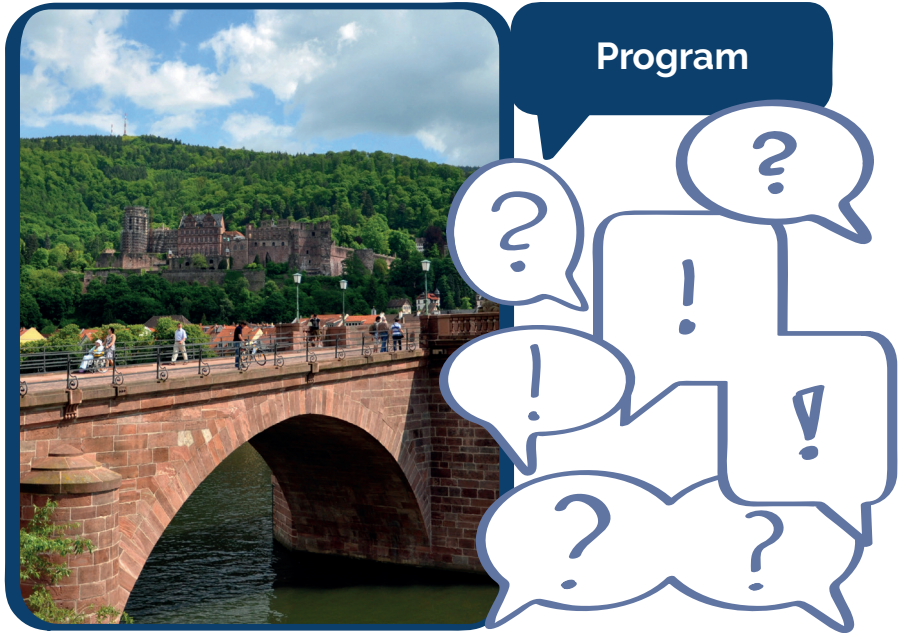


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surgical data science



June 20th, 2016
Heidelberg, Germany



The workshop is funded by the Collaborative Research Center (SFB/TRR) 125 'Cognition-Guided Surgery' and is endorsed by the International Society for Computer Aided Surgery (ISCAS).

Organization

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Welcome

SURGICAL DATA SCIENCE is an emerging scientific discipline with the objective of improving the safety, quality, effectiveness, and efficiency of surgical care by means of data acquisition, modeling, and analysis. Improvement may come from understanding of processes and strategies, assisting surgeons and controlling devices before, during and after surgery as well as from improvements to training, simulation and assessment. Surgical data science builds on principles and methods from other data-intensive disciplines such as computer science, engineering, information theory, statistics, mathematics, and epidemiology, and complements other information-enabled technologies such as surgical robotics, smart operating rooms, and electronic patient records. The goal of this workshop is to bring together researchers working on diverse topics in surgical data science in order to discuss existing challenges, potential standards and new research directions in the field. On the workshop day, keynote lectures by leading experts in the field will be complemented by short presentations of accepted workshop papers.

We would like to take this opportunity to thank the Program Board for their dedication and are grateful to all authors for choosing to submit their manuscripts to the workshop.

June 2016
Lena Maier-Hein
Stefanie Speidel
Pierre Jannin
(General Chairs)

Keynotes

Medical Keynote I

09:15 - 09:50

Markus W. Büchler
Heidelberg University

Surgical Data Science for Cognition-guided Surgery

The vision of the collaborative research center (SFB/Transregio 125) "Cognition-Guided Surgery" is a Cognitive Surgical Assistant CoSA that guides the surgeon in the treatment process and learns from experience, similar to a human assistant. To achieve this goal, CoSA mimics cognition in a technical system. CoSA perceives data from its environment along the whole clinical pathway of a surgical patient. The interpretation algorithms rely on a knowledge base combining factual knowledge and models of surgical reality with experience from previous patients in the form of semantically enriched data. On this foundation, CoSA performs context-aware actions by recommending the optimal treatment for complex patients or by guiding a cognitive surgical robot. By performing these actions, CoSA will gain more experience and learn, subsequently improving over time.

This talk will discuss the crucial role of surgical data science for cognition-guided surgery from a clinical perspective.

BIOGRAPHY

Professor Markus W. Büchler is the executive director and professor of surgery at the department of surgery at Heidelberg University. He is an internationally respected expert in the field of surgery, especially in the field of pancreatic surgery. More than 2200 authored scientific manuscripts published by him focused on the molecular basis of GI cancer and pancreatic diseases as well as clinical surgical problems. He is a member of the Royal Colleges of Surgeons of England and Scotland among other societies. He has received multiple scientific awards and is a member of the editorial boards of many well-known scientific journals.

Technical Keynote I

11:35 - 12:00

Gregory Hager

Johns Hopkins University

Surgical Data Science: Computational Challenges and Future Opportunities

The availability of large amounts of data together with advances in analytical techniques afford an opportunity to make healthcare safer, more effective, more efficient, and more patient-centered. Surgical patient care, in particular, stands to gain through establishment of standardized, evidence-based approaches to the teaching and practice of surgery. For example, recent research has shown that deficiencies in surgical technical skill are correlated with significant increases in patient morbidity and mortality; such deficiencies might be addressed through a more quantitative approach to training and credentialing. Surgeons in training rarely become completely proficient at all of the procedures in their discipline; creating an online “coach” might begin to address some of these learning deficits. However, achieving these goals requires solving a number technical, organizational, and regulatory challenges. I'll conclude by outlining these challenges and suggest a few paths toward overcoming them.

BIOGRAPHY

Gregory D. Hager is a Professor and Chair of Computer Science at Johns Hopkins University. He received his BA from Luther College and his MSE and PhD from the University of Pennsylvania in 1986 and 1988, respectively. After a year as a Fulbright scholar at the University of Karlsruhe, he joined the faculty of Yale University in 1990. He moved to Johns Hopkins in 1999. His research interests include image-guided robotics, human-machine collaboration, and medical applications of image analysis and robotics. He has served as the Deputy Director of the NSF Engineering Research Center for Computer Integrated Surgical Systems and Technology, he serves on board of the International Federation of Robotics Research, and he is a fellow of the IEEE for his contributions in vision-based robotics. He serves as Chair of the Computing Community Consortium.

Medical Keynote II

13:00 - 13:35

Adrian Park

Anne Arundel Medical Center, Johns Hopkins University

The Operating Room: the Least Understood "High Stakes" Work Space

Humans routinely occupy "high stakes" work environments in which their decisions and performance can impact for better or worse, human health & safety, vital security and even business enterprises. Whether considering the operation of a commercial airliner, a nuclear power plant or a national defense organization, work flow, decision making structure, human factors and ergonomic considerations have been studied and planned in detail. Surprisingly the same cannot be said about the operating room and perioperative environment, one of the highest stakes working spaces that exist. In this presentation the increasing focus on patient safety and quality care in the perioperative environment will be discussed. Our limited understanding of human factors and ergonomic risk factor violations in the operating room and what is now being done to mitigate them will be presented. As well current views on operative work flow will be discussed, as will measures being taken to address the problem of "distraction & disruption" in the operating room.

BIOGRAPHY

Dr. Park is chairman of the Department of Surgery and of the Earl SAIL Center of Anne Arundel Health Systems in Maryland and Professor of Surgery at Johns Hopkins University School of Medicine. He is a member of the American Surgical Association, and is a Fellow of the Royal College of Surgeons of Canada, American College of Surgeons and the College of Surgeons of Central Eastern and Southern Africa. Currently a member of the Board of Directors of the SAGES, he has also served as the Fellowship Council's founding President and as its Board Chair. He is editor-in-chief of Surgical Innovation. The author of over 200 scholarly articles and book chapters and holder of 20 patents, he has been instrumental in the development and application of new technologies in endoscopic surgery.

Technical Keynote II

15:05 - 15:30

Bernard Gibaud

Inserm, University of Rennes 1

Semantic Models and Ontologies in Surgical Data Science

Surgical Data Science involves the representation of various kinds of models of the procedures, activities, instruments, materials, surgical staff and of the roles played by such entities in surgical activities. In order to specify such models and to build up computer systems, it is essential to define an explicit and consistent vocabulary. This is where ontologies and semantic technologies come into play, enabling: 1) to collect, share and annotate surgical data and learn from it; 2) to ensure the interoperability of complex equipment in the OR, 3) to ensure smooth communication between the automated systems and the humans that use them. The presentation will summarize the state of the art in the domain of ontologies for Surgical Data Science, mostly relying on a workshop held in Rennes (France) on 28-29 April, 2016. This workshop led to launching a collaborative action whose goals and activity will be introduced.

BIOGRAPHY

Bernard Gibaud is a senior researcher with Inserm, the French national institute for health and medical research, working in the LTSI Laboratory at Rennes (France). He graduated from Sup'Télécom in Paris in 1979, and he received a doctor-engineer degree in 1983 from the University of Rennes I. His initial research interests were in 3D medical imaging and PACS. He participated in pioneering PACS projects in France, as well as in the EurlPACS/MIMOSA European project (Medical Image Management in an Open System Architecture) in the early nineties. Since 2000, his contributions focus on the use of ontologies and semantic web technologies in biomedical research, towards applications for image processing, integration of heterogeneous data, simulation, and more recently in the area of surgical process models.

Program: 20th June, 2016

09:00 - 09:15	Opening	Lena Maier-Hein Stefanie Speidel Pierre Jannin
09:15 - 09:50	Medical Keynote I Surgical Data Science for Cognition-guided Surgery	Markus W. Büchler Heidelberg University
09:50 - 10:50	Short Talks of Participants	
	Perspectives on Surgical Data Science	S. Swaroop Vedula, Masaru Ishii, Gregory Hager Johns Hopkins Uni- versity, Johns Hopkins Medicine
	Surgical Data Analysis for Decision Making Support and Knowledge Discovery in Deep Brain Stimulation	Pierre Jannin, Yulong Zhao, Claire Haegelen Inserm, University of Rennes 1, University Hospital of Rennes
	What does it all mean? Capturing Semantics of Surgical Data and Algorithms with Ontologies	Darko Katic, Maria Maleshkova, Sandy Engelhardt, Ivo Wolf, Keno März, Lena Maier-Hein, Marco Nolden, Martin Wagner, Hannes Kenn-gott, Beat Müller-Stich, Rüdiger Dillmann, Stefanie Speidel Karlsruhe Institute of Technology, German Cancer Research Center (DKFZ), Heidelberg University
	Modeling of Surgical Workflow in Transcatheter Aortic Valve Implantation Procedures	Stamatia Giannarou, Herbert De Praetere, Guang-Zhong Yang Imperial College Lon- don, University Hospital Leuven

<p>Bringing Data-Driven Process Analysis into Surgical Practice – the Surgical Process Analyzer</p>	<p>Martin Wagner, Tobias Weller, Lena-Marie Ternes, Rudolf Rempel, Darko Katic, Stefanie Speidel, Maria Maleshkova, York Sure-Vetter, Beat Müller-Stich, Hannes Kenngott Heidelberg University Hospital, Karlsruhe Institute of Technology</p>
<p>Evaluation of Structured Learning Algorithms for the Prediction of Clinical Workflows</p>	<p>Klemens Birnbaum, Andreas Boehm, Thomas Neumuth Innovation Center Computer Assisted Surgery, Leipzig University Hospital</p>
<p>Generalized Ontology Modelling for Integration of Heterogeneous Patient-individual Data</p>	<p>Guido Schmidt, Keno März, Matthias Eisenmann, Maximilian Knoll, Mohammedreza Hafezi, Nassim Fard, Ali Majlesara, Sepehr Abbasi, Maria Maleshkova, Darko Katic, Stefanie Speidel, Arianeb Mehrabi, Lena Maier-Hein German Cancer Research Center (DKFZ), Heidelberg University, Karlsruhe Institute of Technology</p>
<p>10:50 - 11:05</p>	<p>COFFEE BREAK</p>
<p>11:05 - 11:35</p>	<p>Brainwriting on Surgical Data Science</p>

11:35 - 12:00	Technical Keynote I Surgical Data Science: Computational Challenges and Future Opportunities	Gregory Hager Johns Hopkins University
12:00 - 13:00	LUNCH	
13:00 - 13:35	Medical Keynote II The Operating Room: the Least Understood "High Stakes" Work Space	Adrian Park Anne Arundel Medical Center, Johns Hopkins University
13:35 - 14:35	Short Talks of Participants	
	Learning based Endovascular Skill Modelling, Training and Assessment	Wenqiang Chi, Jindong Liu, Hedyeh Rafii-Tari, Christopher Payne, Colin Bicknell, Guang-Zhong Yang Imperial College London, Harvard University
	Skill Analysis in Fetal Surgery: Motion Analysis and Eye Gaze Tracking	Francisco Vasconcelos, Evangelos Mazomenos, Donald Peebles, Sebastien Ourselin, Danail Stoyanov University College London
	Multi-modal Objective Skill Assessment in Transesophageal Echocardiography	Evangelos Mazomenos, Francisco Vasconcelos, Jeremy Smelt, Marjan Jahangiri, Bruce Martin, Andrew Smith, Susan Wright, Danail Stoyanov University College London, St George's University Hospitals, St Bartholomew's Hospital

	Is Indecisiveness Linked to Hand Movements in Performing Laparoscopic Ventral Hernia Repair?	Hossein Mohamadipannah, Chembian Parthiban, Lakita Maulson, Shlomi Laufer, Drew Rutherford, Katherine Law, Shannon DiMarco, Carla Pugh University of Wisconsin
	Surgical Process Modelling for Procedural Skill Assessment	Germain Forestier, Pierre Jannin University of Haute-Alsace, Inserm, University of Rennes 1
	Radiation Safety in Tomorrow's Hospital	Nicolas Loy Rodas, Michel de Mathelin, Nicolas Padoy University of Strasbourg
	Towards Semantic Simulation for Patient-Specific Surgery Assistance	Nicolai Schoch, Stefanie Speidel, York Sure-Vetter, Vincent Heuveline Heidelberg University, Karlsruhe Institute of Technology
14:35 - 15:05	Brainwriting on Surgical Data Science with coffee	
15:05 - 15:30	Technical Keynote II Semantic Models and Ontologies in Surgical Data Science	Bernard Gibaud Inserm, University of Rennes 1
15:30 - 18:00	World Café on Surgical Data Science	
18:00 - 18:30	Plenum Discussion	
18:30	RECEPTION	

