UNIVERSITÄT LEIPZIG

Faculty of Medicine

ICCAS

#SMART_OR

#HYPER_SPECTRAL_IMAGING

#WORKFLOW   #MR_GUIDED_INTERVENTIONS

#FOCUSED_ULTRASOUND

#MEDICAL_TECHNOLOGIES_MADE_SMART

#ROBOTICS   #MODELBASED_MEDICINE

#PERSONALISED_MEDICINE

#LIFE_SUPPORT_SYSTEMS
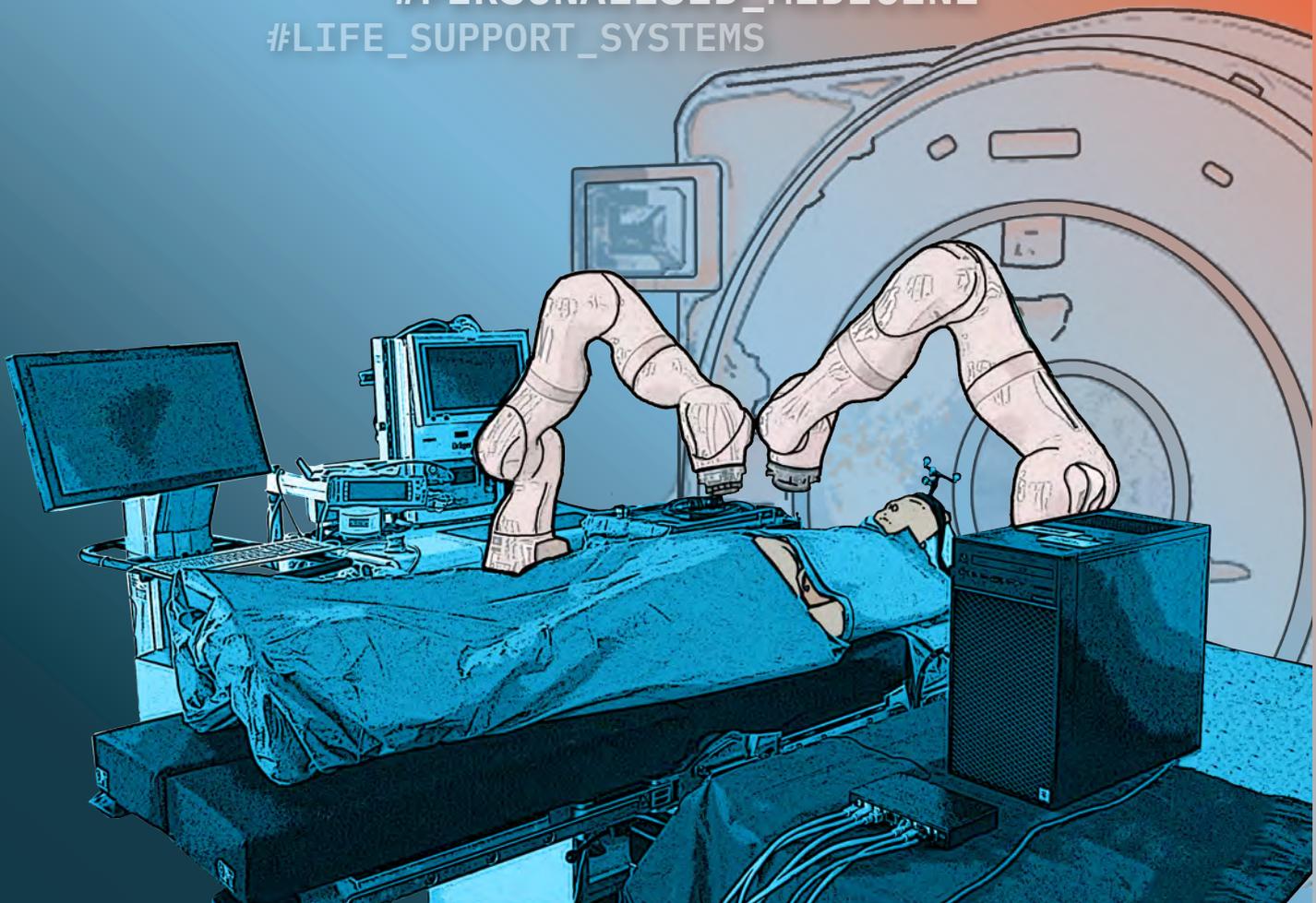
ICCAS #ANNUAL_REPORT.2019

INNOVATION CENTER COMPUTER ASSISTED SURGERY

CONTENTS

#PREFACE

Dear Ladies and Gentlemen,

In 2019 the total number of ICCAS employees increased from 77 to 82. Due to the significant size ICCAS has received, we decided to create two joint divisions Computer-Assisted Interventions and Model-Based Medicine. They are working interrelated and closely together towards the greater goal of the ultimate intelligent hybrid operating room for smart medical technologies in surgical and interventional care.

Six new projects were launched with a total value of more than eight million euros. Two new BMBF projects began in the field of MR guided interventions, focusing on stent implantation and thrombosis treatment. There were notable developments in the IMPACT and SONO-RAY BMBF projects, with preclinical studies being carried out. In the field of hyperspectral imaging, there was remarkable success in clinical application together with the Department of Visceral Surgery. The results of the MoVE project were presented at MEDICA. The newly developed Service-Oriented Device Connectivity (SDC) family of standards, in whose development ICCAS was involved, were presented by OR.Net e.V. at the DMEA. ICCAS showcased its results at its own exhibition stands, including at the BMWi's Innovation Day for SMEs, at SMIT and the BMT, and at the EUFUS and ISTU joint symposium in Barcelona.

Numerous ICCAS events offered networking opportunities and brought current research topics into focus. In March, regional companies and authorities met for a university transfer event at ICCAS. ICCAS also organized a doctoral workshop on the medical campus and the 6th international Digital Operating Room Summer School which attracted participants from five nations. In October, we discussed the application of artificial intelligence applications with the Chairman of the German Ethics Council at the University Hospital. Furthermore, ICCAS was visited by international delegations as part of university exchange programs as well as by Rafael Laguna de la Vera, founding director of the Leipzig-based German Agency for Disruptive Innovation (SprinD).

A great success is the continuation of our research center as an institute at the Leipzig University's Faculty of Medicine, which is now planned for 2020.

We would like to thank everyone involved for the successful year 2019 and are already looking forward to the new year. One highlight will be the BMT 2020 in Leipzig, to which we cordially invite you.

Prof. Dr. Andreas Melzer   Prof. Dr. Thomas Neumuth

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Fotograf: Swen Reichhold
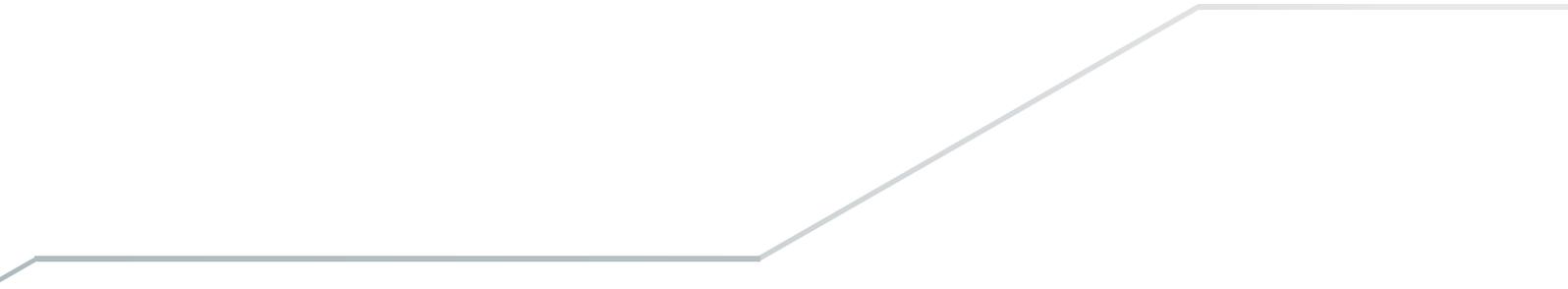
#FOREWORD BY
THE DEAN

Congratulations! This year the Innovation Center for Computer-Assisted Surgery celebrates its fifteenth anniversary. I congratulate the ICCAS Board and the entire team of researchers, clinicians and staff who have made this milestone possible. Founded in 2005 as a 'Centre for Innovation Competence', ICCAS started out with two research groups and over time developed into an innovative research centre with six different specialisations. Over the past 15 years, it has attracted some 45.8 million euros in external funding and generated around 600 publications. Today ICCAS enjoys a national and international reputation as a research centre at Leipzig University.

With its unique focus, this research centre boasts a number of features that make it stand out from the crowd: ICCAS develops various digital technologies for clinical settings; it is an interface between research and application, thus promoting interdisciplinary collaboration between medical professionals, computer scientists and engineers; and it also addresses issues of social relevance, such as how artificial intelligence can be put to efficient use in healthcare. ICCAS is an established and certified partner for medical engineering companies. Its research findings facilitate the work of clinical personnel, increase treatment safety and lead to more economical processes in everyday clinical practice. ICCAS supports the medical disciplines in meeting the current challenges of digitisation and raises their profile at state, federal and international level. The Minister President of Saxony, Germany's Federal Minister of Health, and the European Commissioner for Humanitarian Aid and Crisis Management have all visited ICCAS, where they found out about the current state of research.

Research findings are transferred via clinical departments, teaching and research institutions in cooperation with numerous partners at national and international level. ICCAS is thus an integral part of Leipzig's wider University Medical Centre, which boasts around 50 institutes, divisions and departments. As the largest educational institution for medicine and pharmacy in Saxony, our faculty also makes an important contribution to teaching with the doctoral workshops and summer schools run by ICCAS.

My sincere thanks go to all those involved who, with their tireless effort, personal dedication and thirst for research, have all contributed to this successful performance. This includes our partners in the scientific community as well as those from politics and industry. Looking ahead, I hope that ICCAS will be involved in a wide range of new research projects, all with the aim of ensuring the well-being of patients.

Professor Michael Stumvoll
Dean of the Faculty of Medicine

#INSTITUTIONAL FACTS

2009
- ICCAS colloquium on Computer Assisted Surgery launched
- Establishment of the IRDC – ICCAS as a pioneer and cooperation partner

2010
- Surgical Planning Unit (SPU) opens
- ICCAS teams up with HTWK Leipzig – establishment of the Innovation Surgical Training Technology (ISTT) under professorship of Werner Korb
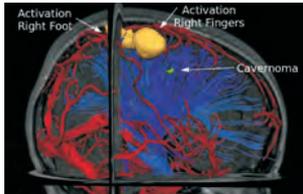
2011
- ICCAS participates in the DICOM WG24 group
- ICCAS's demo OR 2.0 opens
- RESEARCH AREAS: Model-Based Automation and Integration (Dr. Thomas Neumuth) and Standards (Prof. Heinz U. Lemke)
- Advisory Board founded

2012
- ICCAS starts academic courses at HTWK
- RESEARCH AREA – Digital Patient Model (Dr. Kerstin Denecke) starts

2013
- TPU including 'oncoflow' launched at Leipzig University Hospital
- PascAL (Patient Simulation Models for Surgical Training and Teaching) – research project by Leipzig University and HTWK Leipzig
- ICCAS plays a key role in the national BMBF research project 'OR.Net – Safe and Dynamic Networks in the Operating Room'
- Honorary Professorship of Biomedical Information Systems at the HTWK Leipzig: Thomas Neumuth
- Project 'HWS – Structural Defect Classification and Modeling of the Cervical Spine' in cooperation with the Institute of Anatomy (Leipzig University) and the Fraunhofer IWU, Dresden
- Researcher exchange programs with University of Southern California, ARTORG Center for Biomedical Engineering Research (University of Bern) and Fraunhofer MEVIS in Bremen

2014
- Prof. Andreas Melzer joins ICCAS as Director as well as professor of computer assisted surgery
- IT Innovation Award for 'oncoflow'
- First Digital Operating Room Summer School – DORS 2014

2015
- Launching of cooperation with several scientific and clinical institutions
- Tenth anniversary of ICCAS with second DORS and ICCAS International Symposium
- Project OR.Net: Presentation of results in the complete demonstrator
- NEW RESEARCH AREAS: Noninvasive Image Guided Interventions (Prof. Andreas Melzer), Multimodal Intraoperative Imaging (Dr. Claire Chalopin)
- Clinical Advisory Board founded
- New Advisory Board members: Prof. Ron Kikinis and Prof. Günter Rau
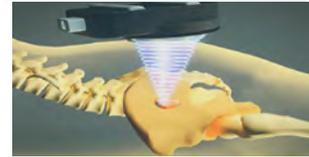
2016
- Final presentation of the flagship project OR.Net
- ICCAS receives ISO 13485 certification
- Federal health minister visits ICCAS
- 3rd Digital Operating Room Summer School – DORS 2016
- Project start of Meta-ZIK SONO-RAY

2017
- ICCAS meets Federal Chancellor Angela Merkel at Digital Summit 2017
- 4th Digital Operating Room Summer School consolidates its unique feature
- EUFUS 2017 & Preconference Workshop Experimental FUS and HIFU take place in Leipzig
- Successful non-invasive treatments with HIFU at Leipzig University Hospital
- RESEARCH AREA Life Support Systems with projects IMPACT and EMU launches
- Start of projects European Modular Field Hospital, PAPA-ARTIS and MoVE
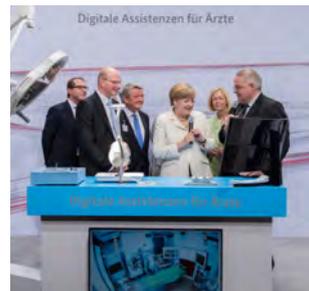
2018
- ICCAS welcomes Saxony's Prime Minister Michael Kretschmer
- 5th Digital Operating Room Summer School inspired international participants
- ICCAS takes part at the Surgical Robot Challenge of the Hamlyn Symposium in London
- ICCAS hosts Steering Committee Meeting of the European Modular Field Hospital project
- ICCAS invites to the 17th Annual Conference of the CURAC-Society
- Launch of projects: ENSEMBLE, COMPASS and LYSiS
- EU Commissioner for Humanitarian Aid & Crisis Management Christos Stylianides visits ICCAS

2019
- ICCAS organizes the 'FutureMedTechnologies' doctoral workshop and transfer meeting
- OR.Net e.V. presents the SDC-Standard at DMEA 2019
- 6th Digital Operating Room Summer School successfully performed
- ICCAS conducts a public discussion on AI in Medicine in the framework of the BMBF's Year of Science
- Launch of projects MR-Stents, MR Thrombosis, MOMENTUM and MPM

#FACTS AND FIGURES

HEADCOUNT
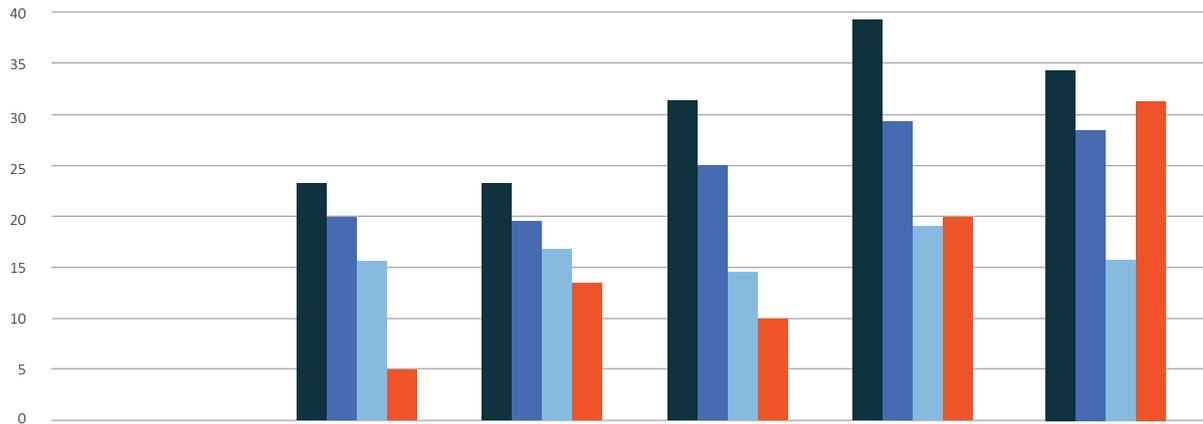
	2015	2016	2017	2018	2019
■ Research Associates	23	23	32	39	34
■ Research Associates (FTE)	20	19	25	29	28
■ Research Assistents	16	17	14	18	16
■ Guest Researchers	5	13	10	20	32

PUBLICATIONS
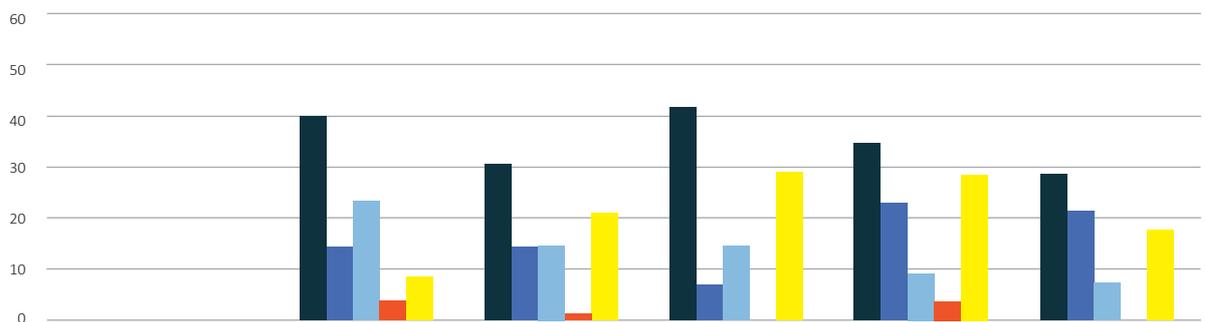
	2015	2016	2017	2018	2019
■ Total	40	31	42	35	28
■ First- and Senior Authorship	14	14	7	22	21
■ Co-Authorship	23	15	15	9	7
■ Book Chapters	3	2	0	4	0
■ Conference Proceedings	9	21	29	28	18

GRADUATIONS
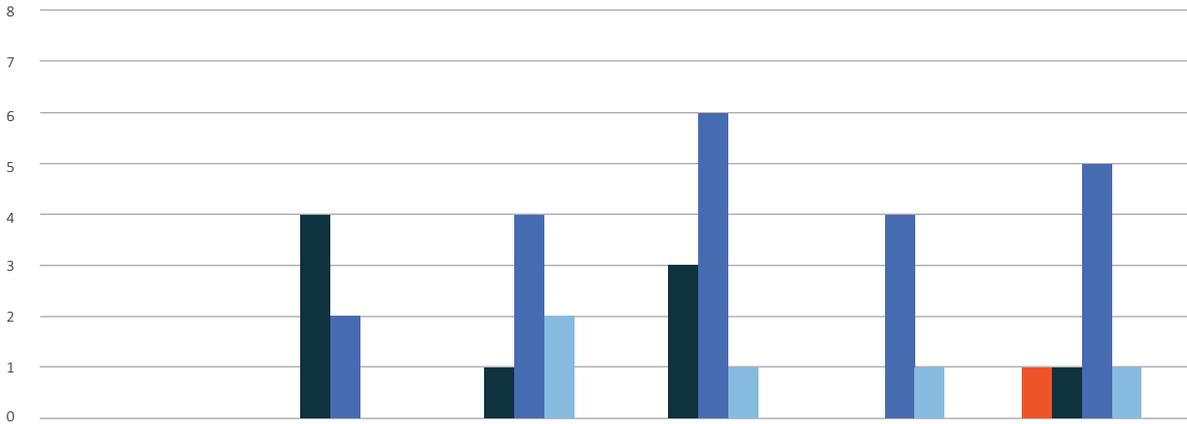
		2015	2016	2017	2018	2019
■	Habilitation	0	0	0	0	1
■	Doctoral theses	4	1	3	0	1
■	Master theses	2	4	6	4	5
■	Bachelor theses	0	2	1	1	1

FUNDING
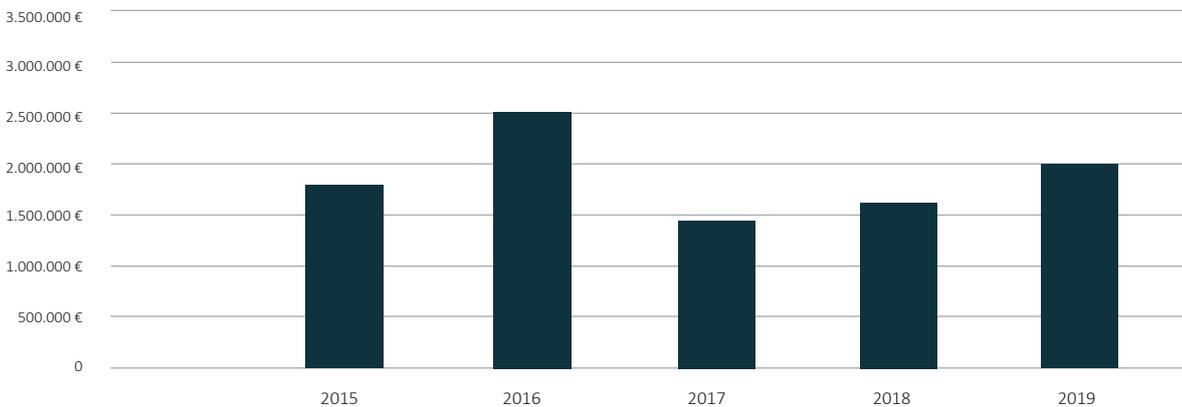
ICCAS's main funding is provided by the BMBF Federal Ministry of Education and Research. Further-more, ICCAS receives funding from the BMWi Federal Ministry for Economic Affairs and Energy for projects related to the ZIM Central Innovation Program for small and medium-sized enterprises. Leipzig University's Faculty of Medicine provides ICCAS with performance-based funding.

#SELECTED ACTIVITIES

HIGHLIGHTS

FMT-TRANSFERMEETING AT ICCAS | MARCH 2019

Leipzig University's Prorectorate for Development and Transfer and the Leipzig Chamber of Commerce and Industry invited to the FutureMedTechnologies (FMT)-Transfer Meeting at ICCAS. Representatives of regional companies, local municipalities and science gathered to explore ICCAS' research and find common interests.

© Leipzig University, Faculty of Medicine / Steffi Engel

Prorector Prof. Thomas Lenk opens the Transfer Meeting at ICCAS.

FMT-DOCTORAL WORKSHOP | MARCH 2019

In cooperation with the Economic Development Corporation of Leipzig City ICCAS hosted the FutureMedTechnologies (FMT) – doctoral workshop on the Leipzig medical campus. The event addressed regional companies with their products and job offers and PhD students, who presented their current research work.

© ICCAS

Award of the workshop's best presentations.

PUBLICATION OF THE SEOUL DECLARATION | APRIL 2019

Professor Andreas Melzer is co-editor of the ‚Manifesto for Ethical Medical Technology' published in the MITAT Journal, April 2019. The foundation for the declaration was laid with the presentation and signing during the SMIT 2018 conference in Korea. It should serve as an ethical guideline for the medical device development and appropriate clinical use.

© Young Woo Kim, SMIT President 2018

500 delegates signed 'The Seoul Declaration: A Manifesto for Ethical Medical Technology' at SMIT Conference 2018 in Seoul.

6TH DIGITAL OPERATING ROOM SUMMER SCHOOL – DORS | AUGUST 2019

Participants from 5 nations experienced an intensive training course during the sixth ICCAS Digital Operating Room Summer School (DORS). The guests were given a detailed look at the work of surgeons at the Leipzig University Hospital and Heart Center and were able to lend a hand in training modules.

© ICCAS

DORS-participants lend their hands on flexible endoscopy in visceral surgery.

VISIT OF ´SprinD AGENCY´
| AUGUST 2019

ICCAS welcomed the founding director of the Leipzig-based 'Agency for Disruptive Innovation (SprinD)' Rafael Laguna de la Vera to present the latest developments in medical technology and medical informatics.

© ICCAS

Director SprinD Rafael Laguna de la Vera in ICCAS' Intelligent OR.

PUBLIC DISCUSSION ON AI IN MEDICINE
| OCTOBER 2019

The chairman of the German Ethics Council Prof. Peter Dabrock, UCCL-Director Prof. Florian Lordick and Prof. Thomas Neumuth discussed together with Leipzig citizen about the use of Artificial Intelligence (AI) in medicine. The event took place within the framework of the BMBF-Year of Science.

© Leipzig University, Faculty of Medicine | Katharina Werneburg

The three experts Prof. Florian Lordick, Prof. Peter Dabrock and Prof. Thomas Neumuth (f.l.t.r.) in conversation with moderator Monika Seynsche.

PARTICIPATION IN FAIRS

DMEA 2019
| APRIL 9 – 11, BERLIN

Presentation of the new developed IEEE standard 'Service-oriented Device Connectivity' (SDC).

© OR.NET e.V. | Rajko Knobloch

BMWI INNOVATIONSTAG MITTELSTAND
| MAY 9, BERLIN

Exhibition booth on Hyperspectral Imaging-application.
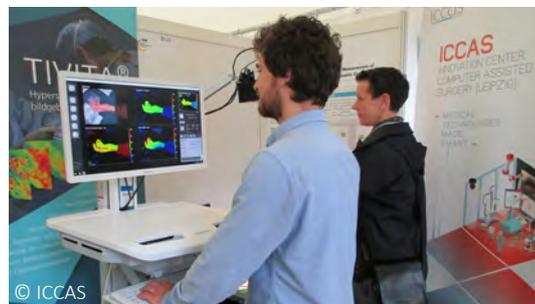
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ISTU / EUFUS JOINT SYMPOSIUM
| JUNE 12 – 15, BARCELONA (SPAIN)

SONO-RAY presents results on robot-assisted, MR-guided focused ultrasound hyperthermia .

© ICCAS

BMT 2019
| SEPTEMBER 25 – 26, FRANKFURT A. M.

IMPACT with an exhibition booth on the topic Electrical Impedance Tomography (EIT) for patient-specific visualization of lung function.

© ICCAS

SMIT 2019
| OCTOBER 10 – 13, HEILBRONN

Participation with scientific lectures, science slam presentations and a robot-demo.

© ICCAS

DIGITAL SUMMIT 2019
| OCTOBER 28, DORTMUND

Prof. Thomas Neumuth about AI-based digital platforms in research in an expert panel of industry and science.

© Plattform Lernende Systeme | Thilo Schoch

MEDICA 2019
| NOVEMBER 18 – 21, DÜSSELDORF

Exhibition booth on device networking and automated operating room.

© ICCAS

INHOUSE EVENTS

January 16, 2019

© ICCAS

Senior Academy of Leipzig University on excursion at ICCAS.

January 24, 2019

© ICCAS

ICCAS Status Seminar 2018 with opening words from the Medical Faculty Dean Prof. Dr. Christoph Josten.

February 20, 2019

© ICCAS

Kids from the UKL-holiday program MEFALE visited ICCAS.

November 11 – 19, 2019

©

ICCAS welcomed the Dean Mount Kenya Medical School, Dr. Juliet Gathera, for a job shadowing at ICCAS.

PROJECT LAUNCHES

MR-STENTS AND MR-THROMBOSIS

The two BMBF-funded projects started in early 2019. Aim of the project MR-Stents is the worldwide first Magnetic Resonance (MR)-guided stent implantation. The project MR-Thrombosis-Theranostics deals with the research and development of the worldwide first Magnetic Resonance (MR)–guided diagnosis and minimially-invasive therapy of thromboses. Principal investigator is Prof. Andreas Melzer.

MOMENTUM

In the BMBF-funded joint project, suitable concepts for the continuous integration of innovative networking technologies in emergency care and accident medicine will be developed and evaluated to improve treatment processes from the place of use to the hospital. ICCAS is the project coordinator. The kick-off meeting took place at ICCAS in November 2019. Principal investigator is Prof. Thomas Neumuth.

© ICCAS

The MOMENTUM partners at the kick-off meeting in Leipzig

MPM

In December, ICCAS launched the BMBF-funded project Models for Personalized Medicine (MPM). The aim is to create a scientific-methodological basis for future model-based, personalized cancer treatments in close cooperation with regional industry partners and clinical users. Principal investigator is Prof. Thomas Neumuth.

#HONORS AND AWARDS

DR. CLAIRE CHALOPIN successfully completed her habiliation process. Her postdoctoral thesis deals with the technical development of intraoperative 3D ultrasound with contrast medium and dynamic infrared thermography (DIRT) for neurosurgery.

She has been appointed member of the scientific advisory board of the newly founded EU-Sano Centre for Computational Personalised Medicine in Krakow (Poland).

PROF. DR. ANDREAS DIETZ has been elected President of the German Society for Otolaryngology, Head and Neck Surgery (DGHNO). He will chair the Society for one year.

JAN GAEBEL won the poster prize at the 15th Leipzig Research Festival for Life Sciences 2019 in the category Computer Assisted Surgery for his work on 'Integrated System Architecture for Model-Based Decision Support in ENT'.

MARIANNE MAKTABI won the poster prize at the joint conference of the societys: 'Mitteldeutsche Gesellschaft für Gastroenterologie' (MGG) and 'Mitteldeutsche Chirurgenvereinigung' (MDCV) for her work on 'Hyperspectral Imaging during esophagectomy for the measurement of ischemic conditioning effects of the gastric conduit'.

PROF. DR. ANDREAS MELZER was elected a fellow of the British 'Academy of Medical Sciences'. The Academy is an independent institution in the United Kingdom representing the diversity of medical science.

He has been appointed visiting professor by the National Cancer Center Graduate School of Cancer Science and Policy in South Korea.

JULIANE NEUMANN received the best paper award of the Future-Med-Technologies doctoral workshop for her work on optimizing work processes in operating rooms.

C. Martin Reich took second place at the science slam of the congress of the international Society for Medical Innovation and Technology (iSMIT) in Heilbronn. He amusingly showed the expert audience what is all about 'The Sexiness of MRI-guided Interventions'.

#RESEARCH DIVISIONS
AND RELATED RESEARCH AREAS

#LIFE_SUPPORT_SYSTEMS

#INTRAOPERATIVE_MULTIMODAL_
IMAGING

#ROBOTICS

Interrelated divisions: #Computer_Assisted_Image_Guided Interventions
#Model_Based_Automation_and_Intelligent_OR

#MODEL_BASED_AUTOMATION

#DIGITAL_PATIENT_MODEL

#IMAGE_GUIDED_FOCUSED_ULTRASOUND

#MR_GUIDED_INTERVENTIONS

ICCAS

DIVISION
#COMPUTER_ASSISTED_IMAGE_GUIDED INTERVENTIONS

Research in the division of image-guided interventions focuses on new technologies in the field of MRI-guidance to enable minimally and non-invasive procedures for patient-friendly diagnosis and treatment. In addition to improved soft tissue contrast, advantages of MRI include the absence of iodine-containing contrast agents and ionizing radiation. The project work aims to develop innovative MR-compatible instruments, investigate suitable medical workflows with restricted patient access and communication in the MR environment. Application of focused ultrasound, transfer of minimally invasive catheter intervention and robotic assisted procedures are established and evaluated.
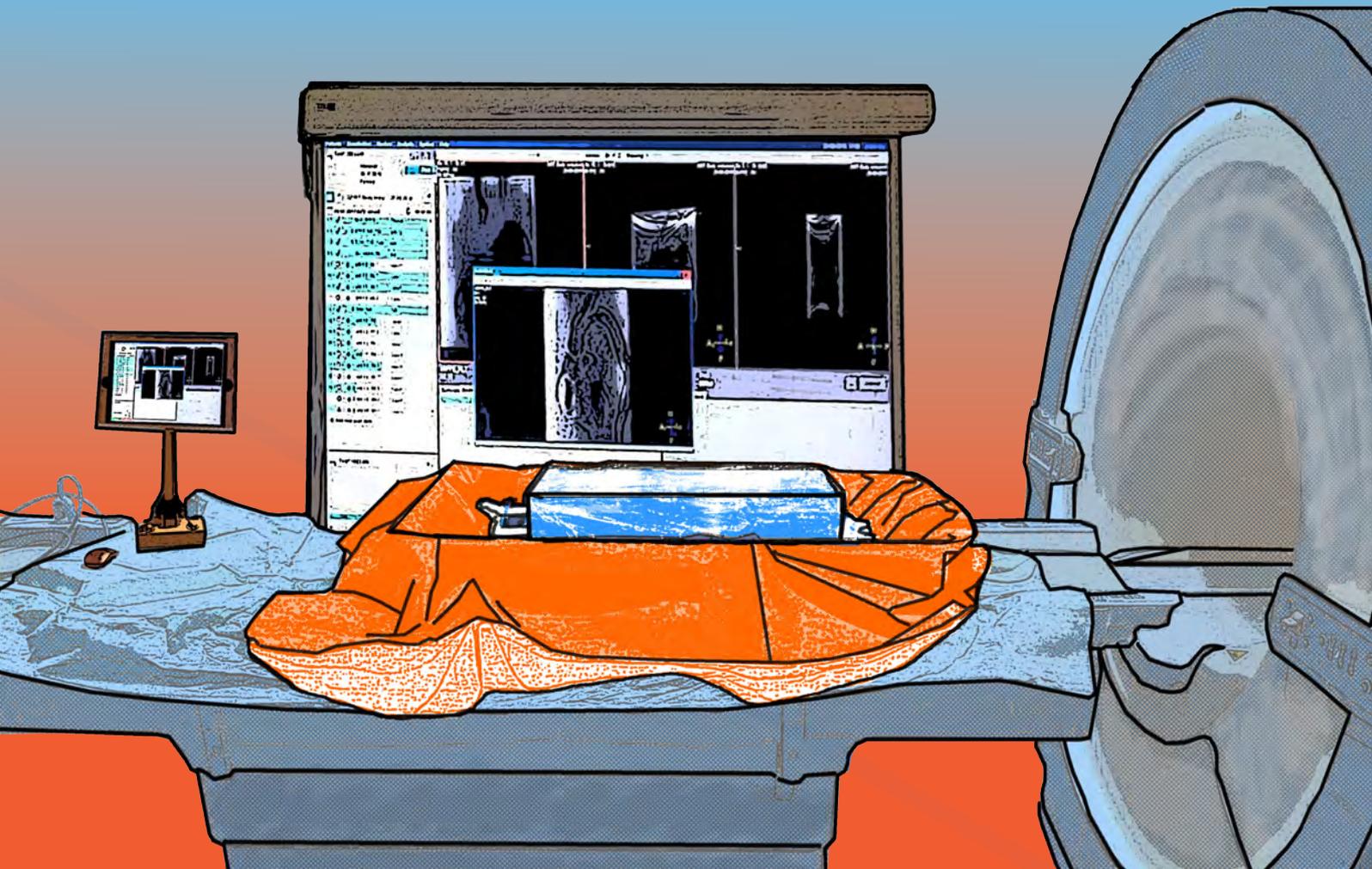
DIVISION LEADER
Prof. Dr. Andreas Melzer

´ICCAS researches on new technologies for computer-assisted image-guided procedures. This theme is a logic development of the traditional ICCAS research on computer-assisted surgery towards less invasive image-guided interventions.´

SCIENTIFIC STAFF

Nikolaos Bailis, Johann Berger, Julian Donig, Denis Gholami Bajestani, Felix Girrbach, Erwin Immel, Lisa Landgraf, Andreas Melzer, Ina Patties, Annekatrin Pfahl, C. Martin Reich, Upasana Roy, Andreas Seifert

SELECTED PUBLICATIONS

- Karakitsios I, Mihcin S, Melzer A. Reference-less MR thermometry on pre-clinical thiel human cadaver for liver surgery with MRgFUS. Minimally Invasive Therapy & Allied Technologies. 2019; 28(1): 15-21.

- Berger J, Unger M, Landgraf L, Melzer A. Evaluation of an IEEE 11073 SDC Connection of two KUKA Robots towards the Application of Focused Ultrasound in Radiation Therapy. Current Directions in Biomedical Engineering. 1. September 2019; 5(1): 149–52.

- Köhler H, Jansen-Winkeln B, Maktabi M, Barberio M, Takoh J, Holfert N, Moulla Y, Niebisch S, Diana M, Neumuth T, Rabe SM, Chalopin C, Melzer A, Gockel I. Evaluation of hyperspectral imaging (HSI) for the measurement of ischemic conditioning effects of the gastric conduit during esophagectomy. Surg Endosc. November 2019; 33(11): 3775–82.

DIVISION
#COMPUTER_ASSISTED IMAGE_GUIDED INTERVENTIONS

SCIENTIFIC RESEARCH AREAS AND RELATED PROJECTS:

#IMAGE_GUIDED_FOCUSSED_ULTRASOUND:

- SONO-RAY | Tumor Therapy Combined by MR-Guided Focused Ultrasound and Radiation Therapy |Founding: META-ZIK of the Federal Ministry of Education and Research (BMBF)

- CURE-OP | Oncological Therapy Platform for Combined Ultrasound Radiation Therapy | Founding: Federal Ministry of Education and Research (BMBF)

- Imaging Robotics | Concepts for Robotic-guided Focused Ultrasound Hyperthermia and Radiation Therapy in the Clinic | Founding: Saxony's Ministry for Sciences and Arts (SMWK)

#MR_GUIDED_INTERVENTIONS:

- MR-Biopsy | MR Safe Flexible Biopsy Forceps for Minimally Invasive Tissue Sampling | Founding: Federal Ministry of Education and Research (BMBF)

- MR-Thrombosis | MR-guided Minimally-invasive Diagnostics and Therapy of Thrombosis | Founding: Federal Ministry of Education and Research (BMBF)

- MR-Stents | MR-Guided Stent-Implantation |Founding: Federal Ministry of Education and Research (BMBF)

- MRgFUS in the Treatment of Uterine Fibroids – collaborative project with UKL

- MRgLIFUP | Neuromodulation Induced by Transcranial Focused Ultrasound (tFUS) Measured with EEG – collaborative project with Max-Planck-Institute and Fraunhofer IBMT
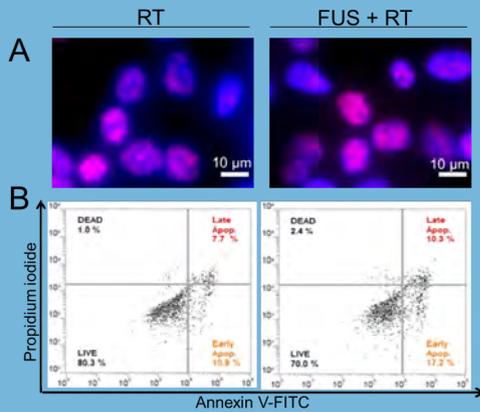
Impact of FUS and RT treatment on prostate cancer cell line PC-3 72 h after intervention. (A) DNA double strand breaks stained in magenda. Blue nucleus. (B) Apoptosis level detected via flow cytometry.
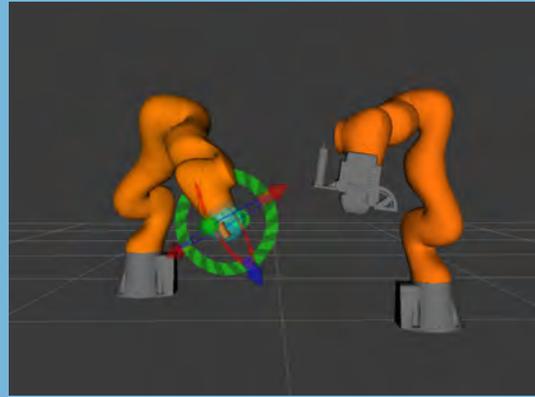
Concept for clinical translation of FUS and RT. Two Kuka robotic arms holding therapeutic transducer and imaging transducer.

SONO-RAY PROJECT: FOCUSED ULTRASOUND (FUS) COMBINED WITH RADIATION THERAPY (RT) TO IMPROVE RADIOONCOLOGICAL TREATMENTS

The Sono-Ray project, a joint project of ICCAS (Leipzig) and OncoRay (Dresden) funded by BMBF, started in October 2016 to investigate effects of focused ultrasound (FUS) at the molecular level of cancer cells with the goal to radiosensitize tumor cells by mild heating with low intensity FUS to improve the radiation treatment. FUS describes a unique technique using ultrasound beams to heat a target tissue inside the body in a non-invasive way via image-guidance and quantifiable temperature control in real-time due to magnetic resonance thermometry. Therefore, low intensity FUS displays for the first time a tool to heat only the target region avoiding tissue necrosis and without needle incsision or heating of sourounding tissue structures.

Intensive analysis on in vitro 2D cell cultures started and different in vitro systems for high troughput FUS treatment ultrasound pene-trable 96-well cell culture plates were developed in cooperation with Fraunhofer IBMT (St. Ingbert). Prostate cancer cells, glioblasto-ma and head and neck cancer cell lines were treated with FUS and RT using in vitro systems and the effects on metabolic activity, DNA damage, cell cycle and the apoptotic levels

were determined. To realize the treatment in a small animal model, all steps towards the MRI-guided FUS and CT-guided RT were full-filled in strong coopertaion with Fraunhofer IZI (Leipzig). A dedicated MR-compatible FUS in vivo system was installed into a 7T Bruker preclinical MRI and tested. To control the temperature during the FUS intervention, PRF based MR-thermometry was evaluated in the preclinical MRI to run in parallel to the FUS treatment.

In vitro results showed a significant reduction in the metabolic activity in the prostate cancer cell line PC-3 three days after the FUS and RT combination treatment with a higher apop-tosis level, increased amount of DNA double strand breaks and more cells in Sub-G1 cell cycle phase indicating the induction of pro-grammed cell death while avoiding necrosis. First in vivo experiments demonstrated the feasibility of MRI-guided moderate heating at low FUS intensities in tumro xenografts. The reduction of potential hypoxia and decrease in tumor growth after FUS and RT will be in-vestiagted in 2020.

To conclude, radiosensitizing events of low intensity FUS at moderate temperatures in a range of 41-46°C could be demonstrated in vitro in prostate cancer cells, currently indica-ting dependence on the cancer cell indentity. Further in vivo experiments are needed to pro-ve our in vitro findings and verify the imapct

Prototypical system consisting of a Kuka LBR iiwa robotic arm with the treatment head attached.

The setup of two KUKA lbr iiwa 7 R800 robot arms (KUKA AG, Augsburg) in the demonstrator OR at ICCAS Leipzig. Robots connected with IEEE 11073 SDC standard.

of FUS on tumor hypoxia and perfusion. Regarding the clinical translation of a combined FUS and RT treatment, first steps were realized by implementing robotic solutions with two Kuka robotic arms to hold one therapeutic and one imaging transducer. Furthermore, the integration of FUS into the radiation room led to the EUROSTARS project CURE-OP in cooperation with the french company Theraclion which launched in January 2019.

CURE-OP - COMBINATIONAL ULTRASOUND AND RADIOTHERAPY ENHANCED ONCOLOGY PLATFORM

The aim of CURE-OP is to develop the first commercially available high intensity focused ultrasound (HIFU) platform specifically designed for combinational cancer therapy. ICCAS will develop a robotic system that can deliver a broad range of ultrasound regimes (hyperthermia, thermal ablation, and cavitation) enabling different types of cancer polytherapy.

A Kuka LBR iiwa robotic arm was combined with Theraclions HIFU treatment head. ICCAS is developing motion algorithms to ensure a stable acoustic coupling of the treatment head.

For the integration of the CURE-OP hardware into a radiotherapy facility, the current workflow was recorded during a site visit at the department of radiooncology of the University of Leipzig Medical Center.

IMAGING ROBOTICS

The robotics group at ICCAS aims for the integration of collaborative robotic systems into the clinical domain. The collaborative aspects of such systems (direct interaction with the robots during autonomous movement) provide promising interaction and workflow concepts that reduce complexity and ease the handling of the robots during surgical tasks. The main research focus lies on the development of an integrated platform for an interconnection of collaborative robotics with other medical devices. Using the IEEE 11073 SDC standard for medical device connectivity, a first demonstrator with two KUKA lbr iiwa 7 R800 robot arms and an augmented reality based tablet application was implemented. The system is currently under evaluation for the use case of different therapeutic and imaging ultrasound regimes in the projects Sono-Ray and Cure-OP.
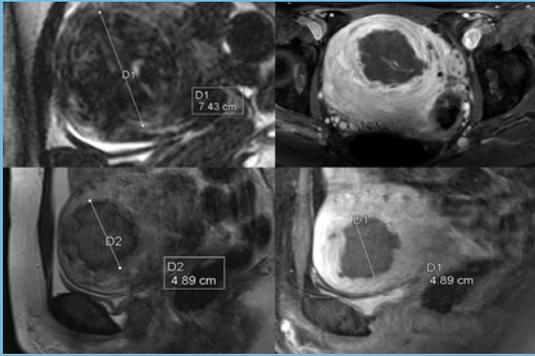
Diagnostic T2-weighted- and contrast-enhanced- MR- images before, immediately and 6 months after MR-HIFU of a 39-year-old patient with a big intramural fibroid and hyper-/ dysmenorrhea. Volume reduction and complete absence of symptoms 6 months after HIFU treatment was achieved, although the fibroid was not to 100% ablated (71% NPV).

Custom-made ultrasound system (Fraunhofer IBMT) that can be synchronized with EEG recordings

MR-GUIDED FUS IN THE TREATMENT OF UTERINE FIBROIDS

Since 2017, we have successfully established a fibroid- treatment- center in our hospital (Leipzig University Hospital). Our aim is to provide an optimized individual treatment to patients with symptomatic uterine fibroids, offering all modern therapy options including MR-g-HIFU (Profound medical Sonalleve MR-HIFU System). To date, over 130 patients have been screened and with 26 of them recieving a MR-HIFU-Treatment. The patients were treated in a clinical setting, under analgesia and sedation. All patients were discharged on the next day after treatment without any significant complaints. Symptom control was accomplished for the majority of the patients and 2 successful pregnancies were also achieved. In addition, a multisession HIFU-Treatment of an extensive desmoid tumor of the thoracoabdominal wall has taken place with satisfying symptom reduction.

NEUROMODULATION INDUCED BY TRANSCRANIAL FOCUSED ULTRASOUND (TFUS) MEASURED WITH EEG

Previous studies suggested that tFUS could be used to non-invasively modulate neuronal activity in humans (Legon et al. 2014). Poten-tially, such modulation of brain activity allows therapeutic applications (e.g. stroke, addiction, Parkinson). We used a custom-made ultrasound system (Fraunhofer IBMT) that can be synchronized with EEG recordings. This device allows to adjust the focus depth, and thus to position a focal ultrasound spot in a given volume with high spatial accuracy. Our preliminary data acquired with four scalp electrodes shows a differential modulation of EEG activity depending on the stimulation depths, i.e. synchronization for focus 30 mm, desynchronization for 100 mm. Currently, an experimental trial is in progress, with denser EEG recordings to further validate our results.

MR SAFE FLEXIBLE BIOPSY FORCEPS FOR MINIMALLY INVASIVE TISSUE SAMPLING – MR-BIOPSY

Endomyocardial biopsy (EMB) is a procedure for diagnosis of tumor, acute myocarditis or transplant rejection. EMB is usually conducted using X-ray fluoroscopy implying unfavorable ionizing radiation, nephrotoxic contrast agents, and poor soft tissue contrast. Goal of the joint project MR-BIOPSY is to overcome these disadvantages by transfer of EMB procedures into the magnetic resonance imaging (MRI) environment. Therefore, a worldwide first MR safe, flexible biopsy forceps containing a combination of novel MRI and X-ray

In vitro model for experimental testing of MR guided minimally invasive interventions. Consisting of arterial vessel system (silicone) connected to porcine heart, embedded in gelatin.

Magnetic resonance (MR) interventional interaction setup at Nuclear Medicine Clinic of Leipzig Medical Center, which allows direct control of the scanner by the physician.

COMPUTER-ASSISTED IMAGE-GUIDED INTERVENTIONS

markers is developed. Feasibility of the intervention is ensured by development of a corresponding clinical workflow and conformity of the components with MR safety regulations like ASTM and ISO standards.

Performed investigations already shown the feasibility of a non-metallic, non-magnetic and non-conductive biopsy jaw. In the current step, metal-based passive markers combined with radiopaque particles are tested under fluoroscopy and real-time cardiac MRI sequences. To evaluate the visibility and usability in a realistic environment, a phantom consisting of a porcine heart connected to a life-size silicone model of a human arterial vessel system was manufactured.

MR-GUIDED STENT IMPLANTATION – MR-STENTS

Coronary heart disease and associated myocardial infarction is one of the main causes of death in Germany. The recommended therapy by the National Disease Management (NVL) guideline is minimally invasive catheter-guided stent implantation, which is usually performed using X-ray fluoroscopy. As a high risk group, children with congenital heart disease (e.g. coarctation of the aorta) are commonly treated by stent implantation. The aim of project MR-STENTS,

funded by 'KMU-innovativ: Medizintechnik' of the Federal Ministry of Education and Research (fund no. 13GW0288D), is to develop a MR-guided stent intervention. MR imaging offers a promising alternative to fluoroscopy guidance, benefitting from excellent soft tissue contrast, possibility of real-time imaging, as well as absence of ionizing radiation.

Novel MR markers are developed at ICCAS to visualize instruments during MR-guided stent implantation. These markers are based on resonant circuits and work with developed corresponding MR sequences. Additionally, a clinical workflow using a novel interaction setup is developed. This setup ensures real time control and communication during MR-guided interventions by the physician. In the further course of the project, the findings should serve as framework for treatment of additional use-cases like stenting of the esophagus, liver, and lung.

MR-GUIDED MINIMALLY INVASIVE DIAGNOSTIC AND THERAPY OF THROMBOSIS – MR-THROMBO-SIS-THERANOSTICS

Thrombi are clots resulting from intravascular blood coagulation – a protective mechanism of the human body. Blood clots disturb the physiological blood flow and can become
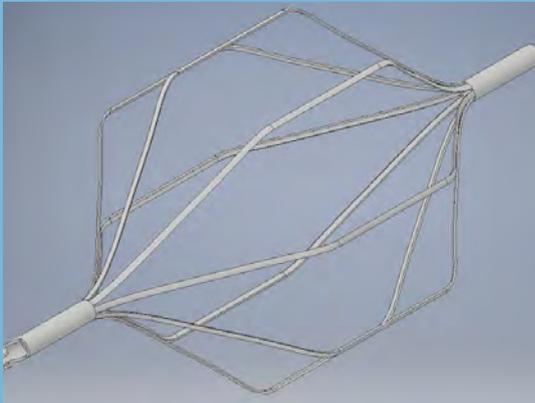
3D CAD model of a vena cava filter (VCF) suitable for interventions using magnetic resonance imaging (MRI). The design as resonant circuit allows additional visualization of trapped thromboembolisms.

3D model of arteriovenous vessel system including right side of human heart serving as framework for a silicone based in vitro model used for future investigations.

detached as thromboembolism. In worst the case this could lead, for example, to a life-threatening pulmonary embolism. Thrombosis can be treated by chemical, surgical or minimally invasive techniques. The latter is usually performed under X-ray-based fluoroscopy, using ionizing radiation and nephrotoxic contrast agents. Especially the usage of ionizing radiation bears certain drawbacks for both, medical staff and patients. Particularly, pregnant women and their unborn children could benefit from a translation of minimally invasive thrombosis therapy into the MR environment. MR-guided interventions would eliminate health hazards associated with X-ray guidance. Next to excellent soft tissue contrast, MR imaging offers the advantage of adjustable tissue weighting, real-time and temperature-sensitive imaging. These features can be used for visual acquisition of thromboembolisms trapped by implanted vena cava filters (VCF), and therefore lead to better decisions regarding the further course of the treatment. However, to ensure conformity with regulations regarding MR safety and biocompatibility, novel medical instruments and corresponding workflows need to be developed.

Goal of the joint project MR-Thrombosis-Theranostics is the investigation of a MR-guided medical intervention for the diagnosis and treatment of thrombosis. ICCAS focuses on diagnosis, minimally invasive therapy of thrombosis and implant based prevention of thromboem-

bolisms. Therefore, nitinol-based baskets and VCFs are developed using optimized manufacturing methods.

Nitinol baskets allow interventional removal of formed blood clots, whereas implanted vena cava filters prevent the migration of thromboembolisms. Both devices have to be designed and produced in a way to ensure MR safety and visibility. The targeted MR marker concept uses resonant circuits to locally enhance the MR signal, rather than the commonly used mechanism of disturbing artifacts caused by shielding properties. To ensure feasibility and sufficient visualization of the devices, suitable MR sequences and adjusted clinical workflows are developed.

In further course of the project, patient model studies using a silicone-based model of a human arteriovenous vessel system, including right side of the heart, are performed. Therefore, anonymous medical imaging data is segmented, 3D rendered and then used for an additive manufacturing process in order to create a realistic patient model.

COMPUTER-ASSISTED IMAGE-GUIDED INTERVENTIONS

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DIVISON
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Research in the division of model-based medicine pioneers the development of biomedical information systems which expand the functioning of current medical devices or create completely new support. Work is in progress on a ´smart´ operating theater adapted to the needs of surgeons. Goal is the qualitative and quantitative improvement of clinical workflows by advancing clinical efficiency and increasing patient safety. This also includes the development of non-invasive image-based assistance systems for new diagnosis and biomonitoring in emergency medicine.
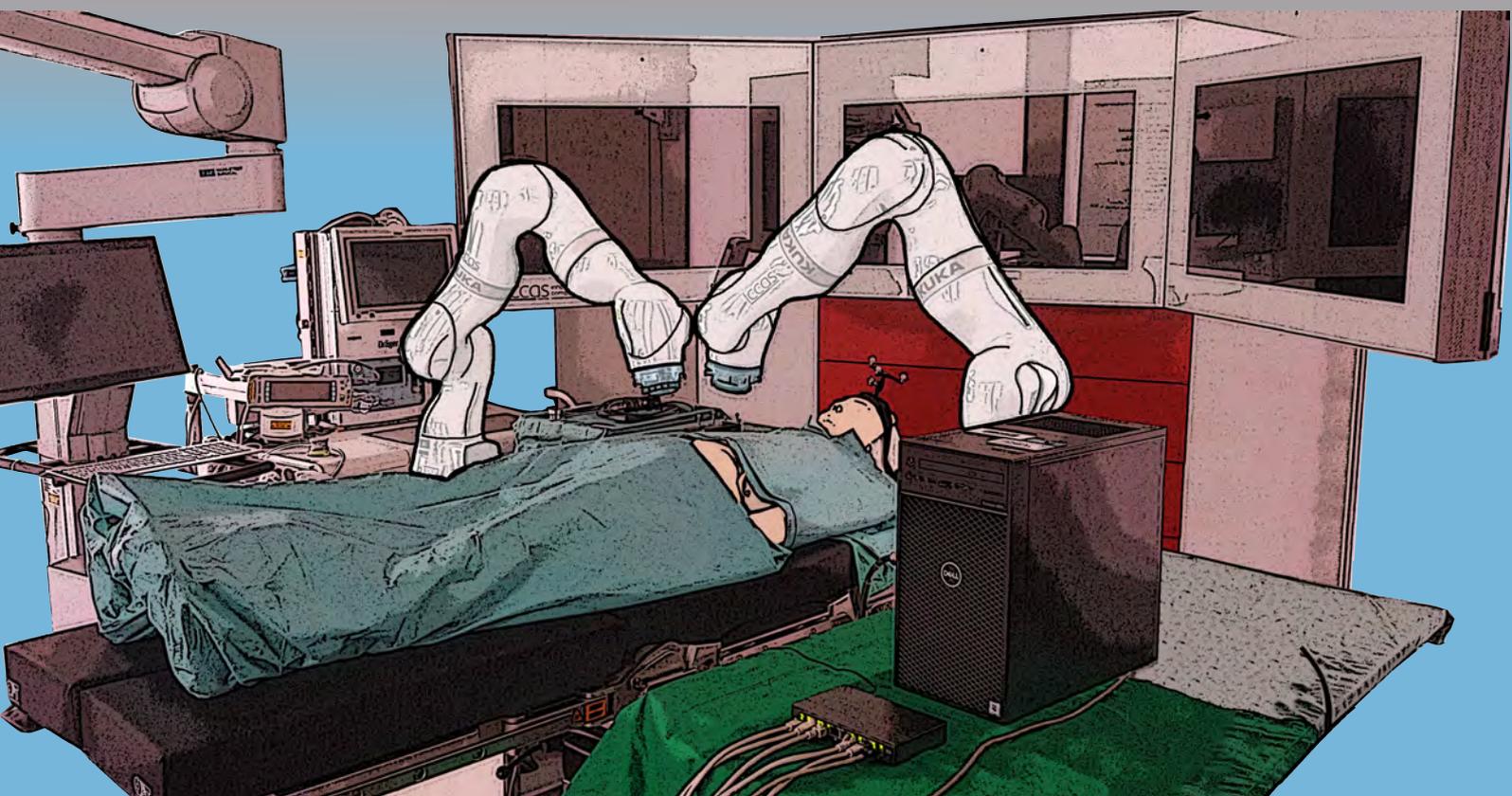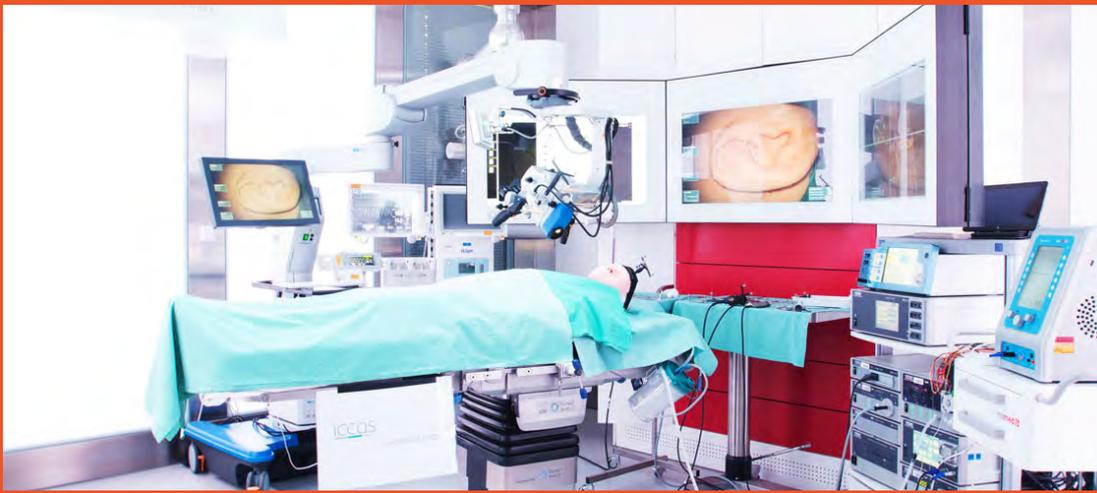
DIVISION LEADER
Prof. Dr. Thomas Neumuth

´Modern medicine is no longer conceivable without the use of technology: medicine, information management and biomedical technology converge to an ever greater extent. This development requires a combination of traditional medical devices.´

SCIENTIFIC STAFF
Richard Bieck, Claire Chalopin, Stefan Franke, Reinhard Fuchs, Jan Gaebel, Christoph Georgi, Hannes Köhler, Patrick Kongtso, Dirk Lindner, Marianne Maktabi, Tim Meschke, Julia Mrongowius, Juliane Neumann, Thomas Neumuth, Alexander Oeser, Max Rockstroh, Peter Salz, Dominic Schneider, Erik Schreiber, Michael Unger

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- Neumann J, Franke S, Rockstroh M, Kasparick M, Neumuth T. Extending BPMN 2.0 for intraoperative workflow modeling with IEEE 11073 SDC for description and orchestration of interoperable, networked medical devices. Int J Comput Assist Radiol Surg 2019; 14(8): 1403-1413.

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SCIENTIFIC RESEARCH AREAS AND RELATED PROJECTS:

#MODEL_BASED_AUTOMATION:
- MoVE | Modular Validation Environment for Medical Networks | Founding: Federal Ministry of Education and Research (BMBF)
- MOMENTUM | Mobile Medical Technology for Integrated Emergency Care and Accident Medicine | Founding: Federal Ministry of Education and Research (BMBF)
- COMPASS | Comprehensive Surgical Landscape Guidance System for Immersive Assistance in Minimally-invasive and Microscopic Interventions | Founding: Federal Ministry of Education and Research (BMBF)
- ENSEMBLE | Development of a scalable and magnetic resonance (MR)-compatible blood circulation model | Founding: Federal Ministry of Economic Affairs and Energy (BMWi) – ZIM-program

#DIGITAL_PATIENT_MODEL:
- Digital Patient- and Process Model | Founding: Federal Ministry of Education and Research (BMBF)
- PAPA-ARTIS | Paraplegia Prevention in Aortic Aneurysm Repair by Thoracoabdominal Staging with 'Minimally-Invasive Segmental Artery Coil-Embolization': A Randomized Controlled Multicentre Trial | Founding: European Union - H2020 - GA-Nr. 733203

#INTRAOPERATIVE_MULTIMODAL_IMAGING:
- AutoSon | Automatic Navigated Intraoperative Ultrasound Imaging for Brain Tumor Removal | Founding: Federal Ministry of Economic Affairs and Energy (BMWi) – ZIM-program
- LYSIS | Innovative Imaging for Tissue Differentiation in Minimally Invasive Surgery | Founding: Federal Ministry of Education and Research (BMBF) – KMU-Innovative program

#LIFE_SUPPORT_SYSTEMS:
- EU-MFH | European Modular Field Hospital | Founding: General Directorate for European Civil Protection and Humanitarian Aid – Operations: ECHO/SUB/2016/739964/PREP14
- IMPACT | Mobile System for Emergency Medical Diagnosis and Monitoring of the Pneumothorax | Founding: Federal Ministry of Education and Research (BMBF) – KMU-Innovative program
- EMU | Ventilation System with Electrical Impedance Imaging to Monitor Patient Condition and to Optimally Ventilate the Patient | Founding: Federal Ministry of Economic Affairs and Energy (BMWi) – ZIM-program
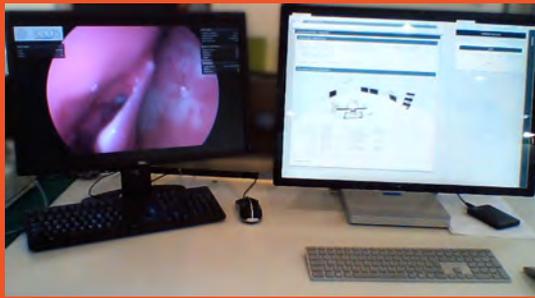
The SDC sandbox simulating devices in an virtual operating room (right) and a situation-aware overlay on the endoscopic video as a service to be tested (left).

MOMENTUM - Mobil techniology for Emergency Care and Trauma Medicine.

MOVE – MODULAR VALIDATION ENVIRONMENT FOR MEDICAL DEVICE NETWORKS

Cross-vendor medical device connectivity based on the IEEE 11073 SDC standards family requires new strategies for testing which account for risks that stem from interoperability. Interoperability poses significant testing challenges especially for small and medium sized enterprises in terms of design and validation of new networked products.

We provide a modular simulation and test framework´s to simplify the development and the approval process for networked medical devices. The frameworks core is an SDC sandbox, which allows to simulate a large variety of medical devices and surgical procedures directly at the developer's desk at low cost. Methods of machine learning and surgical process modeling have been used to simulate the behavior of medical devices in SDC networks. The simulation includes surgical work steps, the usage of devices during these work steps, discrete events, measurements, alerts, and even device failures. The pseudo randomization provides a lot of process variation and simultaneously ensures a sufficient reproducibility. Furthermore, in depth analysis and documentation of the network communication is realized.

With an extendable library of test scenarios as well as abstract and specific simulators, the MoVE framework supports development, interoperability testing, and regulatory approval for a large variety of medical devices and services.

MOMENTUM – MOBILE MEDICAL TECHNOLOGY FOR INTEGRATED EMERGENCY CARE AND TRAUMA MEDICINE

The emergency medical care of patients inside and outside the hospital is based on a complex system of interdependent processes involving many different actors (e.g. doctors, paramedics, nurses) as well as a large number of different medical devices and IT systems. Especially the treatment outside of specialized medical facilities (e.g., hospital, community health center, medical office) requires the quick and easy availability of medical resources, smooth access to information as well as the availability of medical expertise. The care processes are based primarily on the presence of medical-technical resources, for example, imaging units, vital monitoring and respiratory monitoring, and equipment for emergency interventions. However, these services cannot currently be made available for emergency medical care. Due to their complexity and size, many of these modalities are not suitable for mobi-

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Kick-off for MOMENTUM at ICCAS in Leipzig.
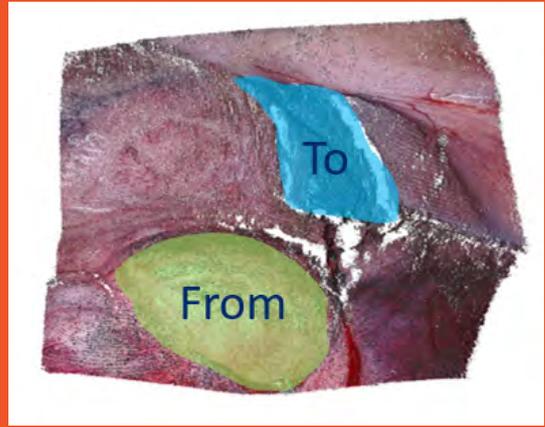
Concept of reconstructed surgical landscape guidance maps from 3D stereoendoscopy.

le use. As a result, there is a need to design strategic and technical concepts to deliver the fastest possible emergency medical care, thereby improving treatment processes from the scene of the accident to the clinic. The overall objective of the project is the development of integrated medical technology, which can be used in a mobile fashion along the process chain, not only in the hospital (e.g., trauma room, operating theater, intensive care unit), but also preclinically in a dynamic setting. The networked medical technology and IT systems are integrated into a common communication infrastructure across heterogeneous communication technologies, such as 5G, LTE, WiFi, and make their functionalities available via the infrastructure. The digital networking in the mobile point-of-care with medical diagnostic and therapy systems results in a significant improvement of the mobile treatment scenario. Thus, it is already possible to access medical resources and information from the hospital at the place of treatment and also transmit data and information to the clinical staff at the trauma center. This not only enables a more precise diagnostic assessment of the patient-specific situation, but also a much higher degree of precision in the early initial diagnosis on site. Evaluations of how to proceed with treatment can be coordinated in this way before the patient arrives at the hospital and continue seamlessly afterwards. The use of the new 5G communication technology and a central infrastructure for the transmissi-

on and analysis of the collected data supports both the coordinating offices (control center), the responders on the site of emergency and the clinical staff in the trauma centers. This should optimize processes for the benefit of the patient and improve the use of resources among the various user groups.

COMPASS – COMPREHENSIVE SURGICAL LANDSCAPE GUIDANCE SYSTEM FOR IMMERSIVE ASSISTANCE IN MINIMALLY-INVASIVE AND MICROSCOPIC INTERVENTIONS

In the project COMPASS, a new technology for immersive assistance in minimally invasive and microscopic interventions is developed to convert navigation systems into fully acknowledged surgical actors. We are approaching surgical navigation from the standpoints of situation awareness, a theory from aeronautics and aerospace research, the cognition-guided surgery paradigm and autonomous robotics navigation. A dual information processing cycle model performs situation comprehension and memory processing for the simulation of human-like behaviour. The model maintains a working memory of relevant information for a current navigation goal. Simulated and real navigation behaviour are compared to identify beneficial navigation support, e.g. directions, work steps, maps.

Merged 3D models of segmented vascular systems.

Mobile applications to support oncological decision making.

ENSEMBLE – DEVELOPMENT OF A SCALABLE AND MAGNETIC RESONANCE (MR)-COMPATIBLE BLOOD CIRCULATION MODEL

Artificial surgical phantoms enable surgeons to improve their skills and dexterity outside of real surgeries. For the training of catheter-based surgeries, a training model with a realistic vascular tree and an active blood circulatory system is required. The project ENSEMBLE aims to provide such a phantom, by using CT images and automatically segmented blood vessel areas throughout combined data sets. The phantom should represent the density, thickness and elasticity of real vessel walls with a maximum degree of branching. Based on a set of multiple CT images, the automatic segmentation of the vascular system is to be performed by model-based segmentation algorithms, such as the greedy snake and statistic form models. Together with a pump and a blood-like fluid, the resulting 3D-representation will be used to manufacture an artificial vascular system.

DPM – DIGITAL PATIENT- AND PROCESS MODEL

The growing number of medical screening options and forms of treatment for complex diseases require more patient-specific therapy decisions and treatment processes that increase the chance of a better clinical outcome. Digital patient and process models integrated in clinical decision support systems address these problems. They represent the disease-specific therapeutic decision-making and therapy processes and are instantiated with patient-specific data for personalized medicine. Bayesian Networks are the basis for this model-based clinical decision support. They allow an objective representation of all causal relationships between the patient, the medical knowledge and the disease with its treatment options. After spending time creating formal decision models in close cooperation with clinical experts, the results were prepared for translation into clinical practice. In different technical environments and clinical applications, the model-based decision support was utilized to validate the functionalities for real-life clinical usage. A centralized app was created to integrate all relevant information entities and to be able to present patient models in their respective context for an optimal assistance to the interdisciplinary teams. Also, the creation and storage of models was enhanced with specialized tools that integrate modern information technologies.

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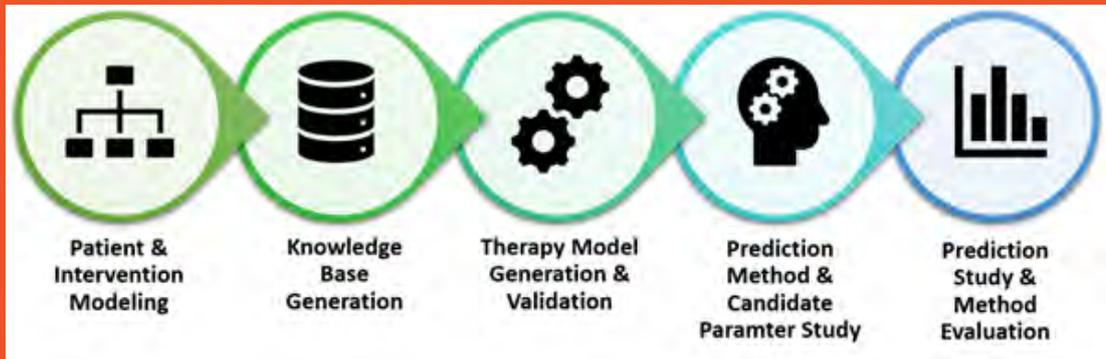
Overview of the PimPaP modeling approach and development stages. within the PimPAP Project.

PIMPAP – PATIENT-BASED INDIVIDUAL MODELING OF PARASPINAL COLLATERAL NETWORK PERFUSION AFTER SEGMENTAL ARTERY OCCLUSION

The repair of large thoracoabdominal aortic aneurysms employs extensive endovascular surgery with stent grafting. A successful intervention still poses risks of paraplegia or death due to ischaemic reactions in the spinal cord. The new MISACE procedure, employed to reduce these risks by preemptively closing supplying segmental arteries of the aorta, is yet to be supported by clinical guidelines. Inside the multi-centric clinical *PAPA_Artis* EU project, we are modeling the patient and his corresponding intervention process in a computational model to investigate the influence of varying MISACE parameters on the convalescence of spinal perfusion and the clinical outcome. We are establishing a digital patient representation based on multimodal information at various stages of the MISACE staging as well as post-operatively after aneurysm repair. With the investigation of temporal changes of specific patient data (vital, pathological, and procedure parameters), we are abstracting the problematic to achieve a more generalised representation of the treatment process. Main patient parameters, e.g. demographic background, imaging data, anamnesis, and diagnosis were identified and the MISACE procedure was analysed using workflow

and process analysis steps. Both the patient and the process model are then used to form a therapy model that is instantiated at for the PAPA_Artis trial.

AUTOSON – AUTOMATIC NAVIGATED INTRAOPERATIVE ULTRASOUND IMAGING FOR BRAIN TUMOR REMOVAL

Development of an innovative neuro-navigation system supporting the use of intraoperative ultrasound imaging Intraoperative ultrasound (US) imaging is standardly used to guide the surgeon during brain tumor operations. It remains, however, not optimally integrated in the surgical workflow. The goal of this project was the development of a new neuro-navigation system to support the use of intraoperative US imaging in the neuro-surgery.

A tool to automatically identify the parameters of image acquisition, for example, the probe and the penetration depth, was implemented in order to automate visualization processes. Moreover, an approach for the enhancement of the tumor boundary in the US images was developed. Both tools were successfully integrated within a demonstrator including the navigation system, a laptop and the US device which was tested in the operating room. Limitations in the exchange of information were observed.

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LYSiS laparoscopic HSI system including the miniaturized HSI camera, the laparoscope with light source and the developed user interface.
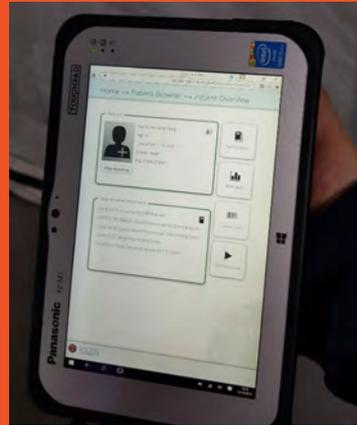
Tablet running the ICCAS EPR during the MODEX exercise in Romania

LYSIS – DEVELOPMENT OF A LAPAROSCOPIC HYPERSPECTRAL IMAGING SYSTEM

Hyperspectral imaging (HSI) is a contactless and totally non-invasive optical imaging method which showed promising results for applications in the surgery. The goal of this project is the development of a laparoscopic system, including HSI, in order to be used during minimal-invasive operations.

A first prototype of a laparoscope including a miniaturized HSI camera and suitable light source was developed. Since the time for the acquisition of HSI data requires several seconds, an approach to register the HSI information with videos was implemented. Moreover, machine learning methods for organ differentiation and tumor identification were evaluated on the HSI data of patients. The next step of the project is the evaluation of the prototype in the operating room based on resected tissue.

EUMFH – EUROPEAN MODULAR FIELD HOSPITAL

The project aims to explore how the medical capacity of the Union Civil Protection Mechanism can be improved. Different EU Member States combine their expertise and build a common deployable Emergency Medical Team (EMT) level 3 for disaster relief missions. ICCAS was commissioned with the conceptualization and provision of an electronic patient record (EPR) for EMTs. As first step, a comprehensive requirements analysis was conducted. Subsequently, a concept for an EPR was derived, taking the special demands (e.g. lightweight, high flexibility, robustness) of EMTs into account.

The EPR was tested during the MODEX exercises in Romania and Estonia. The participating personnel was interviewed, regarding suitability, performance and operational capabilities of the developed EPR. The EPR system was well received by the participants. 21 team members have been interviewed. 14 of them with medical roles (physicians and nurse) and seven of them with supportive roles (Management, Logistics, or Training). Three medical team leaders were among the 14 medical interview partners. All participants came from nine different European countries.

IMPACT – IMPROVED MULTIPARAMETRIC MONITORING OF BLUNT CHEST TRAUMA

The IMPACT project focusses on the development of a mobile miniaturized device for the assessment of pulmonary ventilation and the detection of pneumothorax in pre-clini-
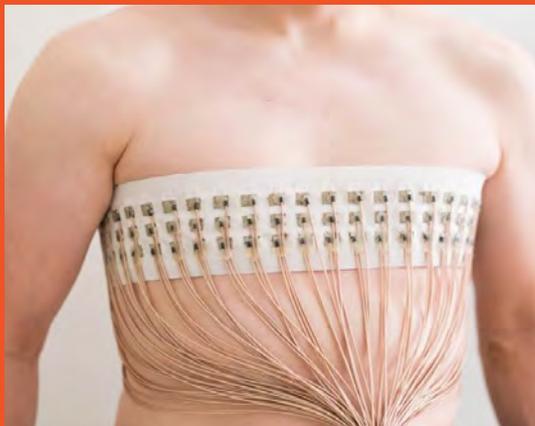
Image of the first prototype of the innovative flexible electrode belt.

Image of the demonstrator of the future EMU system, on the left the joint system of mechanical ventilator and EIT device is shown connected to an incubator setup.

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cal emergency situations based on electrical impedance tomography (EIT). IMPACT is a cooperation project of the companies Fritz Stephan GmbH, ITP GmbH, the Leipzig University of Applied Sciences (HTWK Leipzig) and the ICCAS. Due to a lack of mobile diagnosis modalities, emergency examination of the lung is usually limited to auscultation with a stethoscope, which is particularly susceptible to failures in noisy environments. The information whether the patient is breathing, whether both lungs are ventilated or a part of the lung is injured, is of great importance for the first aid treatment. Since EIT is a medical imaging technique capable of visualizing the lung ventilation in real-time, the development of a mobile EIT system could support the lung examination in emergency situations.

The project enters the integration phase, in which all components are assembled. The first prototype of the innovative flexible electrode belt can be seen in the figure above. The belt is connected with the measurement hardware; the measured EIT voltages are processed and analyzed and the reconstructed images and analysis parameters are displayed in the mechanical ventilator. First pre-clinical studies are conducted at the moment to validate the interaction of the components to support the integration process.

EMU – VENTILATION SYSTEM WITH ELECTROIMPEDANCE IMAGING FOR MONITORING THE PATIENT'S CONDITION AND OPTIMAL VENTILATION OF THE PATIENT

In the EMU project, a combination of mechanical ventilation device and electrical impedance tomography (EIT) was developed in cooperation with Fritz Stephan GmbH. With the help of EIT, lung ventilation can be made visible and various ventilation parameters can be calculated. The system comprises a joint processing and display unit of the two devices, with the aim of improving the ventilation strategy for the patient. The application focus here is on neonatal ventilation.

The EMU project was successfully completed this spring. In the figure you can see a demonstrator of the future system. The created joint analysis and presentation of the various parameters allow for a more individual and precise setting of ventilation parameters.

#PUBLICATIONS

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#PUBLICATIONS

CO-AUTHORSHIP

Jansen-Winkeln B, Holfert N, Köhler H, Chalopin C, Gockel I. Bestimmung der idealen Anastomosenposition durch hyperspectrale Bildgebung. Z Gastroenterol. 2019; 57(9): e219.

Jansen-Winkeln B, Holfert N, Köhler H, Moulla Y, Takoh JP, Rabe SM, Mehdorn M, Barberio M, Chalopin C, Neumuth T, Gockel I. Determination of the transection margin during colorectal resection with hyperspectral imaging (HSI). International Journal of Colorectal Disease. 2019; 34(4): 731-739.

Meuschke M, Oeltze-Jafra S, Beuing O, Preim B, Lawonn K. Classification of Blood Flow Patterns in Cerebral Aneurysms. IEEE Trans Vis Comput Graph. 2019; 25(7): 2404–18.

Muders T, Hentze B, Simon P, Girrbach F, Doebler MRG, Leonhardt S, Wrigge H, Putensen C. A Modified Method to Assess Tidal Recruitment by Electrical Impedance Tomography. J Clin Med. 2019; 8(8): 1161.

Pirlich M, Stöhr M, Neumuth T, Dietz A. The Intelligent ENT Operating Room of the Future. Laryngorhinootologie. 2019; 98(S 01): 5–31.

Spallazzi M, Dobisch L, Becke A, Berron D, Stucht D, Oeltze-Jafra S, u. a. Hippocampal vascularization patterns: A high-resolution 7 Tesla time-of-flight magnetic resonance angiography study. Neuroimage Clin. 2019; 21: 101609.

Sucher R, Athanasios A, Köhler H, Wagner T, Brunotte M, Lederer A, Gockel I, Seehofer D. Hyperspectral Imaging (HSI) in anatomic left liver resection. International Journal of Surgery Case Reports. 2019; 62: 108–111.

CONFERENCE PROCEEDINGS

Bieck R, Neumuth T. Cognitive Situation Awareness for Intelligent Navigation Assistance in Minimally-Invasive Endoscopic Surgery. A System Design Approach. 49th Annual Congress of the German Society for Endoscopy and Imaging Systems. Stuttgart, Germany; 2019.

Fuchs R, Mrongowius J, Landeck T, Salz P, Neumuth T, Reske AW. Electrical Impedance Tomography for monitoring of homogeneous pulmonary ventilation. Annual Meeting of the German Society of Biomedical Engineering. Frankfurt am Main, Germany; 2019.

Georgi C, Rockstroh M, Franke S, Neumuth T. Design of a dynamic user interface for IEEE 11073 SDC interoperability testing. 18. Jahrestagung der Deutschen Gesellschaft für Computer-und Roboterassistierte Chirurgie (CURAC). Reutlingen, Germany; 2019.

Köhler H, Maktabi M, Barberio M, Kohler LH, Neumuth T, Gockel I, Chalopin C. Hyperspektralbildgebung (HSI) für die intraoperative ortsaufgelöste Quantifizierung des Fettgehalts von Gewebe. 18. Jahrestagung der Deutschen Gesellschaft für Computer-und Roboterassistierte Chirurgie (CURAC). Reutlingen, Germany; 2019.

Kongtso P, Salz P, Neumuth T, Reske AW. Konzept eines anatomischen Atlas für medizinische Studien und patientenspezifische 3D-Modelle. 18. Jahrestagung der Deutschen Gesellschaft für Computer-und Roboterassistierte Chirurgie (CURAC). Reutlingen, Germany; 2019.

Landeck T, Mrongowius J, Salz P, Gottschaldt U, Reske AW, Girrbach FF. Elektrische Impedanztomografie als Verfahren zur Bestimmung der korrekten Lage des Doppellumentubus in der Thoraxchirurgie. Deutscher Anästhesiekongress. Leipzig, Germany; 2019.

Landgraf L, Melzer A. Klinische Anwendungen der MR gestützten Ultraschalltherapie. 43. Dreiländertreffen. Leipzig, Germany; 2019.

Landgraf L, Zhang X, Unger M, Patties I, Gerold B, Melzer A. In vitro investigation of combined focused ultrasound (FUS) hyperthermia (HT) and radiation therapy (RT) for future use of image guided FUS and RT in the clinic. European Congress of Radiology (ECR). Vienna, Austria; 2019.

Landgraf L, Zhang X, Unger M, Patties I, Melzer A. Radiosensibilisierung von Krebszellen in vitro durch fokussierte Ultraschall-Hyperthermie (FUS-HT). 100. Deutscher Röntgenkongress. Leipzig, Germany; 2019.

Maktabi M, Köhler H, Thieme R, Takoh J, Rabe S, Jansen-Winkeln B, Gockel I, Chalopin C. Automatic tumor tissue classification of oncological esophageal resectates based on hyperspectral data. Viszeralmedizin. Wiesbaden, Germany; 2019.

Mrongowius J, Reske AW. Patientenüberwachung mittels textiler Sensorik in der Notfallmedizin. 23. Symposium Technische Textilien. Reichenbach im Vogtland, Germany; 2019.

Mrongowius J, Reske AW, Salz P, Neumuth T. Electrical Impedance Lung Imaging with partial access to the thorax. Future Med Technologies. Leipzig, Germany; 2019.

Neumann J, Angrick C, Roth A, Neumuth T. Ergonomic Assessment of Operating Room Setups for Orthopedic Reconstructive Surgery. 18. Jahrestagung der Deutschen Gesellschaft für Computer-und Roboterassistierte Chirurgie (CURAC). Reutlingen, Germany; 2019.

Pfahl A. Visualization of instruments for minimally invasive MR-guided interventions. 31st Conference of the International Society for Medical Innovation and Technology (SMIT). Heilbronn, Germany; 2019.

#PUBLICATIONS

Reich CM, Pfahl A, Seifert A, Lehnhardt M, Uihlein B, Schauer S, Busse H, Unterberg-Buchwald C, Ritter C, Uecker M, Melzer A. Research and development of a forceps for MR-guided interventions with the use case endomyocardial biopsy. 15th Leipzig Research Festival for Life Sciences. Leipzig, Germany; 2019.

Rosenthal J-C, Bieck R, Wittenberg T, Eisert P, Neumuth T. Introducing surgical landscape guidance for intelligent assistance in minimally-invasive surgery. International Congress of Computer Assisted Radiology and Surgery (CARS). Rennes, France; 2019.

Roy U, Fournelle M, Greiser S, van Gorkum R, Speicher D, Grunwald T, Kozerke S, Tretbar S, Landgraf L, Melzer A. Platform for Preclinical MRI-Guided Focused Ultrasound Hyperthermia in 7 Tesla MRI. 31st Conference of the International Society for Medical Innovation and Technology (SMIT). Heilbronn, Germany; 2019.

Roy U, Fournelle M, Greiser S, van Gorkum R, Speicher D, Grunwald T, Kozerke S, Tretbar S, Landgraf L, Melzer A. Preclinical MR-guided Focused Ultrasound Hyperthermia in 7 Tesla MRI. 53rd Conference of the German Society for Biomedical Engineering (BMT). Frankfurt am Main, Germany; 2019.

Roy U, Fournelle M, Greiser S, Robbert van G, Speicher D, Grunwald T, Kozerke S, Tretbar S, Landgraf L, Melzer A. Preclinical MRI-guided focused ultrasound hyperthermia in 7 T MRI. 19th International Society for Therapeutic Ultrasound (ISTU)/5th European Focused Ultrasound Charitable Society (EUFUS). Barcelona, Spain; 2019.

Unger M, Berger J, Landgraf L, Melzer A. Robotic Positioning for Image-Guided Ultrasound Interventions. 18. Jahrestagung der Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie (CURAC). Reutlingen, Germany; 2019.

Zhang X, Unger M, Patties I, Landgraf L, Melzer A. Focused ultrasound radiosensitize prostate cancer cells in vitro. 31st Conference of the International Society for Medical Innovation and Technology (SMIT). Heilbronn, Germany; 2019.

Zhang X, Unger M, Patties I, Landgraf L, Melzer A. Focused ultrasound-induced hyperthermia as radiosensitizer for glioblastoma, prostate cancer and head and neck cancer cell lines. 33rd. Annual Meeting of the European Society for Hyperthermic Oncology (ESHO). Warschau, Poland; 2019.

Zhang X, Unger M, Patties I, Landgraf L, Melzer A. In Vitro Focused Ultrasound Hyperthermia (HT) for Radiosensitization of Human Cancer Cells. 19th International Society for Therapeutic Ultrasound (ISTU)/5th European Focused Ultrasound Charitable Society (EUFUS). Barcelona, Spain; 2019.

#EVENTS

Zhang X, Unger M, Patties I, Landgraf L, Melzer A. In vitro radiosensitization of human cancer cells with focused ultrasound induced hyperthermia. 53rd Conference of the German Society for Biomedical Engineering (BMT). Frankfurt am Main, Germany; 2019.

Zhang X, Unger M, Patties I, Landgraf L, Melzer A. Radiosensitization of human cancer cells in vitro with focused ultrasound induced hyperthermia. 105th Scientific Assembly and Annual Meeting of the Radiological Society of North America (RSNA). Chicago, USA; 2019.

EVENTS

IN-HOUSE EVENTS

VISIT FROM SENIOR-ACADEMY
January 16, 2019 | ICCAS
- Erik Schreiber | demonstration of ICCAS' 'Intelligent OR'
- Jan Gaebel, Alexander Oeser | project demonstration: Digital Patient Model

15TH RESEARCH FESTIVAL FOR LIFE SCIENCES LEIPZIG
January 18, 2019 | Medical Study Center, Leipzig University
- Johann Berger | poster: 'Towards Integrating Combined Radiation and Focused Ultrasound Therapy into the Clinical Domain'
- Jesús Guillermo Cabal Aragón | poster: 'The AutoSon project: Improvement of a Neuro-Navigation System for Neurosurgical Procedures'
- Reinhard Fuchs | poster: 'Monitoring of Ventilation Delay with Electrical Impedance Tomography'
- Jan Gaebel | poster: 'Integrated System for Clinical Decision Models'
- Shaonan Hu | poster: 'Alternative Treatment of Prostate Cancer: New Strategies Using Focused Ultrasound'
- Hannes Köhler | poster: 'Untersuchung des Einflusses der ischämischen Konditionierung auf die Oxygenierung des Schlauchmagens mittels intraoperativer Hyperspektral-bildgebung'
- Marianne Maktabi | poster: 'Supervised Tissue Discrimination during Thyroid and Parathyroid Surgery Based on Hyperspectral Imaging'
- Julia Mrongowius | poster: 'Simulation Study on Electrical Impedance Lung Imaging with Partial Access to the Thorax'
- Juliane Neumann | poster: 'Process Simulation Techniques for Perioperative Process Optimization'
- Alexander Oeser | poster: 'Towards Semi-Automatic Generation of Bayesian Decision Networks in Oncology Using a Hybrid Modeling Approach'

#EVENTS

- Annekatrin Pfahl, C. Martin Reich, Andreas Seifert | poster: 'Research and development of a Forceps' Erik Schreiber | poster: 'Implementation and Evaluation of an Electronic Patient Record for Disaster Relief Missions'
- Michael Unger | poster: 'Assessment of Automatic Perforator Detection in Infrared Thermal Images' for MR-Guided Interventions with the Use Case Endomyocardial Biopsy'
- Xinrui Zhang | poster: 'In Vitro Study of FUS Induced Hyperthermia and Radiation Therapy Combination Treatment on Cancer Cells'

ICCAS STATUS SEMINAR 2018
January 24, 2019 | ICCAS
Presentation of ICCAS' research results and highlights in 2018

15TH MEFALE (MEIN FERIENABENTEUER LEIPZIG)
February 20, 2019 | ICCAS
Insight into ICCAS' research work for pupils

FUTURE MED TECHNOLOGIES – PHD WORKSHOP AND INDUSTRY FAIR
March 5, 2019 | Medical Study Center, Leipzig University
- Johann Berger | lecture: 'Integration of Combined Radiation and Focused Ultrasound Therapy into the Clinical Domain'
- Richard Bieck | lecture: 'Cognitive Navigation Assistance in Minimally-Invasive Surgery'
- Jesús Guillermo Cabal Aragón | lecture: 'The AutoSon Project: Improvement of a Neuronavigation System for Neurosurgical Procedures'
- Reinhard Fuchs | lecture: 'Development and Evaluation of an Instrument-Recognition-System for Intraoperative Activity-Tracking through a Multi-Sensor Armband'
- Jan Gaebel | lecture: 'Modular Infrastructure for Decision Models in ENT Oncology'
- Shaonan Hu | lecture: 'Alternative Treatment of Prostate Cancer: New Strategies using Focused Ultrasound'
- Hannes Köhler | lecture: 'Evaluation of Hyperspectral Imaging on Measurement of Ischemic Conditioning Effects of the Gastric Conduit'
- Marianne Maktabi | lecture: 'Supervised Tissue Discrimination during Thyroid and Parathyroid Surgery based on Hyperspectral Imaging'
- Julia Mrongowius | lecture: 'Electrical Impedance Lung Imaging with Partial Access to the Thorax'
- Juliane Neumann | lecture: 'Process Simulation Techniques for Perioperative Process Optimization'
- Alexander Oeser | lecture: 'Semi-Automatic Generation of Bayesian Belief Networks in Oncology Using a Hybrid Modeling Approach'
- C. Martin Reich | lecture: 'Research and Development of a Forceps for MR-Guided Interventions with the Use Case Endomyocardial Biopsy'
- Max Rockstroh | lecture: 'Herausforderungen bei der Prozessunterstützung im Operationssaal'

- Erik Schreiber | lecture: 'An Electronic Patient Record for the European Modular Field Hospital'
- Michael Unger | lecture: 'Assessment of Automatic Perforator Detection in Infrared Thermal Images'
- Xinrui Zhang | lecture: 'In Vitro Focused Ultrasound Hyperthermia for Radiosensitization of Human Cancer Cells'

FUTURE MED TECHNOLOGIES - TRANSFERMEETING
March 5, 2019 | ICCAS
Project demonstrations to invited regional companies and municipalities accompanying funding- and collaboration-talks

VISIT FROM THE DIRECTORATE-GENERAL FOR EUROPEAN CIVIL PROTECTION AND HUMANITARIAN AID OPERATIONS (DG ECHO) IN THE SCOPE OF ICCAS' EU-MFH PROJECT
March 6 – 7, 2019 | ICCAS
Presentation of ICCAS' research groups

ICCAS-COLLOQUIUM
March 21, 2019 | University Hospital Leipzig
- Ernst Marlinghaus | invited lecture: 'Transkranielle Puls Stimulation TPS bei Patienten mit Alzheimer Demenz'

GIRL'SDAY
March 28, 2019 | ICCAS
- Johann Berger, Marianne Maktabi, Juliane Neumann, Annekatrin Pfahl | Insight into medical informatics for female pupils

VISIT FROM KENYAN PARTNER UNIVERSITIES
June 26, 2019 | ICCAS
Project presentation and exchange about application-targeted project work with representatives from Kenyan Universities

6TH DIGITAL OPERATING ROOM SUMMER SCHOOL (DORS)
August 26 – 30, 2019 | ICCAS, University Hospital Leipzig, Heart Center Leipzig
Unique introduction to various topics of computer assisted medicine

VISIT FROM 'GERMAN AGENCY FOR DISRUPTIVE INNOVATION' AND LEIPZIG CITY
August 29, 2019 | ICCAS
Presentation of ICCAS' innovative developments in the areas medical technology and informatics

#EVENTS

DISCUSSION EVENT 'SCIENCE CONTROVERSIAL'
October 7, 2019 | University Hospital Leipzig
- Thomas Neumuth | public discussion: 'With AI against cancer - How Artificial Intelligence and Robotics Revolutionize Medicine'
- Stefan Franke, Alexander Oeser | presentation of ICCAS' 'Intelligent OR' and the DPM

VISIT FROM BUCAMARANGA HEALTH CLUSTER
November 21, 2019 | ICCAS
Presentation of computer assisted surgery and funding programs discussion with Colombian healthcare representatives

CONFERENCES, SYMPOSIA, WORKSHOPS

W.O.M. GMBH
February 7, 2019 | W.O.M. WORLD OF MEDICINE GMBH, Berlin
- Thomas Neumuth | invited lecture: 'Möglichkeiten der OR-Vernetzung'

ZUVERLÄSSIGE STROMVERSORGUNG FÜR DEN OP- UND INTENSIVBEREICH
February 13, 2019 | TÜV SÜD AG, München
- Stefan Franke | lecture: 'Vernetzte Medizintechnik im Operationssaal'

48. JAHRESTAGUNG DER DEUTSCHEN GESELLSCHAFT FÜR THORAX-, HERZ- UND GEFÄßCHIRURGIE (DGTHG) UND 51. JAHRESTAGUNG DER DEUTSCHEN GESELLSCHAFT FÜR PÄDIATRISCHE KARDIOLOGIE (DGPK)
February 16 – 19, 2019 | Wiesbaden
- Dr. Stefan Franke | lecture: 'Next Generation OR'

25TH EUROPEAN CONGRESS OF RADIOLOGY (ECR)
February 27 – March 3, 2019
- Lisa Landgraf | poster presentation: 'In Vitro Investigation of Combined Focused Ultrasound (FUS) Hyperthermia (HT) and Radiation Therapy (RT) for Future Use of Image Guided FUS and RT in the Clinic'
- Andreas Melzer | lecture: 'TRANS-FUSIMO: Preliminary In-Vivo Animal Results of MR-Guided Focused Ultrasound of Liver under Respiratory Motion'

136. KONGRESS DEUTSCHE GESELLSCHAFT FÜR CHIRURGIE (DCK)
March 26 – 29, 2019 | Munich
- Claire Chalopin | invited lecture: 'Deep Learning and Algorithms of Cancer Recognition via Hyperspectral Imaging'
- Hannes Köhler | poster presentation: 'Evaluation of Ischemic Conditioning Effects of the Gastric Conduit with Hyperspectral Imaging (HSI)'

49. KONGRESS DER DEUTSCHEN GESELLSCHAFT FÜR ENDOSKOPIE UND BILDGEBENDE VERFAHREN E.V. (DGE-BV)

March 28 – 30, 2019 | Stuttgart
- Richard Bieck | lecture: 'Cognitive Situation Awareness for Intelligent Navigation Assistance in Minimally-Invasive Endoscopic Surgery'
- Claire Chalopin | lecture: 'Supervised Tissue Discrimination during Thyroid and Parathyroid Surgery Based on Hyperspectral Imaging'
- Andreas Melzer | board member; congress opening and welcome; invited lecture: 'AI und Machine learning im OP der Zukunft'

EU CIVIL PROTECTION EXERCIXE (MODEX)

April, 11 – 13, 2019 | Tallin, Estonia
- Christoph Georgi, Erik Schreiber | presentation and evaluation of ICCAS' electronic patient file under real conditions of a field hospital in a simulated situation after a meteorite impact with accompanying flash flood

KONGRESS FÜR TECHNIK UND HYGIENE IM KRANKENHAUS – WÜMEK

May 8 – 9, 2019 | Würzburg
Thomas Neumuth | lecture: 'Der intelligente Operationssaal' in coordination with OR.NET e.V.

2. GEMEINSAME JAHRESTAGUNG DER MITTELDEUTSCHEN GESELLSCHAFT FÜR GASTROENTEROLOGIE (MGG) UND DER MITTELDEUTSCHEN CHIRURGENVEREINIGUNG (MDCV)

May 10 – 11, 2019 | Halle/Saale
- Hannes Köhler | lecture: 'Hyperspectral Imaging (HSI) during Esophagectomy for the Measurement of Ischemic Conditioning Effects of the Gastric Conduit'
- Marianne Maktabi | poster: 'Automatic tissue classification based on hyperspectral imaging'

DGAV OP-WORKSHOP 'HSI IN DER VISZERALCHIRURGIE'

May 17, 2019 | Department of Visceral, Transplantation, Thoracic and Vascular Surgery, University Hospital Leipzig
- Hannes Köhler | lecture: 'Hyperspektral-Imaging (HSI): Technische Aspekte 'in a nutshell'
- Marianne Maktabi | lecture: 'Gewebeklassifikation und Tumordetektion mittels HSI'
- Claire Chalopin, Thomas Neumuth | management

TREFF DER WISSENSCHAFTLER_INNEN IM SIKT

May 21, 2019 | Saxon Incubator for Clinical Translation (SIKT), Leipzig
- Lisa Landgraf | lecture: 'Bildgestützer fokussierter Ultraschall: Technische Grundlagen und Einsatz in der Krebstherapie'

#EVENTS

42ND CANADIAN MEDICAL AND BIOLOGICAL ENGINEERING CONFERENCE (CMBEC42)

May 21 – 24, 2019 | Ottawa, Canada

- Max Rockstroh | lecture: 'SDC – A new Interoperability Standard for Electromedical Devices – IEEE 11073' in cooperation with OR.NET e.V.

INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION (ICRA)

May 20 – 24, 2019 | Montréal, Canada

- Max Rockstroh | lecture: 'The IEEE11073 SDC - Standard Family: Networked Medical Devices in Operating Room and Clinic'

FIELD HOSPITAL EXERCISE

May 21 – 23, 2019 | Gurcy-le-Châtel, France

- Jan Gaebel, Erik Schreiber | establishment of an European Modular Field Hospital (EU-MFH) training network in an simulated scenario of a nerve gas attack in cooperation with army, emergency services and police

33RD ANNUAL MEETING OF THE EUROPEAN SOCIETY FOR HYPERTHERMIC ONCOLOGY (ESHO)

May 22 – 24, 2019 | Warsaw, Poland

- Xinrui Zhang | lecture: 'Focused Ultrasound-Induced Hyperthermia as Radiosensitizer for Glioblastoma, Prostate Cancer and Head and Neck Cancer Cell Lines'

100. DEUTSCHER RÖNTGENKONGRESS

May 29 – June 1, 2019 | Leipzig

- Lisa Landgraf | lecture: 'Radiosensibilisierung von Krebszellen in vitro durch fokussierte Ultraschall-Hyperthermie (FUS-HT)'

27TH INTERNATIONAL CONGRESS OF THE EUROPEAN ASSOCIATION FOR ENDOSCOPIC SURGERY (EAES)

June 12 – 14, 2019 | Seville, Spain

- Johann Berger | lecture: 'Modelling a Collaborative Robot with the IEEE 11073 SDC Standard for Combined Focused Ultrasound and Radiation Therapy'
- Andreas Melzer | invited Sir Alfred Cuschieri technology lecture: 'Image Guided Surgery'; course director: 'Ultrasound'

33RD INTERNATIONAL CONFERENCE ON COMPUTER ASSISTED RADIOLOGY AND SURGERY (CARS)

June 18 – 21, 2019 | Rennes, France

- Johann Berger | lecture: 'GATOR: Connecting Integrated Operating Room Solutions Based on the IEEE 11073 SDC and ORiN Standards'
- Marianne Maktabi | lecture: 'Tissue Classification of Esophagus Resected Tissue Based on Hyperspectral Data'

- Andreas Melzer | program committee
- Juliane Neumann | lecture: 'Extending BPMN 2.0 for Intraoperative Workflow Modeling with IEEE 11073 SDC for Description and Orchestration of Interoperable, Networked Medical Devices'
- Thomas Neumuth | invited lecture: 'OR.NET and beyond: AI and machine learning in the OR of the Future'

12TH HAMLYN SYMPOSIUM ON MEDICAL ROBOTICS ON 'CLINICAL CHALLENGES AND LEVELS OF AUTONOMY'

June 23 – 26, 2019 | London, UK

- Andreas Melzer | lecture: 'New Technologies for MR guided Endovascular Procedures: Cardiac Biopsy, Aortic Coarctation Stenting, Heart Valve Prosthesis and Thrombolysis'

ANNUAL MEETING OF THE CARDIOVASCULAR AND INTERVENTIONAL RADIOLOGICAL SOCIETY OF EUROPE (CIRSE)

September 7 – 10, 2019 | Barcelona, Spain

- Upasana Roy | lecture: 'Platform for Preclinical MRI-Guided Focused Ultrasound Hyperthermia'

63. ÖSTERREICHISCHER HNO-KONGRESS

September 11 – 14, 2019 | Salzburg, Austria

- Andreas Dietz | lecture: 'Operationssaal der Zukunft'

HEALTHCARE HACKATHON KIEL

September 12 – 13, 2019 | Kiel

- Max Rockstroh | topic developing and presentation to public and media

JAHRESSYMPOSIUM DER DEUTSCHEN NOTES ARBEITSGRUPPE (D-NOTES)

September 13, 2019 | Hannover

- Thomas Neumuth | lecture: 'Surgical Workflows'

EUROPEAN SPACE AGENCY (ESA) - MEETING

September 17 – 18, 2019 | Bologna, Italy

- Andreas Melzer | lecture: 'Anwendung FUS/HIFU auf der Marsmission'

71. JAHRESKONGRESS DER DEUTSCHEN GESELLSCHAFT FÜR UROLOGIE (DGU)

September 18 – 21, 2019 | Hamburg

- Andreas Melzer | invited lecture: 'MR geführter Fokussierter Ultraschall der Prostata, eine Option?'; invited talk: 'Computer Assistierte Chirurgie – Fluch oder Segen?'

#EVENTS

18. JAHRESTAGUNG DER DEUTSCHEN GESELLSCHAFT FÜR COMPUTER- UND ROBOTER-ASSISTIERTE CHIRURGIE (CURAC)

September 19 – 21, 2019 | Reutlingen
- Stefan Franke | lecture: 'Design of a Dynamic User Interface for IEEE 11073 SDC Interoperability Testing'
- Hannes Köhler | lecture: 'Hyperspektralbildgebung (HSI) für die intraoperative ortsaufgelöste Quantifizierung des Fettgehalts von Gewebe'
- Patrick Kongtso | lecture: 'Konzept eines anatomischen Atlas für medizinische Studien und patientenspezifische 3D-Modelle'
- Juliane Neumann | lecture: 'Ergonomic Assessment of Operating Room Setups for Orthopedic Reconstructive Surgery'

64TH INTERNATIONAL CONGRESS OF HEARING AID ACOUSTICIANS (EUHA)

October 16 – 18, 2019 | Nuremberg
- Andreas Dietz | lecture: 'Artificial Intelligence in the Operating Theatre of the Future'

2ND ANNUAL CONGRESS OF THE EUROPEAN ASSOCIATION OF NUCLEAR MEDICINE (EANM)

October 12 – 16, 2019 | Barcelona, Spain
- Andreas Melzer | lecture: 'Nuclear Medicine Guided Focused Ultrasound – A Potential Future Application'

43. DREILÄNDERTREFFEN DER DGUM, ÖGUM, SGUM

October 16 – 19, 2019 | Leipzig
- Lisa Landgraf | lecture: 'Klinische Anwendungen der MR-gestützten Ultraschalltherapie'

DIGITAL-GIPFEL 2019

October 28 – 29, 2019 | Dortmund
- Thomas Neumuth | panel discussion: 'Forschung – KI für digitale Plattformen'

23. SYMPOSIUM TECHNISCHE TEXTILIEN

November 13, 2019 | Reichenbach
- Julia Mrongowius | lecture: 'Patientenüberwachung mittels textiler Sensorik in der Notfallmedizin'

INTERNATIONAL CONFERENCE ON BIOMEDICAL TECHNOLOGY (ICBT)

November 18 – 20, 2019 | Hannover
- Andreas Melzer | plenary lecture: 'Advanced Technologies for Image Guided Interventions'

10TH NATIONAL CONGRESS OF THE ROMANIAN ASSOCIATION FOR ENDOSCOPIC SURGERY (ARCE)
11TH NATIONAL SYMPOSIUM OF BARIATRIC AND METABOLIC SURGERY

November 21 – 23, 2019 | Bucharest, Romania

- Andreas Melzer | lectures: 'US Physics', 'Artificial and Machine Intelligence in the OR of the Future', 'Non-Invasive Surgery through Image Guided Robotic Focused Ultrasound'; session chairs: 'iSMIT @ RAES – Advances in Surgical Education', 'Robotic Surgery – Joint Session with The Romanian Robotic Surgery Club'

SCADS.AI KICK-OFF-EVENT
November 27, 2019 | Leipzig
- Thomas Neumuth | lecture: 'Medical Image and Data Analyses'

105TH SCIENTIFIC ASSEMBLY AND ANNUAL MEETING OF THE RADIOLOGICAL SOCIETY OF NORTH AMERICA (RSNA)
November 30 – December 4, 2019 | Chicago, IL, USA
- Andreas Melzer | lecture: 'Radiosensitization of Human Cancer Cells In Vitro with Focused Ultrasound Induced Hyperthermia'

PRESENTATIONS AT FAIRS

DIGITAL MEDICAL EXPERTISE & APPLICATIONS (DMEA)
April 9 – 11, 2019 | Berlin
- Stefan Franke, Christoph Georgi, Thomas Neumuth, Max Rockstroh | showcase for the Service-Oriented Device Connectivity (SDC)- Standard in cooperation with OR.NET e.V.

INNOVATIONSTAG MITTELSTAND DES BUNDESMINISTERIUMS FÜR WIRTSCHAFT UND ENERGIE (BMWI)
May 9, 2019 | Berlin
- Claire Chlopin, Hannes Köhler | booth presentation: 'Hyperspektralbildgebungs-System zur nichtinvasiven Messung der Hautdurchblutung und Oberflächenfeuchtigkeit zur Beurteilung des Patientenzustandes'

19TH SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR THERAPEUTIC ULTRASOUND (ISTU)
5TH SYMPOSIUM OF THE EUROPEAN FOCUSED ULTRASOUND CHARITABLE SOCIETY (EU-FUS)
June 13 – 15, 2019 | Barcelona, Spain
- SONO-RAY-group | exhibition booth
- Johann Berger | posters: 'Modelling a Collaborative Robot with the IEEE 11073 SDC Standard for Combined Focused Ultrasound and Radiation Therapy', 'Evaluation of a Mobile Ultrasound Device for Robot Assisted Focused Ultrasound Applications'
- Lisa Landgraf | invited session chair: 'Therapy Ultrasound plus'
- Andreas Melzer | congress co-chair; EUFUS organizing committee; welcome and closing; invited session chairs: 'Organ Panel: Prostate and Kidney', 'Other Clinical Vascular and

#EVENTS

Benign HIFU Applications'; invited lecture: 'TRANS-FUSIMO – Model Based Treatment Support for FUS in Moving Abdominal Organs', poster: 'Robotic Driven Motion Model for Static vs Dynamic MRgFUS Systems'
- Upasana Roy | poster: 'Preclinical MRI-Guided Focused Ultrasound Hyperthermia in 7 t MRI'
- Xinrui Zhang | poster: 'In Vitro Focused Ultrasound Hyperthermia for Radiosensitization of Human Cancer Cells'

53RD ANNUAL CONFERENCE OF THE GERMAN SOCIETY FOR BIOMEDICAL ENGINEERING (DGBMT WITHIN VDE) (BMT)
September 25 – 26, 2019 | Frankfurt/Main
- Johann Berger | lecture: 'IEEE 11073 Compliant SDC Modelling of a Collaborative Robot for the Application of Focused Ultrasound in Radiation Therapy'
- Richard Bieck | lecture: 'Surface EMG-Based Surgical Instrument Classification for Dynamic Activity Recognition in Surgical Workflows'
- Jesús Guillermo Cabal Aragón | poster: 'The AutoSon Project: Improvement of a Neuronavigation System for Neurosurgical Procedures'
- Stefan Franke | lecture: 'Models for Personalized Cancer Treatment'
- Reinhard Fuchs | lecture: 'Electrical Impedance Tomography for Monitoring of Homogeneous Pulmonary Ventilation'
- Andreas Melzer | chair: 'Artificial Intelligence', 'Personalized Medicine'; technical committee pitch: 'Medizintechnik in der MRT'
- Thomas Neumuth | technical committee pitch and lecture: 'Modellgestützte personalisierte Medizintechnik'
- Alexander Oeser | lecture: 'Development of an Assistance System for the Intuitive Assessment of Laboratory Findings in Oncology'
- Upasana Roy | poster: 'Preclinical MR-Guided Focused Ultrasound Hyperthermia in 7 Tesla MRI'
- Michael Unger | poster: 'Vision-Based Depth Measurement for Laparoscopic Hyperspectral Imaging'
- Michael Unger, Xinrui Zhang | lecture: 'In vitro Radiosensitization of Human Cancer Cells with Focused Ultrasound Induced Hyperthermia'

31ST CONFERENCE OF THE INTERNATIONAL SOCIETY FOR MEDICAL INNOVATION AND TECHNOLOGY (SMIT)
October 10 – 13, 2019 | Heilbronn
- Johann Berger | lecture: 'Augmented Reality-Based Treatment Planning for Robotic Positioning in Image-Guided Interventions'; science slam contribution: 'Science Fiction in the OR – How Robert Learned to Fight Cancer'
- Lisa Landgraf, C. Martin Reich | science slam contribution: 'The Sexiness of MRI Guided Interventions'
- Andreas Melzer | session moderations: 'Operating Room of the Future', 'closure'; lecture: 'State of the Art and Future Developments of OR Technology'
- Thomas Neumuth | lecture: 'Value-Added Services Based on SDC'

- Annekatrin Pfahl | lecture: 'Visualization of Instruments for Minimally Invasive MR-Guided Interventions'
- Upasana Roy | lecture: 'Towards Magnetic Resonance Image-Guided Focused Ultrasound in Vivo in 7 Tesla Preclinical MRI'
- Xinrui Zhang | poster: 'Focused Ultrasound Radiosensitize Prostate Cancer Cells in Vitro'

MEDICA 2019
November 18 – 21, 2019 | Düsseldorf
- Thomas Neumuth | lecture: 'OR.NET e.V. – Gerätevernetzung in OP und Klinik 4.0 wird Standard'
- Stefan Franke, Max Rockstroh | booth presentation on Device Networking and ICCAS' 'Intelligent OR'

PROJECT- AND COOPERATION WORK

2ND SONO-RAY STATUS SEMINAR
January 25, 2019 | OncoRay, Dresden
- SONO-RAY-group | Presentation of SONO-RAY's research results

KICK-OFF MR-STENTS AND MR-THROMBOSIS-THERANOSTIC
April 1 – 2, 2019 | EPflex, Dettingen/Erms
- Andreas Melzer, Andreas Seifert | meeting of project partners and project aims declaration

KICK-OFF MOMENTUM
November 7, 2019 | ICCAS
MOMENTUM-group | meeting of project partners and project aims declaration

KICK-OFF SANO'S SCIENTIFIC COMMITTEE
November 25 – 27, 2019 | Sano – Centre for Computational Personalized Medicine, Krakow, Poland
- Claire Chalopin | member: board; lecture on research and clinic transfer

HYPERSPECTRAL IMAGING (HSI) - WORKSHOP
December 4, 2019 | ICCAS
- Claire Chalopin, Hannes Köhler, Marianne Maktabi | Clarification of technical issues in co-operation with Diaspective Vision GmbH, Firma KARL STORZ SE & Co. KG and the German Cancer Research Center (DKFZ)

FINAL PRESENTATION OF THE MOVE PROJECT
December 11, 2019 | Leipzig
- MoVE-group | final presentation of the research project MoVE in the KMU-NetC funding program

#UNIVERSITY COURSES

LEIPZIG UNIVERSITY

Computer Assisted Surgery
Faculty of Mathematics and Computer Science
practical course

Development of Medical Products
Faculty of Mathematics and Computer Science
lecture

Introduction to Computer Assisted Surgery
Faculty of Medicine
lecture

Medical Planning and Simulation Systems
Faculty of Mathematics and Computer Science
lecture

Surgical Navigation, Mechatronics and Robotics
Faculty of Mathematics and Computer Science
lecture

System Innovation in Medicine
Faculty of Mathematics and Computer Science
lecture and seminar

LEIPZIG UNIVERSITY OF APPLIED SCIENCES (HTWK)

Developing Medical Products
Faculty of Electrical Engineering and Information Technology
lecture and seminar

Project Management for Engineers
Faculty of Electrical Engineering and Information Technology, Mechanical and Energy Engineering
lecture and seminar

System Engineering
Faculty of Electrical Engineering and Information Technology
lecture

#GRADUATIONS

HABILITATION DEGREE

Claire Chalopin
'Extended non-standard intraoperative imaging in head surgery: Contrast-enhanced ultrasound imaging and infrared thermography'- Leipzig University

DOCOTRAL DEGREE

PAUL RATHMANN
'Dynamische Infrarot-Thermographie (DIRT) zur Darstellung der Hautdurchblutung bei Kranioplastie-Eingriffen: eine Machbarkeitsstudie zum qualitativen Vergleich mit dem Standard Indocyanin-Grün Video Angiographie (ICGA)'- Leipzig University

MASTER DEGREES

Margarita Ivanova
'Classification of Hyperspectral Endocrine Tissue Images Using Supervised Machine Learning' - Methods' University of Glasgow (GB)

David Lepach
'Entwicklung einer Methodik zur Prädiktion und Simulation von Diagnose- und Patientenauf-kommen in Feldhospitälern'- Leipzig University of Applied Sciences (HTWK)

Tim Meschke
'Automatische Situationserkennung und -vorhersage bei Bandscheibenoperationen durch Surgical Intervention Ontology'- Leipzig University

Erick Angel Raya
'Brain Tumor Segmentation on 3D Intraoperative Ultrasound Images (3D-iUS)'- University of Guanajuato (MEX)

Gergely Pogany
'Development of an approach for the automatic classification of the skin blood vessels in medical dynamic infrared thermography (DIRT)'- University of Glasgow (GB)

BACHELOR DEGREE

Johanna Fleck
'Entwicklung eines digitalen 3D-Herzmodells auf der Grundlage des Visible Human Male Datensatzes als Erweiterung für ein bestehendes Gefäßmodell'- University of Applied Sciences Zwickau

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Industry

- ACL GmbH
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- Bavaria Medizin Technologie GmbH
- Biotype Diagnostic GmbH
- C.R.S. iiMotion GmbH
- Diaspective Vision GmbH
- Dornheim Medical Images GmbH
- Draeger AG & Co. KGaA
- Effigos AG
- EPflex Feinwerktechnik GmbH
- Fritz Stephan GmbH
- GADV – Gesellschaft für Automatisierung mit Datenverarbeitungsanlagen mbH
- Gesundheitsforen Leipzig GmbH
- GMC Systems mbh – Gesellschaft für medizinische Computersysteme mbH
- GTV – Gesellschaft für Technische Visualistik mbh
- healthcare Consulting GmbH
- HEBUmedical GmbH
- Ilara GmbH
- inomed Medizintechnik GmbH
- ITP GmbH – Society for intelligent textile products
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- LeFx GmbH
- LOCALITE GmbH
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- MR:comp
- NOTARZTDIENSTE.DE GmbH
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- Synagon GmbH
- tecVenture GmbH
- UniTransferKlinik Lübeck GmbH
- VISUS Health IT GmbH

- voice INTER connect GmbH
- WEINMANN Emergency Medical Technology GmbH + Co. KG

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- ERNW Research GmbH
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- University of Lubeck, Institute for Electrical Engineering in Medicine (IME), Institute for Software Engineering and Programming Languages (ISP), Institute of Medical Informatics (IMI), Institute of Telematics (ITM)
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- Zuse Institute for Information Technology Berlin (ZIB)

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- MeDrea Medical Science & Technology Ltd.
- MR Instruments Inc.

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- Chongqing University of Technology (CQUT)
- Danish Emergency Management Agency DEMA

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W O
S

Johannisallee

Semmelweisstraße

160 m

13 **14**

500 m

Prager Straße

Philipp-Rosenthal-Straße

W

300 m

14

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