UNIVERSITÄT LEIPZIG
Medizinische Fakultät

iccas

ICCAS
ANNUAL REPORT
2024

#Medical_Technologies_Made_Smart

Leipzig, April 2025

CONTENTS

Dear friends, dear colleagues,

The year 2024 was once again characterized by significant progress and groundbreaking developments that underline our claim to excellence in research and technology. This annual report gives you an overview of the most important milestones and successes that have shaped our work over the past year.

Particularly pleasing were the intensified international collaborations, which further strengthen our location as a leading center for medical innovation. The successful implementation of various projects that combine advanced digital technologies, innovative medical procedures and sustainable solutions has clearly demonstrated our commitment to sustainable healthcare.

Our presence at numerous international specialist events and congresses underlines the outstanding position that our research now occupies in the fields of artificial intelligence, robot-assisted medicine and modern digital healthcare solutions. At the same time, we have actively promoted the importance of sustainability and the responsible use of resources in the medical sector.

None of these successes would have been possible without the close collaboration with our employees, partners and supporters. We would like to express our sincere thanks to them for their commitment and their willingness to actively shape the future of medicine together with us.

We hope that this report provides you with valuable insights and look forward to continuing our collaboration and many joint successes in the future.

With best regards,

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

Ladies and Gentlemen,

The Innovation Center for Computer-Assisted Surgery (ICCAS) continues to set standards in research, development, and application of digital medical technologies. As an integral part of Leipzig University Medicine, ICCAS plays a crucial role in advancing patient-centered innovations and shaping the future of medical technology. With its interdisciplinary approach, it bridges the gap between research and clinical practice, enabling significant advancements in digital precision medicine.

Over the past year, ICCAS has once again demonstrated its pioneering role in the field of computer-assisted medicine. Through cutting-edge research, close collaboration with clinical departments, and strong national and international partnerships, ICCAS is at the forefront of technological progress. The center's work not only improves treatment methods but also enhances patient safety and optimizes clinical processes.

ICCAS's contributions extend beyond research and development. By offering workshops and training programs, it actively supports the education and training of future medical professionals and researchers. The integration of artificial intelligence, robotics, and digital health solutions into clinical environments highlights ICCAS's commitment to fostering innovation and shaping the medical landscape of tomorrow.

I would like to extend my sincere gratitude to the researchers, clinicians, and all staff members for their unwavering dedication and tireless efforts. Their commitment ensures that ICCAS remains a beacon of innovation and excellence. Furthermore, I deeply appreciate the support of our partners in academia, industry, and politics, whose contributions are vital to our shared success.

Looking ahead, I am confident that ICCAS will continue to lead groundbreaking research initiatives and drive the digital transformation of medicine. I look forward to witnessing the center's future achievements, all with the overarching goal of enhancing patient care and advancing medical science.

With best regards,

Prof. Dr. med. Ingo Bechmann
Dean of the Medical Faculty

2024
- Consortium meeting of the MORFEUS project with partners - knowledge transfer between medical technology and aerospace was advanced, in particular for the development of the "synthetic torpor" (sTor)
- Biosaxony held a successful business roundtable in Berlin with the Saudi delegation led by Khalid bin Abdulaziz Al-Falih. The region's excellent life science ecosystem was presented and the first foundations for future cooperation were laid
- Stefan Bohn visited several institutions in Houston/Texas, including the Texas Medical Center and the Rice360 Institute. The aim was to explore innovative medical and eHealth technologies and establish the Houston region as a major center for biomedical and digital health processes
- Tri5G project ended at the DHL hub in Leipzig and presented pioneering innovations in mobility and connectivity. The project emphasized the importance of 5G and edge computing for Leipzig to establish it as a leading center for 5G technologies
- Launch of projects: TeleNoma, FazioTrain, SurgiTrace, SoKoRoMed

2023
- Start of the 6G-Health-Project, the first Europe-wide project to integrate 6G technology into medical technology
- Thomas Neumuth and his team presented the ICCAS research results on the medicine of the future to Minister of State Sebastian Gemkow
- Andreas Melzer was co-organizer of the second joint meeting ISTU- EUFUS 2023
- Presentation and discussions with Minister of State Oliver Schenk on the developments at ICCAS as a representative of Leipzig as a research location and on the design and further development of the life sciences location
- ICCAS won the „Best Design Award" at the Hamlyn Robotics Symposium for its contribution „MERODES"
- Launch of the 5G-COMPASS, 5G Pacemaker, VOLTA, RescEU EMT, MIRACLE-5 and CERTAINTY projects

2022
- ISO 13485 recertification for ICCAS has been extended
- ICCAS developed a blue print of a future ambulance with 5G
- ICCAS took part at the BMT 2022 with many program contributions
- ICCAS members participated the 13th International MRI Symposium and held a network meeting for their partners
- More than €13 million in new project volume raised by ICCAS in 2022
- Launch of Projects 3MPFUS, 6G-Health, KliNet5G, MediNet, Tri5G, VISION-CRE, CortexMap, SDC-VAS

2021
- ICCAS is founding member of the first center for robot-assisted and navigated surgery in Saxony
- Minister of State Petra Köpping and now Member of the Bundestag Holger Mann visit ICCAS
- Center for Medicine Innovation (CMI) selected to move to the next phase in the ideas competition „Wissen schafft Perspektiven für die Region"
- ICCAS involved within the framework for the establishment of the Comprehensive Cancer Center (CCC) for Central Germany
- Launch of projects EyeHearU, SCD Controlstation MED, MMMP FUS

2020
- 15th anniversary of ICCAS – Greetings and video message by Saxon Minister for Science Sebastian Gemkow
- Institute at the Faculty of Medicine at Leipzig University
- BMT in Leipzig – Opening by Federal Minister of Health Jens Spahn
- New Research Group Biomedical Data Analysis with project Post-Stroke (Prof. Galina Ivanova)
- Avatera Cooperation: Instrument Positioning
- Launch of projects VITALS, KAIT, MSI-Endoscopy, HSI-Laparoscopy, AIQNET, SORLIC, AutoCuff, Brainsaver

2019
- ICCAS organizes the 'FutureMedTechnologies' doctoral workshop and transfer meeting
- Habilitation of Dr. Claire Chalopin
- 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, MPM and ProDial

2018
- ICCAS welcomes Saxony's Prime Minister Michael Kretschmer
- 5th DORS inspired international participants
- ICCAS takes part at the Surgical Robot Challenge of the Hamlyn Symposium in London
- ICCAS hosts Steering Committee Meeting of the EUMFH 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
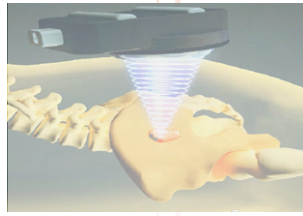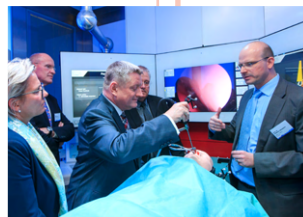
2017
- ICCAS meets Federal Chancellor Angela Merkel at Digital Summit 2017
- 4th DORS consolidates its unique feature
- EUFUS 2017 & Preconference Workshop Experimental FUS and HIFU take place in Leipzig
- Successful non-invasive treatments with HIFU at Leipzig University Hospital
- PROJECT AREA Life Support Systems with projects IMPACT and EMU launches
- Start of projects European Modular Field Hospital (EUMFH), PAPA-ARTIS and MoVE

2016
- Final presentation of the flagship project OR.Net
- ICCAS receives ISO 13485 certification
- Federal health minister visits ICCAS
- 3rd DORS
- Project start of Meta-ZIK SONO-RAY

2015
- Launching of cooperation with several scientific and clinical institutions
- 10th anniversary of ICCAS with 2nd 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

VDE DGBMT
BMT 2020
29.09. – 01.10.2020 | Leipzig
54TH DGBMT ANNUAL CONFERENCE ON BIOMEDICAL ENGINEERING

PUBLICATIONS

First- and
Seniorauthorship

17

Conferende Proceedings &
BookChapters

29

41

Co- Authorship

GRADUATIONS

Bachelor thesis

2

1

Doctoral thesis

9
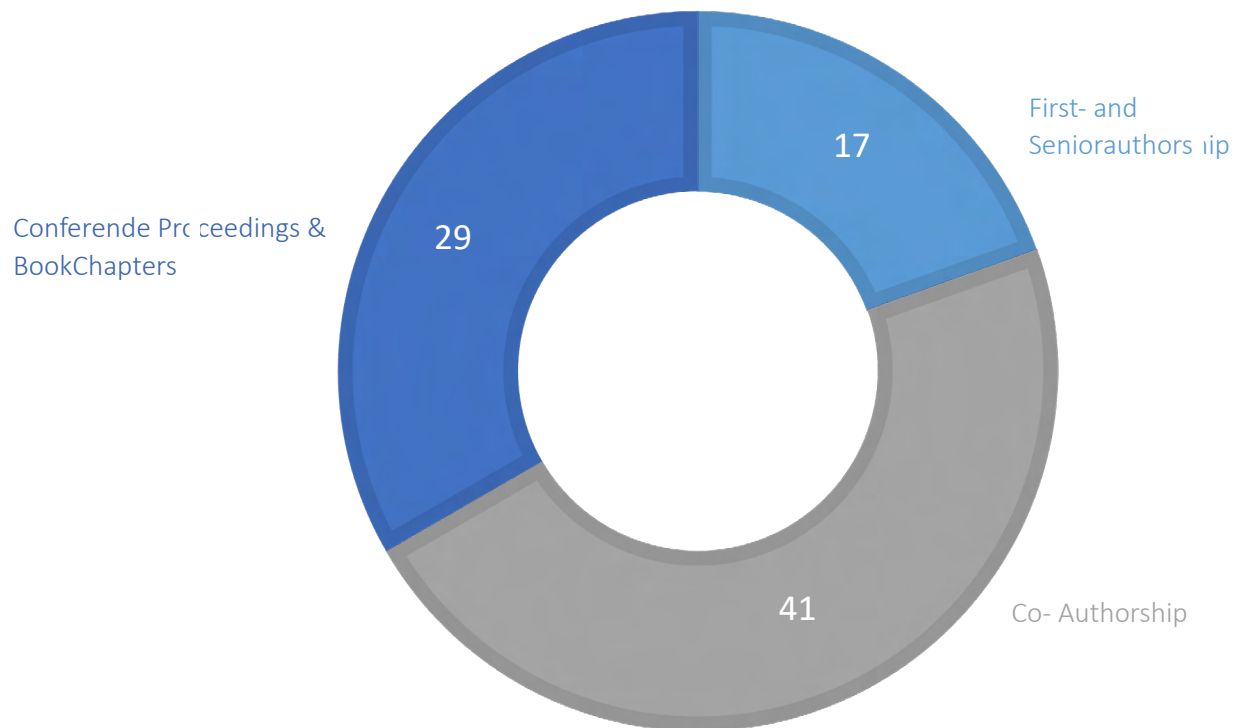
Master thesis
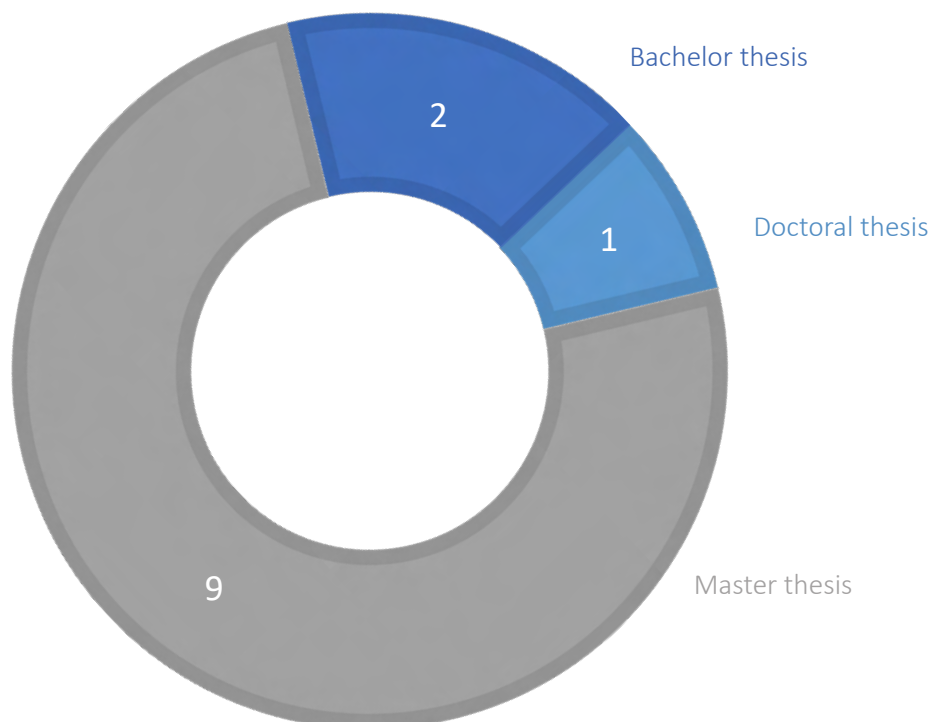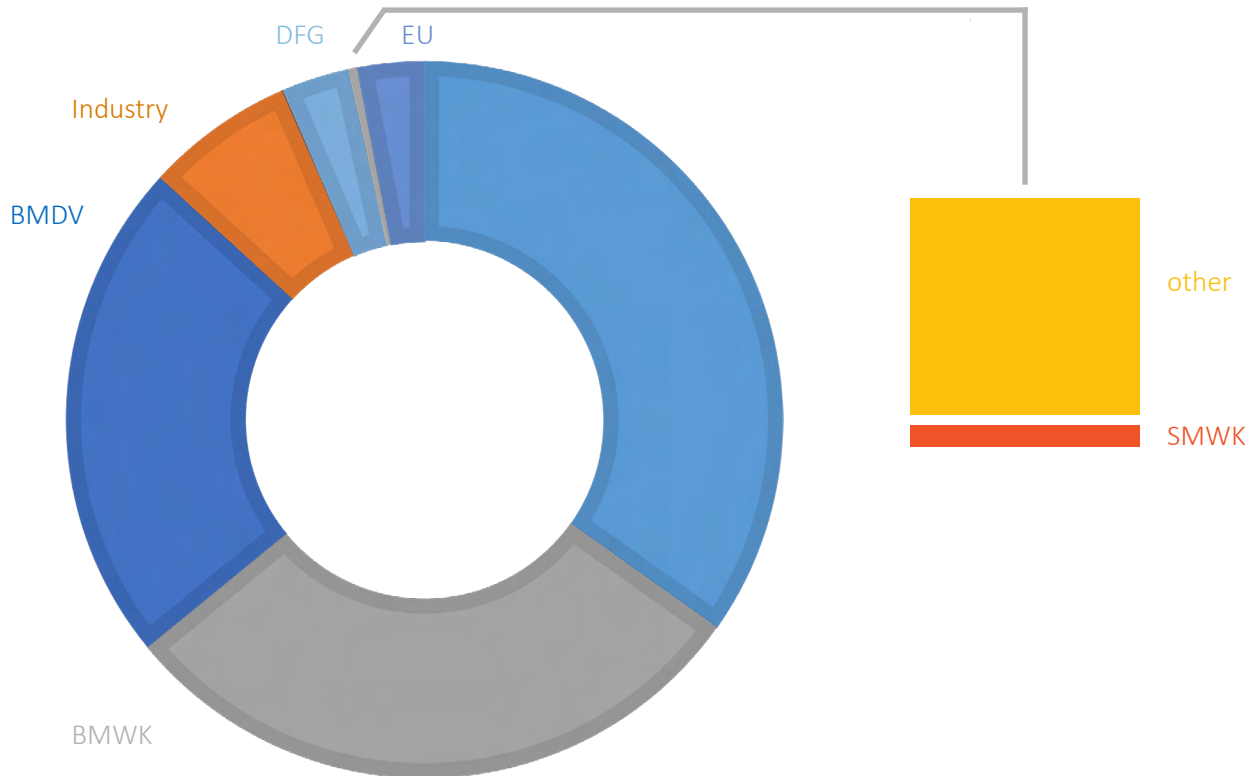
FUNDING

■ BMBF	1.793.940€	■ DFG	156.255€
■ BMWK	1.505.665€	■ EU	153.045€
■ BMDV	1.171.258€	■ SMWK	2.496€
■ Industry	345.661€	■ other	21.988€

ICCAS' main funding is provided by the BMBF- Federal Ministry of Education and Research. Furthermore, ICCAS receives funding from the BMWK- Federal Ministry for Economic Affairs and Climate Action for projects related to the ZIM Central Innovation Program for small and medium-sized enterprises and other ministries.

Leipzig University's Faculty of Medicine provides ICCAS with performance-based funding.

Amount of ICCAS industry-funded project output.
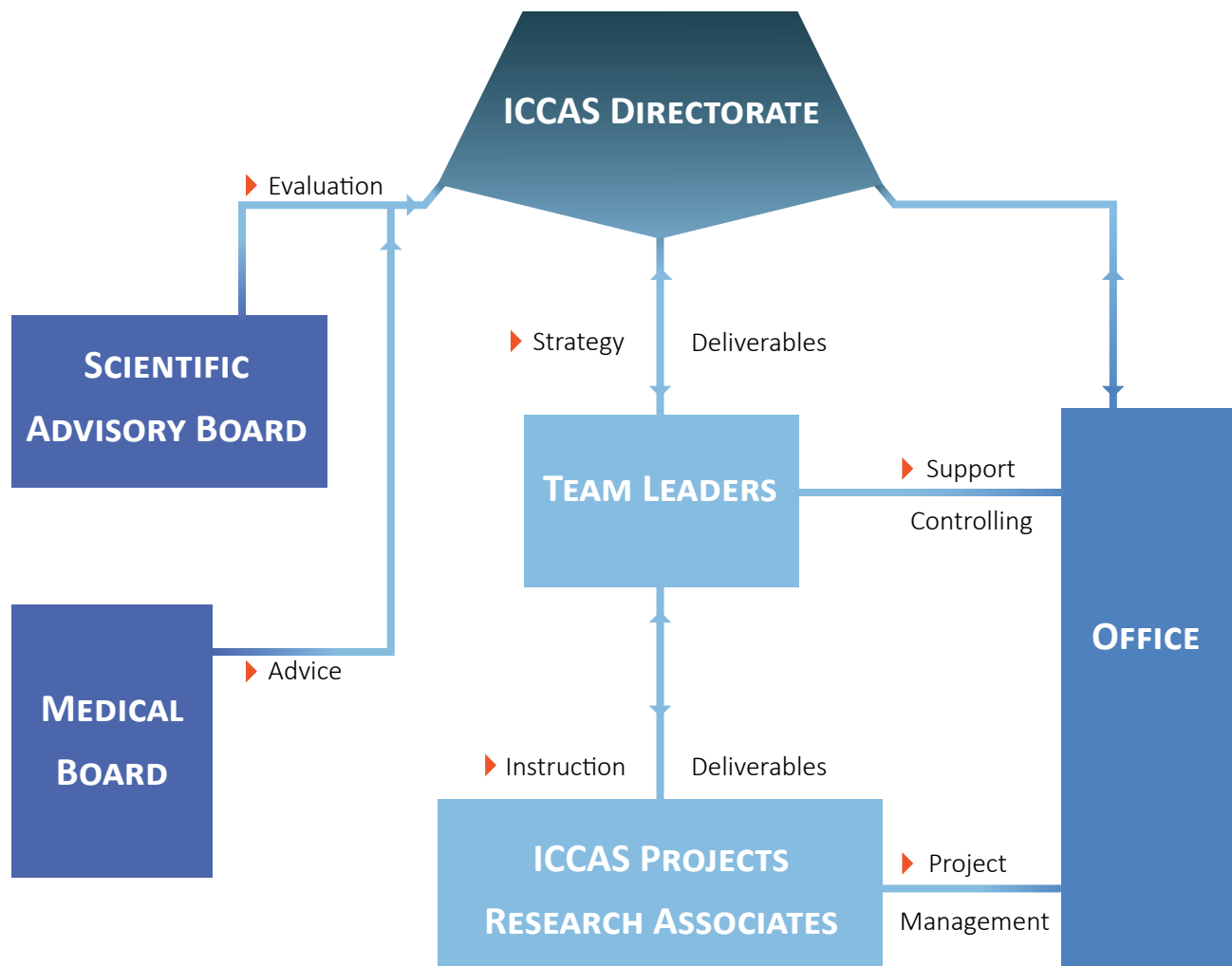
EXECUTIVE DIRECTOR

Melzer, Andreas

Human Medicine & Dentistry

TECHNICAL DIRECTOR

Neumuth, Thomas

Computer Science, Electrical Engeneering

HEADCOUNT STAFF

Guest + Graduates

Research Associates

45

45

15

Research Assistents

MEDICAL BOARD

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• Speaker of the Medical Board | Department of Otolaryngology, University of Leipzig Medical Center

Prof. Dr. med. Bahriye Aktas
• Clinic Director | Clinic and Polyclinic for Gynecology, Leipzig University Hospital

Dr. med. Erdem Güresir
• Director of the Clinic and Polyclinic for Neurosurgery

Prof. Dr. Ulrike Köhl
• Institute Director-Fraunhofer IZI | Professor of Immuno-Oncology at University and Director of Leipzig of the Institute of Clinical Immunology, Leipzig University Hospital
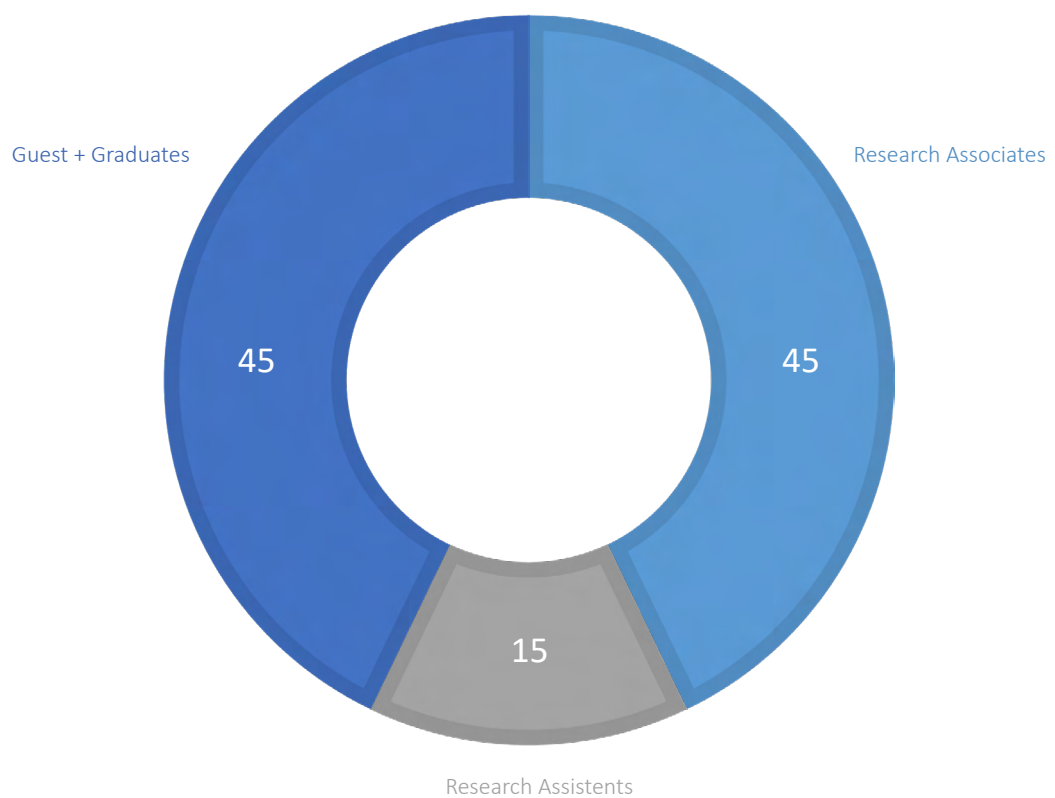
Prof. Dr. Dr. med. Nils Nicolay
• Professor of Radiotherapy and Radiation Oncology, Faculty of Medicine | Head of the Department of Radiotherapy, Leipzig University Hospital

Prof. Dr. med. Uwe Platzbecker
• Director of the Clinic and Polyclinic for Hematology, Cell Therapy and Hemostaseology, Leipzig University Hospital | Medical Director, University Hospital Dresden

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• Clinic for Orthopaedics, Trauma and Plastic Surgery, University Hospital Leipzig

Prof. Dr. MD-PhD. Osama Sabri
• Director and Chairman of the Department of Nuclear Medicine, University Hospital Leipzig

Prof. Dr. med. Daniel Seehofer
• Head of the Leipzig Transplant Center| Hepatobiliary Surgery and Transplant Surgery, Leipzig University Hospital

Prof. Dr. Sebastian Stehr
• Director Department for Anesthesology and intensive Care, University of Leipzig Medical Center

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Prof. Dr. Arno Villringer
• Director of the Department of Neurology, Max Planck Institute for Human Cognitive and Brain Sciences Leipzig | Professor, University of Leipzig

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- B. Leonard Holman Professor of Radiology, Harvard Medical School | Founding Director, Surgical Planning Laboratory | Vice-Chair for Biomedical Informatics Research, Department of Radiology, Brigham and Women's Hospital

Dr. Robert Krieg
- Siemens Healthcare GmbH | VP in Siemens Healthineers' business line Magnetic Resonance

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- Professor of Computer Science and teaches and supervises research on Computer Assisted Medicine, Technical University of Berlin

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- Head | Chair for Computer Aided Medical Procedures & Augmented Reality, Department of Informatics, Technical University Munich

Prof. Dr. Bernhard Preim
- Head of the Chair of Visualization, Otto von Guericke University Magdeburg

Prof. Dr. Andrea Schenk
- Deputy Institute Director, Fraunhofer MEVIS, Professor for Computer-Assisted Diagnosis and Therapy, Hannover Medical School

Prof. Dr. Dipl.-Ing. Thomas Schmitz-Rode
- Director | Institute of Applied Medical Engineering, Helmholtz-Institute of RWTH Aachen, University & Hospital

United States of America
Stanford Medical School
Health Tree Foundation
MR Instruments Inc.
Harvard Medical School (HMS), Brigham and Women's Hospital
Memorial Sloan Kettering Cancer Center (MSKCC)
John Hopkins University
FUS Foundation
Children's National Medical Center (CNMC)
University of Guanajuato, Faculty of Electrical Engineering

United Kingdom
University of Dundee, Institute for Medical Science and Technology (IMSaT)
Imperial College, Hamlyn Center
Kings College London

Norway
Norwegian University of Science and Technology, Department of Imaging and SINTEF Medical Tech.

Denmark
Welfare Tech Odense
Danish Emergency Management Agency DEMA

Netherlands
European Society for Blood and Marrow Transplantation (EBMT)
Universitair Medisch Centrum (UMC) Utrecht
Delft University of Technology, Faculty of Mechanical, Maritime and Materials Engineering,
Department of BioMechanical Engineering
European Burns Association

Belgium
ReGEDiM: Research Group on Emergency and Disaster Medicine, Vrije Universiteit
Research Group on Emergency and Disaster Medicine
Belgian First Aid and Support (B-FAST)
Health Food Chain Safety Enviroment
Myeloma Patients Europe AISBL
University of Namur

France
French DG for Civil Protection and Crisis Management
Institut Curie
Theraclion S.A.
Lyonbiopôle- Cluster Auvergne-Rhône-Alpes
Image Guided Therapy (IGT)
IRCAD – France-Research Institute against Digestive Cancer

Luxembourg
Information Technology for Translational Medicine

Switzerland
Roche Pharma AG
Swiss Federal Institute of Technology Zurich (ETH), Computer Vision Laboratory
Health Tech Cluster Switzerland
Inselspital, Bern University Hospital, Department of Ear, Nose and Throat Diseases (ENT),
Head and Neck Surgery

Italy
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EMT 2 Hospital Regione Piemonte
University of Turin, Department of Surgical Sciences
La Sapienza University
Sant'Anna – School of Advanced Studies, The BioRobotics Institute
Italian Civil Protection Authority

Spain
Hospital Universitario Fundación Jiménez Díaz
EMT, Instituto Nacional de Emergência Médica

#COOPERATIONS

Poland
Wroclaw Medizinische Universität

Czech Republic
Masaryk University

Austria
MEDIFINA GmbH
HeartBalance GmbH
Medical University of Graz, Institute for Medical Informatics, Statistics and Documentation (IMI)

Slovakia
ASSR- Association of Samaritans of the Slovak Republic

Estonia
Estonian Health Board

Romania
Ministry of the Interior
Romanian Association for Endoscopic Surgery and other Interventional Techniques - ARCE
Medis Foundation

Israel
INSIGHTEC Ltd.
The Chaim Sheba Medical Center at Tel HaShomer

Agypt
Menoufia University, Department of Computer Science and Engineering

Congo
Higher Institute of Applied Technology of Kinshasa (ISTA)

China
Chongqing University of Technology (CQUT)
MeDrea Medical Science & Technology Ltd.
Institute for Medical Instrumentation, Shanghai University

Taiwan
IRCAD Lukang

South Korea
National Cancer Center Graduate School of Cancer Science and Policy (NCC-GCSP)

NOTARZTDIENSTE.DE GmbH

ZBW- Leibniz Information Center for Economics

Draeger AG & Co. KGaA

UniTransferKlinik Lübeck GmbH

University of Lübeck, Institute for Software Engineering and Programming Languages (ISP)

University of Lübeck, Center for Open Innovation in Connected Health

Hamburger Informatik Technologie-Center e.V. (HITeC)

WEINMANN Emergency Medical Technology GmbH + Co. KG

Fraunhofer Institute for Digital Medicine (MEVIS)

OFFIS – Institut für Informatik e.V.

Osnabrück University of Applied Sciences

steute Technologies GmbH & Co. KG

German National Library of Science and Technology (TIB), Leibniz Information Center for Science and Technology

Leibniz University of Hannover

Stiftung Deutsche Schlaganfall-Hilfe

MR:comp GmbH

MRI-STaR- Magnetic Resonance Institute for Safety, Technology and Research

VISUS Health IT GmbH University Hospital Knappschaftskrankenhaus Bochum GmbH, Clinic for Anesthesiology, Intensive Care Medicine and Pain Therapy

MotionMiners GmbH

University Medical Center Göttingen, Clinic for Cardiology and Pneumology

Vodafone Group Services GmbH (VOD)

Bio River e.V.

Janssen Cilag GmbH

Nuromedia GmbH

Singleron Biotechnologies GmbH

ZB MED – Information Centre for Life Sciences

University of Cologne

SurgiTAIX AG

Ilara GmbH

Synagon GmbH

Rheinisch-Westfälische Technische Hochschule Aachen (RWTH)

Helmholtz Institute for Biomedical Engineering, Faculty of Mechanical Engineering, Chair of Medical Technology (mediTEC)

qcmed – Quality Consulting Medical GmbH

LOCALITE GmbH

Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS)

Telekom Healthcare Solutions GmbH

Fritz Stephan GmbH
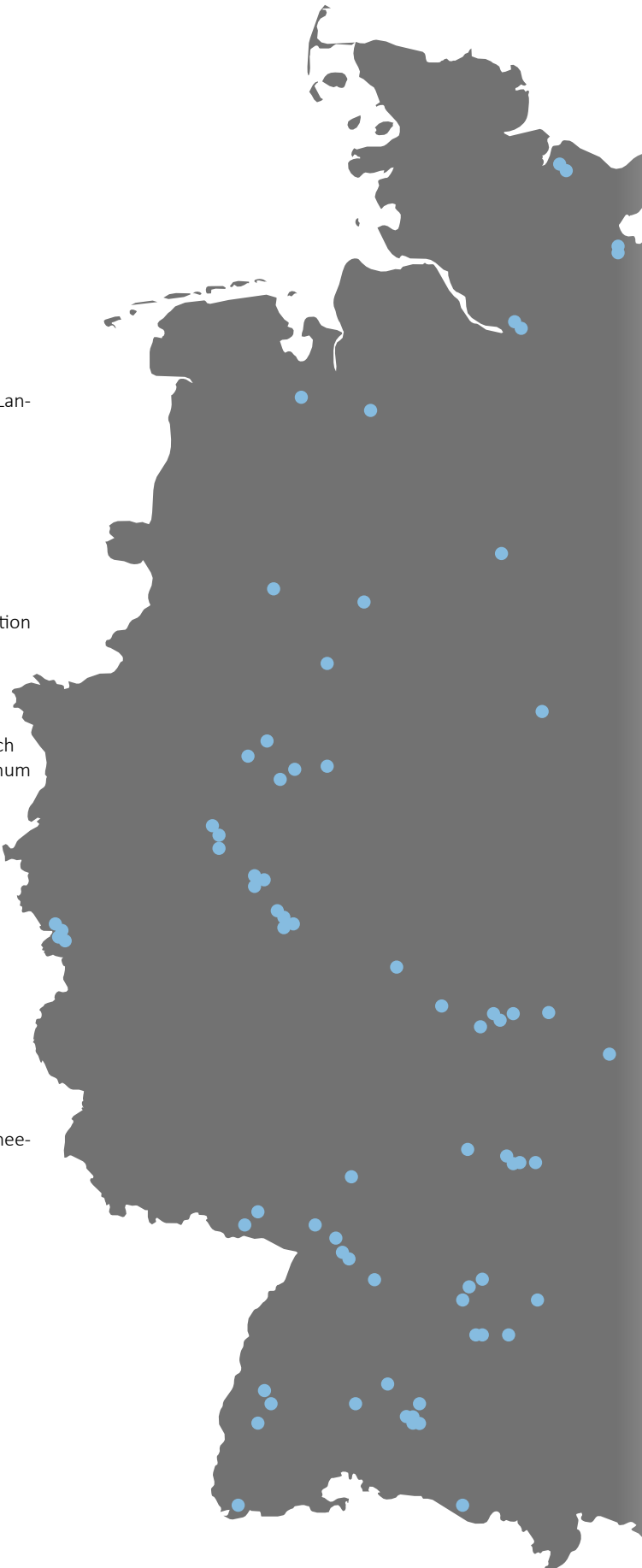
tetronik GmbH

IQVIA Commercial GmbH & Co. OHG

University Hospital Frankfurt, Center of Radiology

Association of Electrical, Electronic and Information Technologies (VDE)

KfH Kuratorium für Dialyse und Nierentransplantation e.V

SIGNUS Medizintechnik GmbH

University Hospital Würzburg

Leibniz Institute for the Social Sciences (GESIS)

Heidelberg University Hospital, Ear, Nose and Throat Clinic

Heidelberg University Hospital, Radiology Clinic

Mediri GmbH

ERNW Research GmbH

Inova DE GmbH

Deutsches Forschungszentrum für Künstliche Intelligenz GmbH

Fraunhofer Institute for Biomedical Engineering (IBMT)

CTC advanced GmbH

HWI pharma services GmbH

Leibniz Institute for Information Infrastructure (FIZ Karlsruhe)

HS Analysis GmbH

WIBU Systems A.G.

ADMEDES GmbH

BioRegio STERN GmbH

Technologie-Transfer-Initiative GmbH

Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)

TZM GmbH

GADV – Gesellschaft für Automatisierung mit Datenverarbeitungsanlagen mbH

University of Tübingen, Ethics Committee at the Medical Faculty

HPZenner Clinical Evaluation GmbH & Co. KG

EPflex Feinwerktechnik GmbH

inomed Medizintechnik GmbH

Schölly Fiberoptic GmbH

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METRAX GmbH, PRIMEDIC

C.R.S. ii Motion GmbH

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KARL STORZ SE & Co. KG

KLS Martin Group – Gebrüder Martin GmbH & Co. KG

HEBUmedical GmbH

Aesculap AG

MedicalMountains GmbH

BioLago e.V. Konstanz

Diaspective Vision GmbH

Computer Science and Electrical Engineering, Institute for Applied Microelectronics and Data Technology (IMD)

Optris GmbH

Fraunhofer Institute for Open Communication Systems (FOKUS)

SectorCon Engineering ltd

Hospital Charité- University Medicine Berlin

Berlin Cert GmbH

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airpuls GmbH

Technical University Berlin

Berufsverband für Orthopädie und Unfallchirugie e.V.

Johanniter-Unfall-Hilfe e.V.

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highstreet technologies GmbH

Freie Universität Berlin, Institute of Computer Science, Human-Centered Computing working group

BIOTRONIK SE & Co. KG Berlin

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Dornheim Medical Images GmbH

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Martin-Luther-University Halle

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PHACON GmbH

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tecVenture GmbH

Gesundheitsforen Leipzig GmbH

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Raylytic GmbH Leizpig

City of Leipzig Administrative Offices

Max Planck Institute for Cognitive and Neurosciences, Department of Neurology

University of Leipzig, Institute for Medical Informatics, Statistics and Epidemiology (IMISE)

University of Leipzig, Institute of Anatomy

University of Leipzig, Biotechnological-Biomedical Center

Leipzig University Hospital, Clinic and Polyclinic for Radiotherapy

Leipzig University Hospital, Clinic and Polyclinic for Ear, Nose and Throat Medicine

Leipzig University Hospital, Polyclinic for Tooth Preservation and Periodontology

Leipzig University Hospital, Clinic and Polyclinic for Nuclear Medicine

University Medical Center Leipzig (UML) Intensive Care and Pain Therapy

Leipzig University Hospital, Medical Clinic and Polyclinic V- Angiology

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LeFx GmbH

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Leipzig University of Applied Sciences (HTWK), Faculty of Engineering (EIT), Institute of Electronics and Biomedical Information Technology (EBIT)

Leipzig Heart Center

ASSKEA GmbH

ITP GmbH- Company for Intelligent Textile Products

Jena University Hospital, Information Technology (IT) Division, Department of ENT

Fraunhofer Institute for Applied Optics and Precision Engineering (IOF)

Avateramedical GmbH

Central Medical Laboratory Altenburg

Chemnitz University of Technology

Biotype Diagnostic GmbH
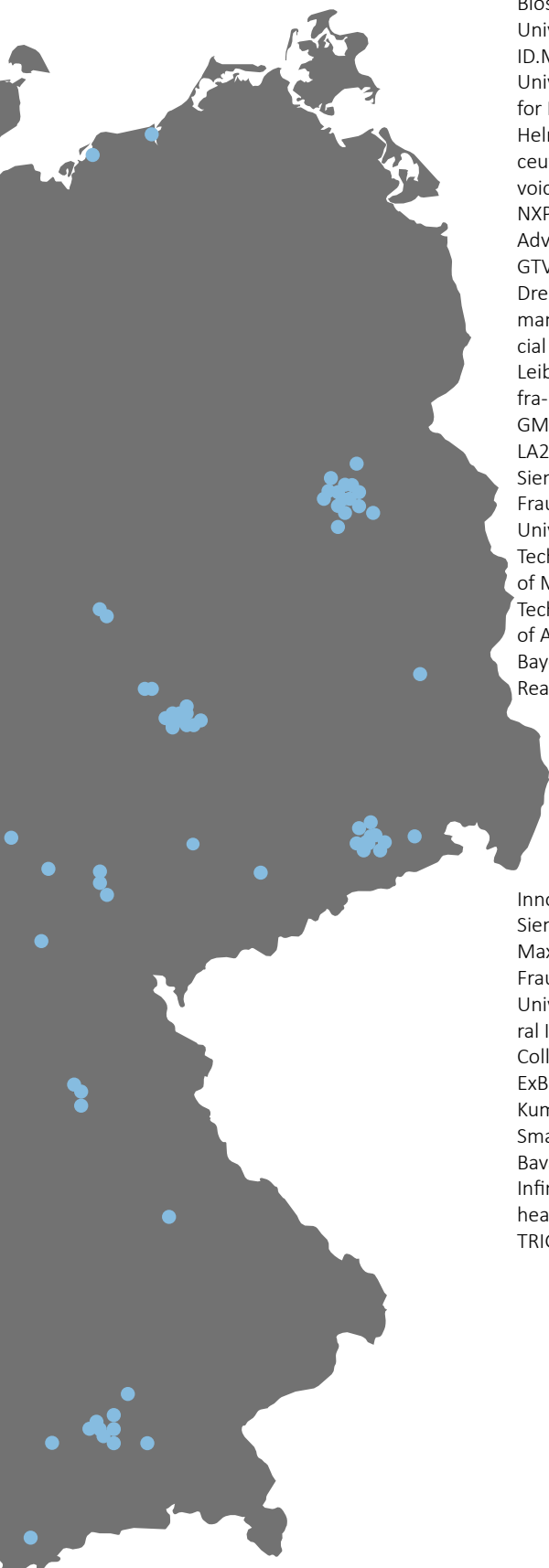
CampusGenius GmbH
Biosaxony e.V.
University Hospital Carl Gustav Carus, Clinic and Polyclinic for Neurosurgery
ID.MED UG
University Hospital Carl Gustav Carus, Faculty of Medicine, OncoRay- National Center for Radiation Research in Oncology
Helmholtz Center Dresden Rossendorf (HZDR), Department of Neuroradiopharmaceuticals
voice INTER connect GmbH
NXP Semiconductors Germany GmbH
Advancing Individual Networks (AIN) GmbH
GTV – Gesellschaft für Technische Visualistik mbh
Dresden University of Technology: Center for Information Services and High Performance Computing, Internati- onal Center for Computational Logic, Institute for Artificial Intelligence
Leibniz Institute: for Ecological Urban and Regional Development, for Information Infra- structure, for Informatics Schloss Dagstuhl, for Social Sciences
GMC Systems mbh – Gesellschaft für medizinische Computersysteme mbH
LA2 GmbH
Siemens Healthcare GmbH
Fraunhofer Institute for Integrated Circuits (IIS)
University Hospital Regensburg, Clinic and Polyclinic for Internal Medicine ll
Technical University of Munich (TUM), Department of Mechanical Engineering, Chair of Microtechnology and Medical Device Technology (MIMED)
Technical University of Munich (TUM), Department of Mechanical Engineering, Chair of Automation and Information Systems (AIS)
Bayerische Motoren Werke Aktiengesellschaft
Reactive Robotics GmbH

Innoroute GmbH
Siemens AG
Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.
University Hospital rechts der Isar, Clinic and Polyclinic for Surgery, Department Visceral Interventions
Collaborate Project Management UG
ExB Labs GmbH
Kumovis GmbH
Smart Mobile Labs AG (SML)
Bavaria Medizin Technologie GmbH
Infineon Technologies AG (INF)
healthcare Consulting GmbH
TRIGA-S Scientific Solutions

► HIGHLIGHTS

CONGRESSES AND FAIRS

FEBRUARY 22ᵗʰ - 24ᵗʰ, 2024 | BUCHAREST, ROMANIA
INNOVATIVE TECHNOLOGIES IN MINIMALLY INVASIVE SURGERY: EAES WINTER MEETING 2024

From February 22th to 24th, 2024, the EAES Winter Meeting in Bucharest brought together leading experts in minimally invasive surgery (MIS) to discuss the latest innovations and technological developments. The scientific programme covered a wide range of topics - from new technologies in surgical training and ergonomic optimization approaches to the clinical impact of robotic systems on surgical procedures.

A particular highlight of the symposium was live oesophagectomy operations performed using two different robotic platforms. In addition, the focus was on practical hands-on courses on safe procedures in the upper gastrointestinal tract, colorectal surgery and image-guided procedures.

ICCAS Director Andreas Melzer led the intraoperative ultrasound workshop "Comparison of wireless ultrasound devices", in which wireless ultrasound technologies were compared and their potential for surgical application was demonstrated. He also co-chaired the "New Projects" meeting and presented current ICCAS research on hyperspectral and multispectral imaging (HSI and MSI).

APRIL 3ᵗʰ - 5ᵗʰ, 2024 | BERLIN
DGE-BV CONGRESS 2024: ADVANCING INNOVATION IN ENDOSCOPY AND IMAGING DIAGNOSTICS

Under the topic "Innovation and Progress in Endoscopy and Imaging Diagnostics," the DGE-BV Congress 2024 brought together leading experts in Berlin to discuss the latest advancements in medical imaging and endoscopic procedures. Organized by the Deutsche Gesellschaft für Endoskopie und Bildgebende Verfahren e.V. (DGE-BV), the congress served as a premier platform for knowledge exchange, networking, and professional development.

The event featured a diverse program, including presentations on cutting-edge research, technological breakthroughs, and the clinical applications of innovative imaging techniques. Beyond theoretical discussions, hands-on workshops and interactive sessions provided participants with direct access to state-of-the-art devices and technologies, fostering a deeper understanding of their practical implementation.

Andreas Melzer set the stage for the congress with an opening address and chaired the distinguished session "ALL IN: Endoscopist Meets Engineer," which facilitated interdisciplinary discussions on the integration of engineering innovations into endoscopic practice.

With its comprehensive agenda and emphasis on collaboration, the DGE-BV Congress 2024 reaffirmed its role as a key driver of innovation in the field of medical imaging and minimally invasive procedures.

Andreas Melzer in his opening speech at the DGE-BV Congress with the topic "Innovation and Progress in Endoscopy and Imaging Diagnostics."

© DGE-BV

DMEA 2024: Shaping the Future of Digital Healthcare

The DMEA trade fair in Berlin is one of the world's leading events for digital health, bringing together healthcare professionals and IT experts to drive the digital transformation of the healthcare sector. As a key platform for innovation, the event provides insights into the latest technological advancements that are revolutionizing medical care and health IT.

ICCAS was once again represented at this year's DMEA, showcasing its latest research at multiple exhibition stands and offering a glimpse into the ambulance of the future. At the OR.NET e.V. and VDE stands, visitors had the opportunity to learn about the groundbreaking 6G-Health project, which aims to develop future medical technology applications by leveraging 6G components. This initiative plays a crucial role in ensuring seamless connectivity between various medical technology systems.

At the Fraunhofer Institute stand, an ICCAS representative presented the potential of LiFi (Light Fidelity) technology as part of the 5G Compass project. LiFi, which uses light for data transmission, is being explored for its potential in enabling secure and efficient communication between medical devices.

By actively participating in DMEA 2024, ICCAS underscores its commitment to pioneering digital healthcare solutions and shaping the future of medical technology through innovative research and collaboration.

EAES Congress 2024: Advancing Endoscopic Surgery and Sustainability in Healthcare

The 32nd International Conference of the European Association for Endoscopic Surgery (EAES) took place from June 11th to 14th, 2024, at MECC Maastricht in the Netherlands. As one of the leading international events in the field of minimally invasive surgery, the congress brought together experts from around the world to discuss the latest research, technological innovations, and best practices in endoscopic surgery.

Our scientists at the DMEA 2024 trade fair in Berlin in front of our RTW.

© ICCAS

This year's program featured a variety of specialized masterclasses covering topics such as endoscopic imaging, image-guided surgery, artificial intelligence in surgery, and the art of writing scientific articles. A central theme of the conference was sustainability in healthcare, addressing the significant environmental footprint of the medical sector, which accounts for approximately 8% of total greenhouse gas emissions in Europe. Experts emphasized the need for more sustainable building structures and improved equipment in hospitals to minimize environmental impact.

Professor Andreas Melzer attended the congress to stay informed about the latest advancements in endoscopic surgery and to explore opportunities for integrating cutting-edge technologies into clinical practice. His participation underscored ICCAS's commitment to fostering innovation and sustainability in medical technology.

By engaging with international experts and contributing to the discourse on sustainability and innovation, ICCAS continued to shape the future of endoscopic surgery and drive forward advancements that benefit both patients and the environment.

CARS Congress 2024: Advancing AI and Image-Guided Medicine

The 38th edition of the renowned Computer Assisted Radiology and Surgery (CARS) Congress took place in Barcelona from June 18th to 22th, 2024, bringing together leading experts from sci-

ence, engineering, and medicine. The event served as a key platform for the presentation and discussion of groundbreaking innovations in medical informatics and imaging technology.

This year's congress focused on key developments in artificial intelligence within the digital operating theatre, model-guided medicine, and image- and model-guided interventions. These advancements are driving the transformation of modern healthcare, enhancing precision, efficiency, and patient outcomes.

ICCAS made a strong contribution to the CARS Congress 2024, with multiple presentations showcasing its latest research. ICCAS researchers Max Rockstroh, Hannes Köhler, Eric Schreiber, Daniel Schneider, and Michael Unger actively participated, presenting their findings and engaging in discussions with international experts.

By playing an active role in this prestigious event, ICCAS reaffirmed its commitment to pioneering research in computer-assisted surgery and medical imaging, helping to shape the future of digital healthcare.

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fltr.: Max Rockstroh, Michael Unger, Eric Schreiber, Hannes Köhler at the CARS Congress in Barcelona.

June 25th - 28th, 2024 | London, England
Hamlyn Symposium 2024: Advancing AI-Driven Healthcare and Medical Robotics

The prestigious Hamlyn Symposium on Medical Robotics 2024 took place from June 25th to 28th, at the Royal Geographical Society in London. Under the theme "AI-Driven Health: Transforming Care," the symposium provided a dynamic platform for experts in medical robotics, surgery, and engineering to exchange insights, showcase innovations, and foster interdisciplinary collaboration.

A highlight of the event was the Surgical Robot Challenge 2024, where cutting-edge robotic technologies and pioneering projects were presented. In addition, the symposium featured numerous sessions on topics such as smart medical devices and systems, continuum and fiber robotics, and human-robot interaction, reflecting the rapid advancements in the field.

Professor Andreas Melzer played a key role in the event by co-organizing the workshop "Endoluminal Robots: A Journey from Unmet Medical Needs, Design Challenges, Regulatory Bodies, and Commercial Opportunities." As a co-chair, he guided discussions on the future of robotic-assisted medical procedures. Additionally, he delivered a presentation on "Imaging-Guided Robotics: Update and Regulatory Requirements," providing valuable insights into the latest developments and regulatory frameworks shaping the field.

ICCAS's active participation in the Hamlyn Symposium 2024 underscores its commitment to driving innovation in medical robotics and advancing AI-driven healthcare solutions that enhance patient care and surgical precision.

July 2nd - 4th, 2024 | Berlin
6G-Conference 2024: Shaping the Future of Healthcare with Next-Generation Connectivity

The 6G-Conference 2024, hosted by the 6G-Platform Germany at the Berlin Congress Center, brought together leading experts to explore the future of 6G technology. Federal Minister Bettina Stark-Watzinger inaugurated the event, which provided deep insights into cutting-edge 6G research and its potential impact across various sectors.

Key topics of discussion included energy efficiency, sustainability, network resilience, security, and the integration of AI and quantum communication. The transformative role of 6G in healthcare and industry was a focal point, highlighting its potential to revolutionize connectivity and technological applications.

ICCAS actively contributed to the conference, presenting its innovative research on the 6G-Health project and unveiling its vision for the

future of medical connectivity with a dedicated research vehicle. Throughout the event, ICCAS experts engaged with attendees, providing insights into the latest developments in medical technology and discussing the role of 6G in advancing healthcare solutions.

By participating in the 6G-Conference 2024, ICCAS reaffirmed its commitment to pioneering next-generation communication technologies and driving innovation in healthcare through advanced connectivity solutions.

PROJECT WORKS

June 09ᵗʰ - 16ᵗʰ, 2024 | Houston, North America
ICCAS Explores Biomedical and eHealth Innovations in Houston

As part of a strategic initiative to foster international collaboration in biomedical and eHealth technologies, ICCAS representative Stefan Bohn visited Houston, Texas, from June 9th to 16th, 2024. His visit included engagements with leading institutions such as the Texas Medical Center, the Rice360 Institute for Global Health Technologies, the CUBIO Innovation Center, and the Texas University of Engineering Medicine EnMed. Additionally, he participated in networking events with key stakeholders from the life sciences and digital health sectors.

Houston is emerging as a major hub for biomedical and eHealth innovations on the southern coast of the United States, complementing the established centers on the west and east coasts. The Houston-Leipzig delegation—comprising repre-

The group around the 6G project in front of the RTW in Berlin.

sentatives from politics, economic development, science, and industry—facilitated valuable exchanges on the latest advancements in medical research, IT-driven healthcare solutions, and laboratory innovations. Discussions also focused on establishing new business models and structures within the healthcare sector.

During the visit, new business contacts and scientific collaborations were initiated, paving the way for future joint research and development projects. Given Houston's reputation as a NASA hub, discussions were also held with engineers on potential collaborations in bioengineering for future space missions, highlighting the intersection of healthcare innovation and aerospace technology.

ICCAS's participation in these high-level discussions underscores its commitment to advancing medical technology through global partnerships and interdisciplinary research, reinforcing Leipzig's role in shaping the future of digital health and biomedical engineering.

Stefan Bohn exchanged ideas with leading institutions from the Texas Medical Center, Rice360 Institute for Global Health Technologies, CUBIO Innovation Center and Texas University of Engineering Medicine EnMed as part of a delegation trip.

July 15th, 2024 | Leipzig
Consortium Meeting at ICCAS: Advancing Medical Technology and Aerospace Research

Leipzig, July 15, 2024 – ICCAS hosted a high-profile consortium meeting as part of the MORFEUS project, welcoming leading scientists and industry partners from Merkle CAE, OHB, Fraunhofer IBMT, Helmholtz Munich, the Max Planck Institute CBS, MRI-STaR, and UKL. The meeting, held at SIKT, focused on fostering collaboration between medical technology and aerospace research, with an emphasis on the development of "synthetic torpor" (sTor) as a transformative technology.

Key discussions addressed shared challenges such as MRI and RF compatibility, as well as the application of aerospace cleanroom technologies to enhance medical hygiene standards. ICCAS showcased its cutting-edge advancements, including neuronavigation, the 6G ambulance, OR robotics, and hyperspectral imaging (HSI), illustrating the potential for cross-sector innovation.

Research into synthetic torpor holds significant promise for both healthcare and space exploration. Potential applications include supporting transplant and coma patients by inducing a controlled metabolic slowdown, as well as protecting astronauts from radiation damage during long-duration space missions.

By facilitating interdisciplinary knowledge exchange and demonstrating pioneering technologies, ICCAS reaffirmed its role as a driving force in medical innovation, bridging the gap between healthcare and aerospace for future breakthroughs.

September 25th, 2024 | Leipzig
Tri5G Project Showcases Future Mobility and Connectivity at DHL Hub in Leipzig

The Tri5G project reached its conclusion with a high-profile demonstration day at Leipzig's DHL hub, highlighting groundbreaking innovations in mobility and connectivity. The event showcased real-world applications of 5G technology, reinforcing Leipzig's role as a hub for future communication and transport solutions.

Key highlights of the event included an autonomous bus developed by the L Group in collaboration with TU Dresden, advancements in vehicle release processes at BMW's logistics center, and cutting-edge ambulance connectivity solutions enabling real-time ultrasound and ECG analysis. Additional demonstrations featured AI-supported fence monitoring and an automated snow clearance system at Halle/Leipzig Airport, underscoring the transformative potential of 5G across multiple sectors.

Expert presentations on mobile networking and edge computing illustrated the significant impact of 5G in northern Leipzig and its broader implications for industry and urban infrastructure. The Tri5G project aims to position Leipzig as a leading center for 5G innovation, paving the way for smarter, more connected mobility and logistics solutions.

With its successful conclusion, the Tri5G project has laid the foundation for future advancements in digital infrastructure, reinforcing Leipzig's standing at the forefront of next-generation technology development.

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At the consortium meeting of the Morfeus project, the partners took a demo tour of the various research focuses of the ICCAS.

The research results of the Tri5G-project were presented at the DHL-Hub in Leipzig.

MISCELLANEOUS

FEBRUARY 20ST, 2024 - LEIPZIG
ICCAS AND SPECTARIS PUBLISH WHITE PAPER ON TELEMEDICINE IN EMERGENCY SERVICES

In light of ongoing healthcare reforms, the medical technology industry association SPECTARIS and the Innovation Center Computer Assisted Surgery (ICCAS) at the University of Leipzig have jointly presented recommendations for integrating telemedicine into emergency services. These findings are compiled in the newly released white paper, "Telemedizin im Rettungsdienst: Weichenstellung für eine digitale Zukunft."

The white paper outlines key measures to address rising healthcare costs and structural challenges by advocating for the implementation of teleconsultations, tele-emergency physicians, standardized communication protocols, and the legal incorporation of telemedicine into state emergency service laws. Further recommendations include the establishment of telemedicine competence centers, the standardization of data protection, mandatory network coverage reporting by mobile providers, and financial support from health insurance companies.

By enabling tele-emergency physicians to optimize resource allocation, reduce response times, and manage multiple patients simultaneously, telemedicine presents a transformative opportunity to enhance the efficiency and effectiveness of emergency medical care. With this initiative, ICCAS and SPECTARIS underscore the urgent need for digital innovation in emergency services to ensure high-quality, accessible care for patients across Germany.

MAY 14TH, 2024 | LEIPZIG
ICCAS RECEIVES STATE-OF-THE-ART SOLA MR TOMOGRAPH FOR PIONEERING NEUROPSYCHIATRIC RESEARCH

As part of the federally funded 3MP-FUS project, a cutting-edge Sola 1.5T MR tomograph from Siemens Healthineers was delivered to the HF cabin in the backyard of the Red House at Leipzig University Hospital AöR on May 14th, 2024. This advanced imaging system will support groundbreaking research conducted by the ICCAS Image-Guided Focused Ultrasound team, led by Prof. Dr. Andreas Melzer.

The new MRI scanner will play a crucial role in the development of innovative therapies for rare neuropsychiatric diseases. In collaboration with Localite GmbH, Fraunhofer IBMT, the Max Planck Institute MPI, and MRI-STAR, ICCAS is leveraging multi-modal, multi-parametric focused ultrasound under MRI control for neuromodulation. This approach aims to advance precision medicine by exploring novel therapeutic strategies for conditions that currently lack effective treatment options.

The delivery of the Sola MR tomograph marks a significant milestone in ICCAS's research efforts, reinforcing Leipzig's position as a hub for medical technology innovation. With cutting-edge imaging and ultrasound techniques, the project aims to push the boundaries of neuropsychiatric research and improve patient outcomes through targeted, non-invasive therapies.

The MR tomograph in its new place in the HF cabin at Leipzig University Hospital.

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SEPTEMBER 08TH, 2024 | BERLIN

STRENGTHENING INTERNATIONAL COLLABORATION: THOMAS NEUMUTH AT BIOSAXONY-SAUDI ARABIA BUSINESS ROUND TABLE

A high-profile business round table in Berlin brought together representatives from Biosaxony and a distinguished Saudi Arabian delegation led by His Excellency Khalid bin Abdulaziz Al-Falih, Minister of Investment. The delegation included Her Excellency Sara Al Sayed, Deputy CEO of the Saudi Investment Promotion Authority, Mr. Ammar M. Altaf, Assistant Deputy of Industry Sectors, and other key figures from the Ministry of Investments and various public and private entities.

The discussions focused on Saxony's thriving life sciences ecosystem, spanning cutting-edge scientific research, innovative companies, a robust clinical network, and advanced logistics.

The Saxonian delegation showcased the region's excellence in life sciences, highlighting opportunities for future collaborations in biotechnology, healthcare, and medical technology.

Biosaxony was well represented by Babett Gläser (SMWK), Alexander Starke, Thomas Neumuth, Katrin Lässig, Andreas Heinecke, Viola Klein, Andreas Mönch, Falk Zakrewski, and Falk Hoffman. André Hofmann and Cornelia Jahnel, together with Rakan Algaarawi and the MISA team, are now preparing the next steps for deepening cooperation, with a planned visit to Riyadh later this year.

This successful exchange has laid the groundwork for strengthened international partnerships, fostering innovation and investment opportunities between Saxony and the Kingdom of Saudi Arabia.

Thomas Neumuth at the meeting with Biosaxony and the Saudi Arabian delegation in Berlin.

© biosaxony

ICCAS Showcases AI and Robotics Innovations at the 21st Circus of Science in Leipzig

Leipzig, September 18, 2024 – The 21st edition of the Circus of Science captivated audiences at Leipzig's Kupfersaal, featuring a special focus on "Robots and AI." A key theme of the evening was the crucial role of high-quality training data in AI development, an aspect often overlooked despite its fundamental importance.

Tobias Pabst from the Innovation Center of Computer Assisted Surgery (ICCAS) delivered an insightful presentation on the challenges facing the healthcare sector in developing reliable, data-driven AI applications. He emphasized the necessity of "interoperable interfaces," highlighting how seamless communication between medical devices and systems is essential for leveraging the vast amounts of healthcare data generated daily.

ICCAS also brought an interactive highlight to the event with the robotic dog Spot from Boston Dynamics. Robot pilot Alexander Prull entertained visitors in the queue and foyer with Spot's impressive tricks, offering a hands-on glimpse into the potential of robotics in medical applications.

Another major attraction was the future-ready networked ambulance, which drew significant interest from attendees. Before the event and during intermissions, ICCAS researchers Anna Schatz and Clemens Möllenhoff engaged with visitors, explaining current challenges in emergency medicine and showcasing potential digitalization strategies aimed at enhancing connectivity and efficiency in rescue operations.

ICCAS continues to pioneer research in medical technology, striving to advance AI-driven healthcare solutions and improve interoperability in emergency medicine, setting new standards for the digitalization of medical processes.

© ICCAS

Tobias Pabst gave a humorous presentation on the ICCAS ambulance of the future at the Circus of Science.

#THE FOCUS OF OUR INTERDISCIPLINARY RESEARCH

Our research focuses on the integration of biomedical device technology with medical information systems, data analysis technologies, medical communication protocols, digital twins, and biomedical sensors to advance the next generation of smart healthcare solutions. A central aspect of these innovations is the development of adaptive operating rooms that dynamically respond to surgeons' needs and medical technologies leveraging 5G infrastructures for advanced communication. The ultimate goal is to enhance clinical workflows, increasing both efficiency and patient safety through intelligent, interconnected systems.

A key area of our work is the advancement of MRI-guided procedures, enabling minimally and non-invasive approaches for diagnosis and treatment. MRI provides superior soft tissue contrast while eliminating the need for iodine-based contrast agents and ionizing radiation. Our research aims to develop MR-compatible instruments, optimize medical workflows with restricted patient access, and improve communication within the MRI environment. Additionally, we are exploring applications of focused ultrasound, minimally invasive catheter interventions, and robotic-assisted procedures to further enhance precision and patient outcomes.

Through the integration of cutting-edge medical technologies and data-driven approaches, we strive to refine clinical efficiency and elevate patient safety, setting new standards for modern healthcare.

LEAD

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 surgery and interventions.

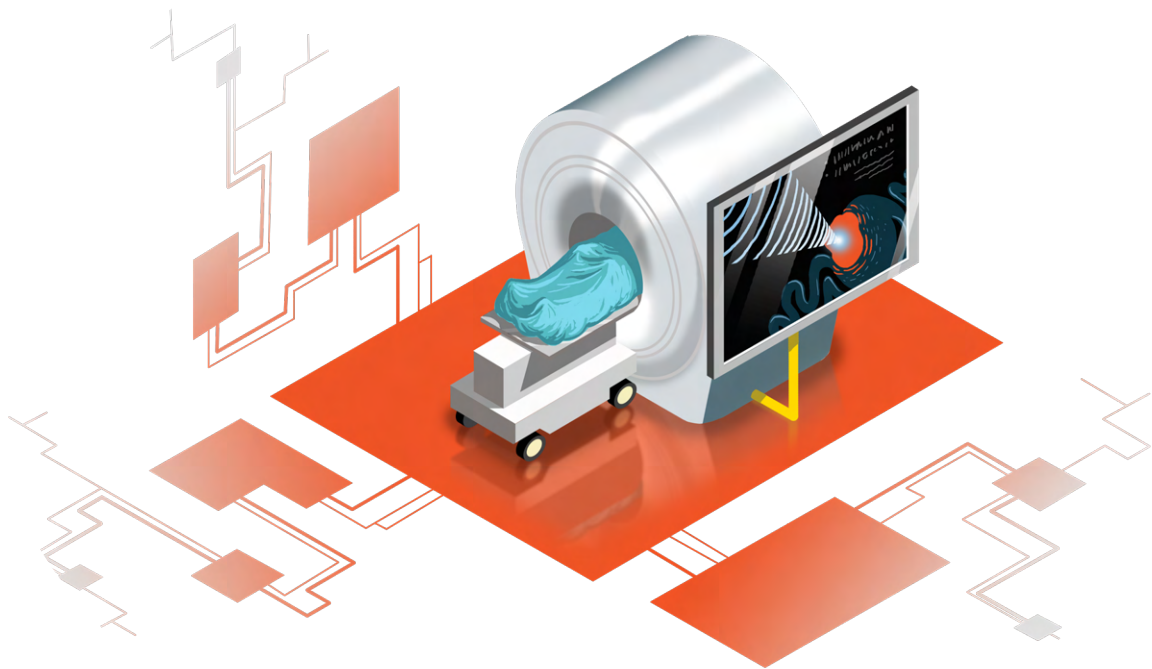## LEAD

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.

MR Technology

The project group deals with the development of MR-supported therapy procedures and the transfer of minimally invasive interventions to the MR environment. Minimally invasive procedures are used for patient-friendly diagnosis and therapy and are currently primarily performed using X-ray imaging. The advantages of the transfer to MRI are improved soft tissue contrast, the absence of iodine-containing contrast agents and the absence of ionizing radiation. In addition to the patients, this also benefits the hospital staff involved in the procedure.

The development of MRI-compatible instruments and devices is a central objective for the implementation of our projects. At the moment, our main focus is on developing therapy procedures using focused ultrasound (FUS) in MRI. With FUS, the sound waves can be bundled in a focus approximately the size of a pine nut. Due to the constructive interference, higher pressures and sound intensities can be achieved in the focal area, which can be used therapeutically without affecting the surrounding tissue. In combination with the excellent soft tissue contrast of MRI, this opens up the possibility of non-invasive use of FUS for therapeutic purposes. We are particularly interested in the use of FUS for neuromodulation and neurostimulation. By applying low-energy FUS, ion channels of neurons can be activated or inhibited in order to modulate the corresponding brain areas.

The aim of our research group is to use MR-guided low-energy FUS non-invasively to modulate deep brain areas in order to treat stroke, addiction and chronic obsessive-compulsive disorder, for example.

Project Leader

Prof. Dr. Andreas Melzer

Projects

- MRG-LIFUP
- MR Thrombose
- MR Biopsie
- MR Stents
- 3MP-FUS

Project Members

- Andreas Eger
- Till Handel
- Leon Schülert

Highlights

- Commissioning of ICCAS MRT
- Start of the navigated FUS neuromodulation study at the MPI CBS
- Integration of FUS and navigation system in our MRI, communication of the 3 devices
- ESA ACT Hibernation Meeting / Concept induction of synthetic torpor by FUS as a key technology for medicine

INTERDISCIPLINARY ROBOTICS

Since September 2024, the "Interdisciplinary Robotics" project team has been working on the further development and optimization of medical robotic systems by integrating principles of soft and continuum robotics as well as networking and standardization. Soft robotics deals with the development of robots made of flexible, soft materials that are characterized by high adaptability and safety. These systems are based on biological models and offer particular advantages when handling sensitive tissues. Continuum robotics describes robot systems whose continuous structure does not require rigid joints. These technologies enable fluid movements and precise adaptations to complex geometries, making them ideal for medical applications.

The team's aim is to make diagnostic and interventional robotic systems safer, more user-friendly and more efficient in order to facilitate their clinical application and promote the translation of innovative technologies into everyday medical practice. In addition, realistic, patient-specific structures are to be developed for use in the planning and execution of interventions as well as in training and simulation scenarios. These approaches help to expand the skills of clinical staff and improve the quality of patient care.

The team's work is based on research into alternative technologies from soft and continuum robotics in order to develop innovative approaches for medical applications. A central focus is on patient protection, which is ensured through the use of soft components and end effectors such as gripping or guidance systems. In addition, realistic organ models, such as an actuated heart simulator, are being developed that can be used for training complex interventions under clinically relevant conditions. One of the main challenges here is the optimization and adaptation of existing soft robotic systems to the specific requirements of clinical practice. The aim here is to overcome known limitations such as the generation of sufficient forces, biocompatibility and flexibility.

At the same time, the team is developing standardized descriptions of robotic systems and procedures for integrating these systems with other medical devices using modern network technologies and standards, in particular IEEE 11073 SDC. These standards create the basis for the smooth integration of different systems and increase interoperability in medical technology.

Project Leader

Johann Berger

johann.berger@medizin.uni-leipzig.de

+49 341 97-12017

Projects

- SoKoRoMed

Project Members

- Albrecht Bloße
- Joel Focking
- Manuel Rosenau
- Julia Pretschner
- Andres Gonzalez

Highlights

- 2024- Kickoff of the SoKoRoMed project between HTWK and ICCAS

▶ IMAGING TECHNOLOGIES

The team researches new imaging technologies and methods for non-invasive use in medicine. The focus is on optical procedures for perfusion imaging and tissue differentiation in the context of surgical interventions. In close cooperation with several clinics and industrial partners, all areas from evaluation in the laboratory to the analysis of study data and its utilization are currently being worked on.

The team has many years of experience in the field of spectral imaging in particular. This technology can support the intraoperative assessment of tissue perfusion, identification of tissue structures and tumor tissue. By recording and analyzing spectral measurement data with various multi- and hyperspectral imaging systems in the laboratory, preclinical and clinical environment, potential medical fields of application and current limits of the technology are to be evaluated. The resulting information will be used, for example, to support intraoperative decision-making and thus contribute to patient safety.

In order to support the transfer to clinical application, methods for the automatic classification and visualization of tissue based on optical image data are being researched and implemented. In addition to conventional machine learning methods, neural networks are also used. The team supports the planning, application and implementation of clinical studies in order to build up clinical evidence and evaluate the methods developed.

In addition to research, the supervision of student theses in the fields of medicine, computer science and engineering is an important part of the team's work.

PROJECT LEADER

Dr. Hannes Köhler

hannes.koehler@medizin.uni-leipzig.de

+49 341 97-12057

PROJECTS

- Basic studies on the clinical relevance of multi- and hyperspectral imaging Industry-sponsored research by KARL STORZ SE & Co. KG

PROJECT MEMBERS

- Annekatrin Pfahl
- Denis Gholami Bajestani

HIGHLIGHTS

- Publication of the first in situ study using the TIVITA® Mini laparoscopic hyperspectral camera (Ilgen et al., Intraoperative Laparoscopic Hyperspectral Imaging during Esophagectomy-A Pilot Study Evaluating Esophagogastric Perfusion at the Anastomotic Sites)
- Conference presentation at CARS 2024 in Barcelona (Köhler et al., Classification of peritoneal lesions and detection of peritoneal metastasis using in vivo laparoscopic hyperspectral imaging)
- Start of a clinical study on the preoperative use of hyperspectral imaging in dermatology at Leipzig University Hospital
- Start of a clinical study on the intraoperative use of hyperspectral imaging in neurosurgery at Leipzig University Hospital
- Publication of two European patent applications (EP4437736A1, EP4384857A1)

Bio Signal Processing

The project team focuses on the use of sensors and technologies to improve medical practice. They combine innovative approaches in diagnostics, treatment and training to increase quality and precision in modern medicine.

The projects are dedicated to non-invasive neurological mapping by developing state-of-the-art methods for the precise recording and visualization of neuronal activity through the measurement of muscle activity. The aim is to process complex data in such a way that it can be seamlessly integrated into clinical workflows and support decision-making.

Another project focuses on improving surgical training processes through data-based assistance systems. These systems analyze training progress, provide targeted feedback and thus promote individual skills development. With the help of sensor technology and artificial intelligence, the learning curve of trainees is optimized, which ultimately increases patient safety.

The third project creates realistic simulation environments that reproduce anatomical conditions with a high level of detail. By mimicking real biomechanical reactions in combination with the integration of sensor technology for condition monitoring, practical training is supplemented with immersive, realistic experiences that facilitate the transition from theory to practice.

Together, the projects demonstrate how technological innovations address fundamental challenges in medicine. They not only promote precise diagnostics and effective treatment, but also the practical teaching of essential skills to define future medical standards.
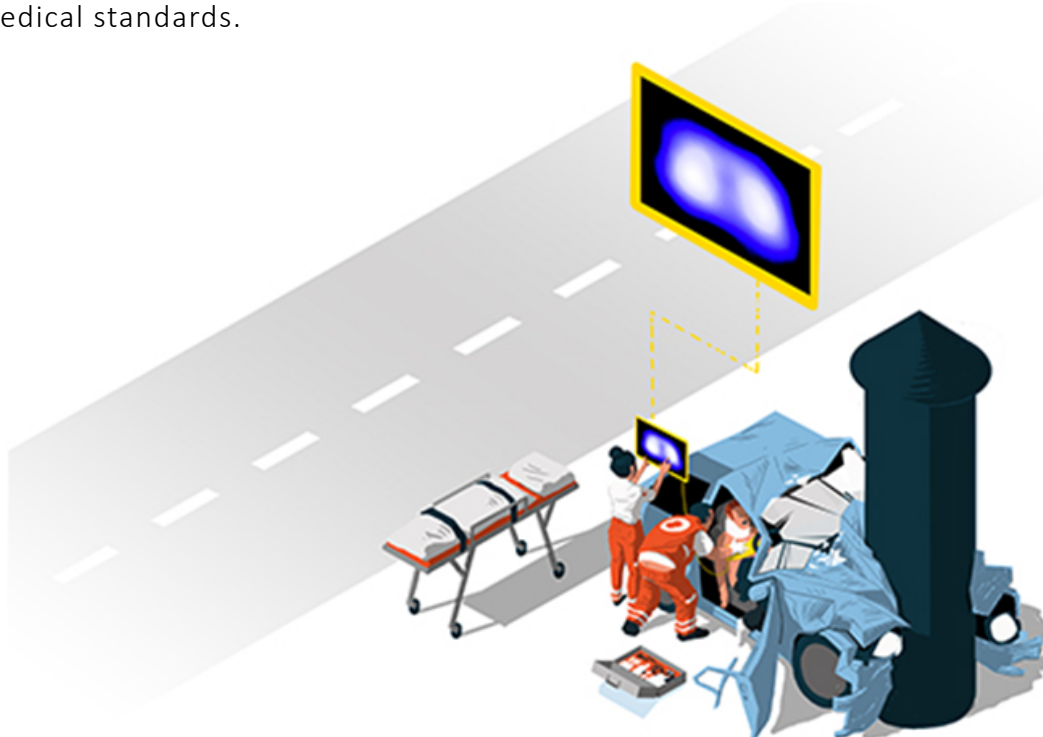
PROJECT LEADER

Dr. Michael Unger

michael.unger@medizin.uni-leipzig.de

+49 341 97-12044

PROJECTS

- CortexMap
- EyeHearU
- FazioTrain

PROJECT MEMBERS

- Reinhard Fuchs

HIGHLIGHTS

- Start of the pre-clinical study in the CortexMap project
- Start of the study in the EyeHearU project
- Development of a realistic training model for fasciotomies on the lower leg in the FaszioTrain project together with Phacon GmbH, based on rapid prototyping methods for reproducing anatomical structures and simulating tissue swelling and nerve pressure for practical training.

MEDICAL COMMUNICATION SYSTEMS I

In our team, we address the challenges arising from increasingly interconnected medical technology and the associated demands on communication technologies. Our focus is twofold: identifying potential application areas and selecting the most suitable technologies for implementation. We always strive to start from the perspective of potential clinical applications and the resulting benefits for users, working collaboratively with our partners from industry and academia to develop powerful demonstrators.

Currently, we rely on technologies in the areas of mobile communication (5G / 6G), interoperability (FHIR, IEEE11073 SDC), augmented and virtual reality, model-based approaches for smart hospital applications, and various tracking technologies (BLE, UWB, 5G). In terms of applications, we address challenges arising from increasingly strained personnel situations. Together with our clinical partners from the ENT department, trauma surgery, and anesthesiology, we develop patient journeys to gain a better understanding of clinical needs and suitable applications.

To bridge the gap between identified needs and technological solutions, we focus on integrating cutting-edge innovations into practical workflows that directly address the challenges faced by healthcare professionals.

Here, technologies enabling high-performance teleconsultations can improve treatment quality. To effectively utilize additional diagnostics outside of clinical settings, we are developing applications that leverage edge computing, such as for mobile ultrasound at the scene of emergencies with guidance features for the user. Wireless sensor technology is designed to better support patients in their postoperative recovery process both at the clinic and outside the clinic, enabling the early detection of healing complications. Through intelligent networking within the hospital, traditional spatial concepts can be reconsidered, and mobile medical technology can be utilized effectively.

To improve the integration of medical devices, we rely on open communication standards wherever possible, such as the IEEE 11073 SDC standards family or HL7 FHIR, and actively contribute to the further development of the SDC standard.

Project Leader

Dr. Max Rockstroh

max.rockstroh@medizin.uni-leipzig.de

+49 341 97-12051

Projects

- Miracle-5 (funded by BMDV)
- 6G-Health (funded by BMBF)
- Tri5G (funded by BMWK)
- SDC-VAS (funded by BMWK)

Project Members

- Tobias Pabst
- Albrecht Bloße
- Alexander Prull
- Anna Schatz
- Annekatrin Pfahl
- Christoph Georgi
- Clemens Möllenhoff
- Gregor Thürk
- Ivana Stjepic
- Ken Paulitz
- Ahmed Eid (WHK)
- Jonas Heine (WHK)

Highlights

- Presentation of innovative technologies for wireless vital data acquisition using JCAS radar technology at the Digital Summit 2024 in Frankfurt as part of the 6G Health project- positioning as a leading research partner for networked, patient-centered medical technology in future 6G networks
- Completion of our 5g + WiFi network
- Opening of the patient room

MEDICAL COMMUNICATION SYSTEMS II

Our interdisciplinary research team is dedicated to the development and application of digital eHealth procedures, modern 5G technologies and IT platforms as well as telemedical procedures for medical IT and medical technology. Our aim is to create pioneering platforms and communication infrastructures that enable efficient, secure and interoperable digital networking in the medical field.

Our team brings together experts from the fields of medical informatics, network technology, medical technology, engineering, IT security and clinical applications. Our work includes researching and implementing specialized system and network architectures for the healthcare sector, developing intelligent communication solutions and ensuring secure and reliable data transmission for medical applications.

We take into account the special requirements of real-time applications, mobility and system and medical device interoperability in digital healthcare systems. We work closely with clinics, medical technology companies and other research institutions to develop future-proof, resilient and secure medical infrastructures and IT processes. With our work, we aim to drive digitalization in the healthcare sector and sustainably improve patient care through innovative technical solutions.
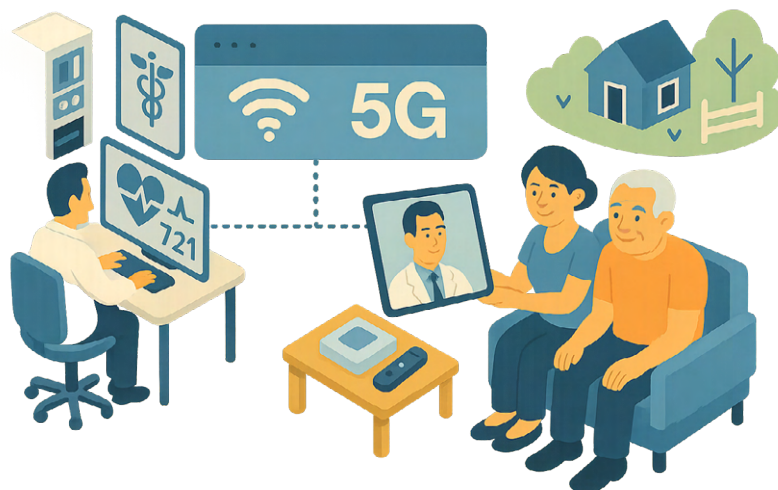
Project Leader

Dr. Stefan Bohn

stefan.bohn@medizin.uni-leipzig.de

+49 341 97-12028

Projects

- KliNet5G
- 5G-COMPASS
- 5G-Pacemaker
- TeleNoma

Project Members

- Henner Baberowsky
- José Córdoba Cabanillas
- David Lepach
- Tobias Pabst
- Sven Martin
- Ivan Matyash
- Manuel Rosenau

Highlights

- Working on a guide and a white paper analyzing the use of 5G technologies and campus networks for medicine and defining future fields of application
- Developing an innovative telemedicine infrastructure based on a nomadic 5G network for mobile medical teams - enabling flexible and secure care in remote regions
- Implementing methods for low-latency and reliable transmission of medical data via 5G for future real-time applications
- Research into medical applications based on light transmission with LiFi to enable highly secure and powerful wireless communication in the clinical environment

DIGITAL PATIENT MODEL

The "Digital Twins" research group develops methods for digital images of patients to enable AI-supported healthcare. Digitization and interoperability for location- and device-independent access to clinical data play a central role in this. Many AI-based methods require structured patient data, but the biggest challenges lie in the lack of standardization of interoperable interfaces, the high complexity of clinical IT ecosystems and the requirements for data protection and security. The aim of the research group is to overcome these technical and methodological hurdles and support networked, patient-centered healthcare through the use of virtual twins.

The MediNET project is creating the basis for a comprehensive network between clinics, research institutions and companies. To this end, the team operates a transfer office that supports regional healthcare providers and companies in particular with organizational and technical challenges in order to integrate new medical technology products into the clinical environment. In addition, the research group is developing a technical platform for virtual twins, which serves as a digital basis for clinical studies and innovative treatment strategies with networked medical devices. By using established international standards and the latest technologies, mobile point-of-care devices can be integrated as well as complex clinical information systems, enabling broad application in modern healthcare.

The work of the research group in the EU project CERTAINTY concentrates on the development of infrastructure, interfaces and mathematical models for personalized cancer therapy. The current focus is on the creation of a modular virtual twin to support the treatment of multiple myeloma. This twin maps the individual pathophysiology of each patient and is continuously updated during therapy. Correspondingly integrated analysis methods enable personalized case analyses and predictions to optimize data-driven decision-making processes and improve the effectiveness of personalized therapies.

Project Leader

Dr. Stefan Franke

stefan.franke@medizin.uni-leipzig.de

+49 341 97-12055

Projects

- MediNET (STARK)
- CERTAINTY (funded by EU)

Project Members

- Max Schreiber
- Jean-Baptiste Tylcz
- Erik Schreiber

- Richard Steinert (SHK)
- Jan Hilbert (SHK)
- Tim Schwarzbrunn (SHK)

Highlights

- First prototypical integration of IDTA AAS (Asset Administration Shell) and IEEE 11073 SDC (Service-oriented Device Connectivity) to support logistics, asset tracking and predictive maintenance in clinical settings.

THE_PROJECT_TEAMS

Smart Clinical Assistance: Decision Support

Our research team focuses on the analysis and modeling of blood cancers such as multiple myeloma (MM) and related diseases such as myelodysplastic syndrome (MDS) and acute myeloid leukemia (AML). In close cooperation with the Polyclinic for Hematology, Cell Therapy, Hemostaseology and Infectiology at Leipzig University Hospital, we are developing data science and machine learning methods that allow us to make precise predictions about disease progression and therapy success. The aim of our work is to provide treating physicians with data-driven decision support and thus optimize individual therapy decisions for the benefit of patients.

Project Leader

Dr. Alexander Oeser/
Maximilian Ferle

maximilian.ferle@medizin.uni-leipzig.de

+49 341 97-12042

Projects

- KAIT/ AMBER (Johnson & Johnson)
- VOLTA (SAB)
- ProRED
- ScaDS.AI (Seedfunding)

Project Members

- Nora Grieb
- Thees Burfeind
- Christian Schulz
- Sarah Strobel
- Hyeon Ung Kim
- Jonas Ader (Guest)

Highlights

- Development of an interactive software demonstrator for the use of an AI-based model for disease progression prediction in MM
- Implementation of a course (lecture series) on the topic of data-driven methods and artificial intelligence in medicine
- Cooperation with Johnson & Johnson Innovative Medicine to develop decision support software for therapy decisions in MM
- Publication of several scientific articles

THE_PROJECT_TEAMS

SMART CLINICAL ASSISTANCE: EMERGENCY MANAGEMENT

The Smart Clinical Assistance: Emergency Management project group at ICCAS focuses on innovative technologies to support emergency and intensive care processes, in particular through digital tools and process assistance. It works on an interdisciplinary basis and combines technical expertise with medical know-how to develop application-oriented solutions for challenges in emergency and disaster medicine. The approach includes the analysis of complex requirements, iterative development and evaluation of prototypes as well as close collaboration with end users to ensure practical applications.

One example of the group's work is the development of the EOS (EMT Operating System) software as part of the RescEU EMT project. This EU-supported project aims to strengthen civil protection capacities in Europe, in particular by providing mobile medical teams (Emergency Medical Teams, EMTs). EOS provides digital support for EMTs and improves mission coordination, patient management and data analysis in crisis situations. By using EOS, emergency teams can respond quickly and efficiently to disasters by using real-time data and optimizing operational procedures.

The Smart Clinical Assistance: Emergency Management project group uses modern software development methods, such as agile and user-centered design, to continuously adapt EOS to the needs of the emergency services. The close involvement of partners and users, such as aid organizations and authorities, ensures the practical relevance and high acceptance of the solutions developed.

PROJECT LEADER

Jan Gaebel

jan.gaebel@medizin.uni-leipzig.de

+49 341 97-12025

PROJECTS

- RescEU EMT
- Tele-KAI
- Digitale Transformationen im gesundheitlichen Bevölkerungsschutz

PROJECT MEMBERS

- Hector Condori Alagon
- Alexander Holzenleiter
- Marcel Zill (Guest)

HIGHLIGHTS

- Exchange with the project management of RescEU to develop an eLearning platform for up to 3,000 emergency physicians; our university teaching experience served as a reference.

- Publication outlining the vision for the Emergency Medical Team Operating System (EMT OS) as a data management approach for field hospitals aligned with predictive, preventive, and personalized medicine (Gaebel et al., The Emergency Medical Team Operating System — a vision for field hospital data management in following the concepts of predictive, preventive, and personalized medicine)

Clinical Workflows and Integrated Assistance Systems

The "Clinical Workflows and Integrated Assistance Systems" team researches and develops innovative concepts, methods and digital tools to improve the efficiency, safety and quality of healthcare services, reduce costs and risks, improve the quality of treatment and reduce the workload of medical staff.

A central aspect of the work is the modelling, analysis and optimization of clinical workflows. The aim is to make healthcare processes transparent, identify inefficiencies and design processes in such a way that they meet both medical standards and the individual needs of patients and patients undergoing treatment. Modern approaches such as business process modeling, data analysis and simulation techniques are used.

In addition, the team develops integrated assistance systems that provide intelligent support in everyday clinical practice. These systems combine technologies such as artificial intelligence, machine learning and sensor-based applications to provide relevant information and support decision-making processes. Examples include tools for identifying and assessing shortcomings of digital systems in everyday clinical practice, support systems for aggregating and visualizing study data from various digital and paper-based data sources, sensor-based gait analysis for predicting falls and real-time decision support for improved guideline-based decision-making in complex and critical situations.

Another research focus is the integration of the developed systems into everyday clinical practice. This includes both the integration into existing workflows and the integration into existing system and data structures. In addition, the team is driving forward the digitalization of existing processes in order to promote the transformation towards a digitalized healthcare system.

The team's comprehensive approach makes a significant contribution to the digitalization and transformation of healthcare by developing innovative solutions that strive for an optimal connection between people and technology.

PROJECT LEADER

Juliane Neumann/
Erik Schreiber

juliane.neumann@medizin.uni-leipzig.de

+49 341 97-12031

erik.schreiber@medizin.uni-leipzig.de

+49 341 97-12058

PROJECTS

- SurgiTrace
- MSC-Ready
- EHR Limitations
- ViGe

PROJECT MEMBERS

- Tim Stelzner

HIGHLIGHTS

- SurgiTrace: AI-based system for optimizing surgical planning and enhancing perioperative safety through intelligent tracking of instruments and implants.

- EHR Limitations: Lightweight app to identify and classify limitations of digital systems in clinical practice, validated through a study at Leipzig University Hospital.

- ViGe: 5G-enabled mobile solution for real-time sensor data transmission in geriatric care and virtual interdisciplinary case discussions.

- ViGe Use Cases: Applied in mobility monitoring post spinal surgery, sensor-guided therapy for pelvic fractures, and mobile EEG for neurodegenerative diseases.

AI in Medicine

Personalized medicine aims to tailor treatments to individual needs by taking into account a variety of patient-specific factors such as vital signs, disease progression, genetics and lifestyle. Analyzing these complex data sets requires powerful tools, and this is where artificial intelligence (AI) comes into play. AI enables automated analyses, prognoses and decision support to optimize prevention, diagnosis and therapy.

Research focus: Our research group focuses on optimizing AI methods for the high demands of clinical application.

- Reliable forecasts with uncertainty estimation: We develop AI systems that forecast realistic probabilities and confidence intervals and take into account both data-related and epistemological uncertainties. When in doubt, these systems say "I don't know" instead of making potentially misleading statements. This is crucial for assessing the reliability of AI in medical decision-making processes.

- Clinical synthetic data: We develop generative models to create synthetic datasets that protect patient privacy. Our expertise includes time-dependent, multimodal and incomplete datasets. Synthetic data enables the development of AI systems, patient models and medical software without privacy risks.

- Traceability of AI predictions: We use transparent AI models that provide traceable insights into the development of predictions. This allows doctors and patients to understand which individual factors have contributed to a particular prediction.

Project Leader

Dr. Daniel Schneider

daniel.schneider@medizin.uni-leipzig.de

+49 341 97-12048

Projects

- NFDI4DataScience
- ScaDS.AI
- ScaDS.AI Seedfunding 2024

Project Members

- Adrian Lindenmeyer
- Anastasia Wolschewski
- Malte Blattmann
- Mariia Tkachenko
- Johannes Keller

Highlights

- Curated and generated high-quality, expert-validated electronic health record datasets tailored for rigorous clinical decision support case studies.
- Implemented and evaluated Trustworthy AI methods for reliable clinical decision support systems leveraging electronic health records data.
- Designed and developed an interactive patient data viewer facilitating the visualization and in-depth exploration of complex electronic health records datasets.

#UNIVERSITY COURSES

LEIPZIG UNIVERSITY

Computer Assisted Surgery

Faculty of Mathematics and Computer Science
Introduction to computer-assisted surgery for medical professionals
Lecture and practical course

Project Management

Faculty of Mathematics and Computer Science
Lecture

Introduction to computer-assisted surgery module for medical professionals

Faculty of Mathematics and Computer Science
Lecture and seminar

LEIPZIG UNIVERSITY OF APPLIED SCIENCES (HTWK)

Project Management for Engineers

Faculty of Electrical Engineering and Information Technology, Mechanical and Energy Engineering
Lecture and practical course

Systems Engineering

Faculty of Electrical Engineering and Information Technology
Lecture

Studium generale: Engineering technology for the medicine of the future

Faculty of Electrical Engineering and Information Technology, Mechanical and Energy Engineering
Lecture

OTTO VON GUERICKE UNIVERSITY MAGDEBURG

Development of Medical Products

Faculty of Mathematics and Computer Science
Lecture

#GRADUATIONS

BACHELOR DEGREES

Philipp Bischof
„Prognoseunterstützung bei spektral aufgenommenen histopathologischen Schnitten des Barrett-Karzinoms mittels Künstlicher neuronaler Netze"
Leipzig University

Finn Ruppel
„Simulationsumgebung für die Verarbeitung medizinischer Daten unter Verwendung des IEEE 11073 SDC Standards."
Leipzig University

MASTER DEGREES

Lisa Dieckmann
„Segmentierung von hyperspektralen Daten zur Unterscheidung von Gewebestrukturen."
Leipzig University

Ahmed Eid
„Development and Evaluation of a Low-Cost BLE Indoor Tracking System for Hospitals."
Anhalt University of Applied Science (HSA)

Janek Franz
„Analyse von Perfusionsparametern verschiedener HSI-Kamerasysteme."
Anhalt University of Applied Science (HSA)

Joel Focking
„Entwicklung eines Designs und dessen Umsetzung einer 3D-gedruckten, künstlichen Hand mit funktionellen Greif- und Haltemechanismen anhand des Grundprinzips der Soft Robotic"
Leipzig University of Applied Sciences (HTWK)

Christoph Georgi
„Konzeption und Entwicklung einer generischen Mensch-Maschine-Schnittstelle für Medizingeräte auf Basis der IEEE 11073 SDC-Standardfamilie"
Leipzig University

Luca König
„Softwarebasierte Optimierung der Methode „Abruf aus dem Frei" beim Ausfallmanagement im Krankenhaus."
Leipzig University of Applied Sciences (HTWK)

Clemens Möllenhoff
„Anforderungs- und Bedarfsanalyse für ein KI-gestütztes Sprachassistenzsystem in der präklinischen Notfallversorgung."
Leipzig University

Michael Richter
„Module for emergency and mass casuality patient record synthetization."
Leipzig University

Marcus Rudolph
„Klassifikation von pathologischen Schnitten basierend auf hyperspektralen Aufnahmen."
Leipzig University

Sebastian Stäger
„Synthetic Data Generation with Variational Autoencoders and Normalizing Flows."
Leipzig University

Gokul Vanjakumar
„Einsatz Künstlicher Neuronaler Netze zur Untersuchung hyperspektral aufgenommener histologischer Schnitte mit Magenkarzinom."
Anhalt University of Applied Science (HSA)

Trang Vi
„Wellenlängenselektion für die multispektrale Bildgebung zur Darstellung der Sauerstoffsättigung und des Hämoglobingehalts von Gewebe auf Basis simulierter Gewebedaten."
Anhalt University of Applied Science (HSA)
Villingen-Schwennigen University

DOCTORATE DEGREES

Hannes Köhler

„Development and Evaluation of Hyperspectral Imaging for Abdominal Surgery."
Leipzig University

TOP 5 PUBLICATIONS

Gaebel J, Schreiber E, Neumuth T
The Emergency Medical Team Operating System — a vision for field hospital data management in following the concepts of predictive, preventive, and personalized medicine
EPMA Journal, 22. April 2024

Katalinic M, Schenk M, Franke S, Katalinic A, Neumuth T, Dietz A, Stoehr M, Gaebel J
Generation of a Realistic Synthetic Laryngeal Cancer Cohort for AI Applications
Cancers (Basel), 01. Februar 2024

Rade M, Grieb N, Weiss R, Sia J, Fischer L, Born P, Boldt A, Fricke S, Franz P, Scolnick J, Venkatraman L, Xu S, Kloetzer C, Heyn S, Kubasch AS, Baber R, Wang SY, Bach E, Hoffmann S, Ussmann J, Schetschorke B, Hell S, Schwind S, Metzeler KH, Herling M, Jentzsch M, Franke GN, Sack U, Köhl U, Platzbecker U, Reiche K, Vucinic V, Merz M
Single-cell multiomic dissection of response and resistance to chimeric antigen receptor T cells against BCMA in relapsed multiple myeloma
Nat Cancer, 19. April 2024

Elisei RC, Graur F, Szold A, Melzer A, Moldovan SC, Motrescu M, Mois E, Popa C, Pisla D, Vaida C, Tudor T, Cote A, Al-Hajjar N
Gelatin-Based Liver Phantoms for Training Purposes: A Cookbook Approach
J Clin Med, 12. Juni 2024

Fischer L, Grieb N, Born P, Weiss R, Seiffert S, Boldt A, Fricke S, Franz P, Heyn S, Kubasch AS, Baber R, Weidner H, Wang SY, Bach E, Hoffmann S, Ussmann J, Kirchberg J, Hell S, Schweind S, Metzeler KH, Herling M, Jentzsch M, Franke GN, Sack U, Reiche K, Köhl U, Platzbecker U, Vucinic V, Merz M
Cellular dynamics following CAR T cell therapy are associated with response and toxicity in relapsed/ refractory myeloma
Leukemia 38, 372-382 (2024)

Gelände des
Universitäts-
klinikums Leipzig

N
W ✦ O
S

Johannisallee

Semmelweisstraße

160 m —

13 **14**

Prager Straße

500 m

Philipp-Rosenthal-Straße

W

300 m —

14
Palliativmedizin

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Medizinische Fakultät