahabad (IN)

Simulation for preoperative planning, balloon inflation for left atrial plaque fracture reduction
K. Aubert, T. Vendrely, M. Rocchi, P. Ribolzi, R. Girdier, A. Genoese, Université de Poitiers, ANSYS France (FR)

Patient's specific computer simulations to assist coronary artery bypass surgery
A. Drucourt, A. Andret, H. Costes, J-P Vertente, Univ Toulouse Compagnie, Université Hospital Rennes (FR)

Computer Assisted Detection of Good View Frame from US Video for ORUS Measurement
B. Kumar, S. Singh, N. Gupta, MNIT Allahabad (IN)

Brain tumor: A Mathematical Brain and an Imaginary Brain - toward a personalized treatment plan
A. Ben-Abid, V. Moogenschap, P. Haigron, E. Flecher, Université Hospital Rennes, ANSYS France (FR)

Thermal and mechanical stresses of an endoscopic magnifying system
X. T. Ha, P. Zanne, F. Nageotte; University of Strasbourg (FR)

Investigating the Role of Helical Markers in 3D Catheter Shape Monitoring from 2D Fluoroscopy
X. T. Ha, P. Zanne, F. Nageotte; University of Strasbourg (FR)

Real-time Prediction of High-risk Instrument Motion based on Location Information
Y. Sawano, N. Ohtori, Ryoichi Nakamura; Chiba University, Jikei University School of Medicine, Japan Science and Technology Agency (JP)

An Experimental Protocol on Attentional Abilities in Classic and Robot-Assisted Laparoscopy
P. Perren-Rude, V. Luquet, M-A. Vitrani, Surgerica (FR)

Mixed Reality Experiment for Herniaohydis Treatment
C. Lohou, M. Bouiller, Emile Gadea-Deschamps, Université Clermont Auvergne, Centre Hospitalier Enfant Princesse, Varsovie (FR)

Image-based registration for lung nodule localization during VATS
P. Amato, P. Simon, M. Chauni, Y. Payan, J-L Dillenseger, Université Hospital Rennes, Université Grenoble Alpes (FR)

Additive Manufacturing of a Microbead Sampling Capsule Based on a Bistable Mechanism

Towards a novel man-machine interface to speed up training on robot-assisted surgery
G. Gill, J. Walker, N. Zemiti, A. Okamura, P. Poignet, Université Montpellier, Stanford University (USA)
International Journal of Computer Assisted Radiology and Surgery
A journal for interdisciplinary research, development and applications of image guided diagnosis and therapy

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IFCARS
International Foundation for Computer Assisted Radiology and Surgery

ISCAS
International Society for Computer Aided Surgery

MICCAI
The Medical Image Computing and Computer Assisted Intervention Society

CURAC
Deutsche Gesellschaft für Computer- und Roboterassistierte Chirurgie

EuSoMI
European Society of Medical Imaging Informatics

CMI
Computed Maxillofacial Congress

CAD
Workshop on Computer-Aided Diagnosis

IPCAI
Information Processing in Computer-Assisted Interventions Conference

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