BAEK im Dialog, Berlin 19.10.2023

Von ärztlicher Kunst mit künstlicher Intelligenz

KI: Konkrete Anwendungsbeispiele und -perspektiven in der medizinischen Versorgung

Ulrike Attenberger

Universitätsklinikum Bonn

Klinik für Diagnostische und Interventionelle Radiologie

Direktorin: Prof. Dr. med. U. Attenberger

DIGITALE TRANSFORMATION DES GESUNDHEITSSYSTEMS

Herausforderungen

- DEMOGRAPHIE
- KURZE INNOVATIONSZYKLEN
- KOSTENDRUCK
- “ACCESS-TO-CARE”
- WERTE-ORIENTIERTES GESUNDHEITSWESEN

MANGEL AN FACHKRÄFTEN

ANSTIEG AN PATIENTENZAHLEN

HOHE QUALITÄTSSTANDARDS

DIGITALISIERUNG & KI ALS LÖSUNG

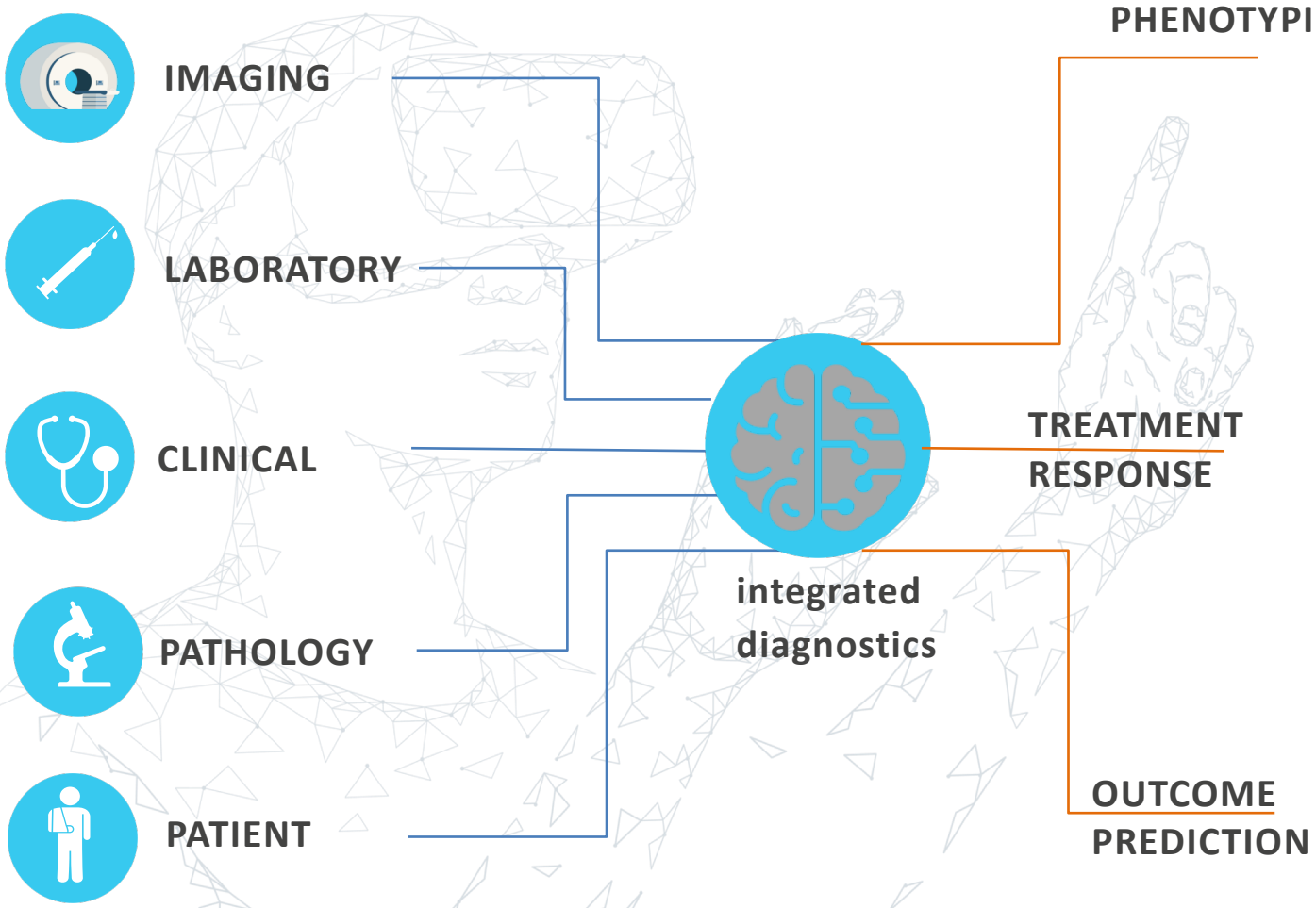
DIGITALE SERVICES AUTOMATISIERUNG

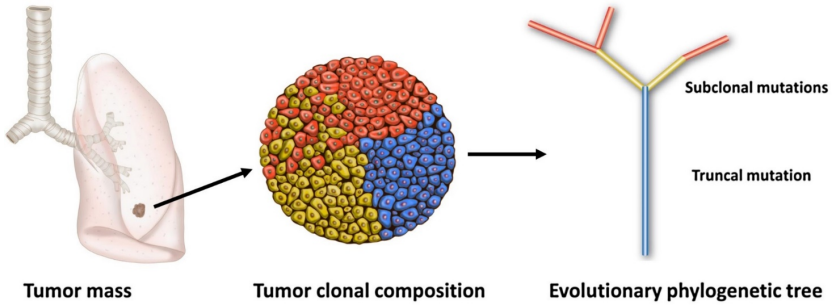
PROZESSOPTIMIERUNG EFFIZIENZ

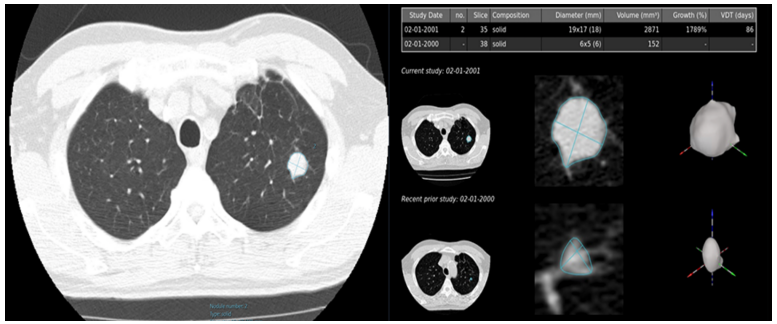
AI-BASED CLINICAL DECISION MAKING (CDSS)

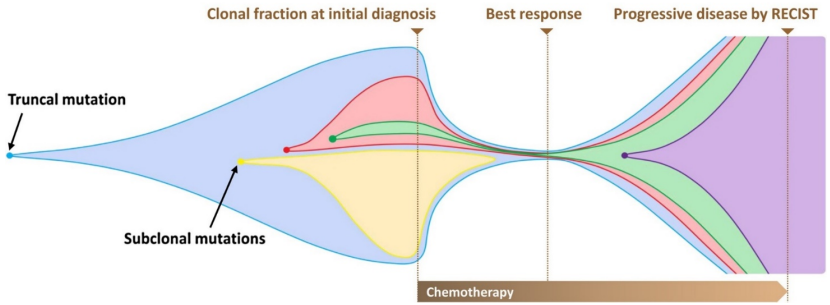
PARADIGMENWECHSEL PRÄZISIONSMEDIZIN

Diagnose und Therapie neu gedacht





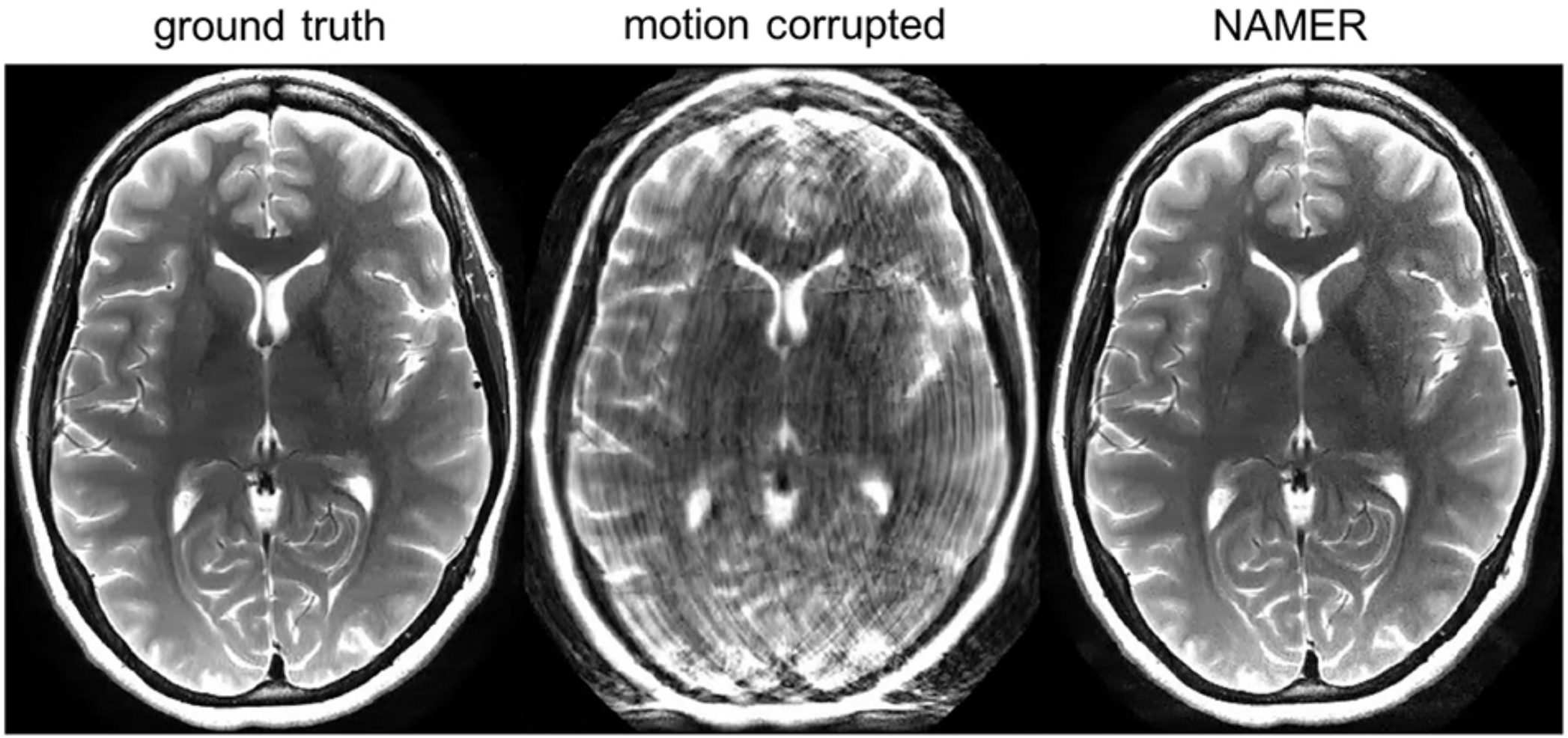




Chassagnon P et al, Med Im An 2020
Lee G et al, European Journal of Radiology 2017

WO KOMMT KI HEUTE SCHON ZUR ANWENDUNG?

Bsp. Heute schon Realität in der Bilddatenakquisition



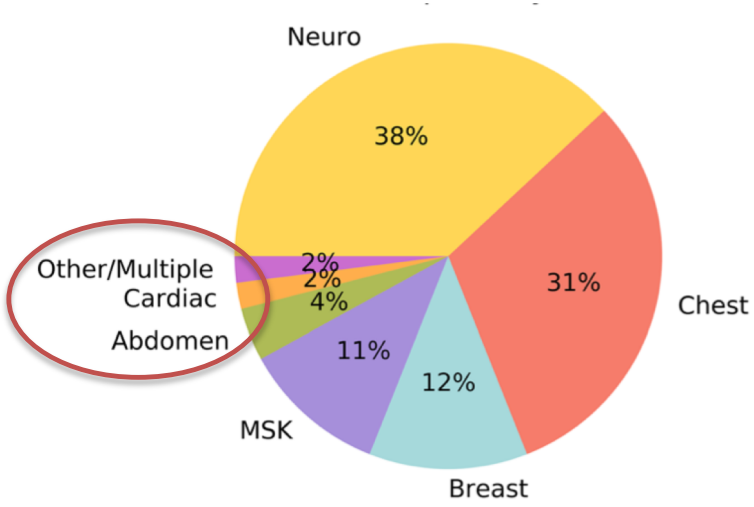
Jin DJ et al, JMRI 2021

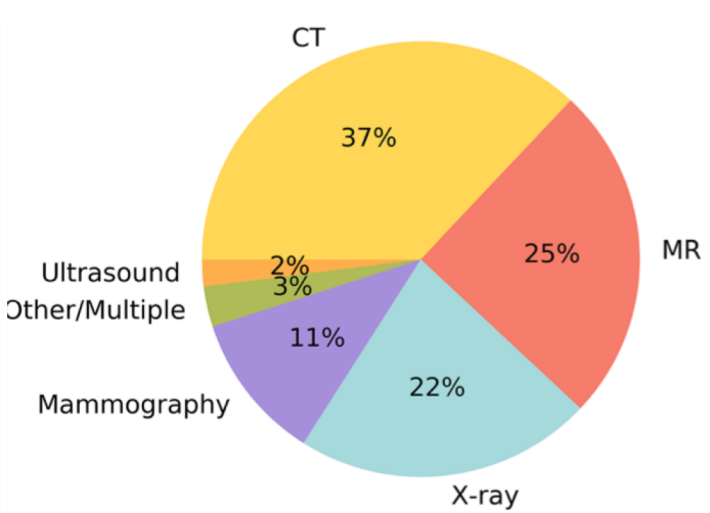
Figure courtesy of Melissa Haskell.

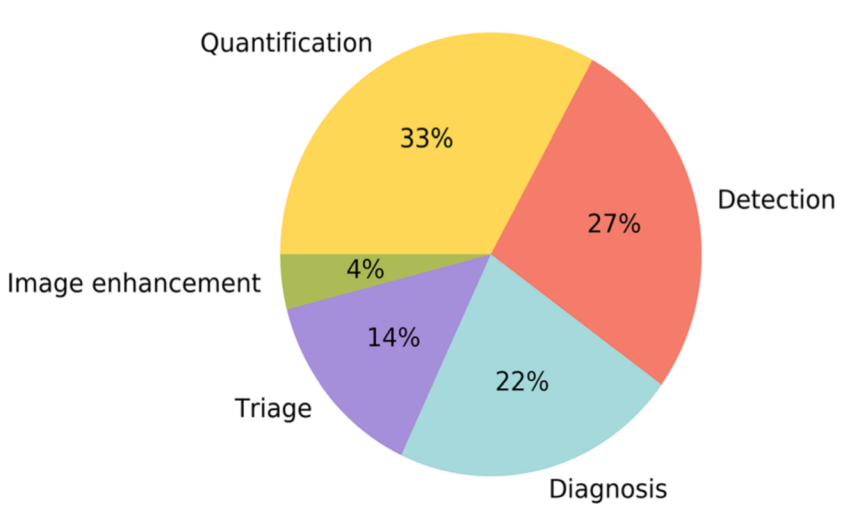
KOMMERZIELL VERFÜGBARE KI LÖSUNGEN IN DER RADIOLOGIE

Artificial intelligence in radiology: 100 commercially available products and their scientific evidence

Kicky G. van Leeuwen [1] • Steven Schalekamp [1] • Matthieu J. C. M. Rutten [1,2] • Bram van Ginneken [1] • Maarten de Rooij [1]





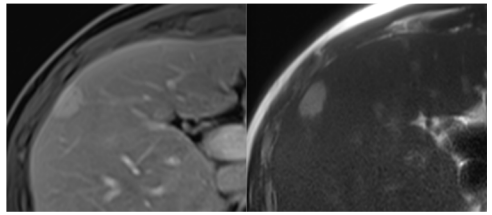


van Leeuwen K et al, European Radiology 2021

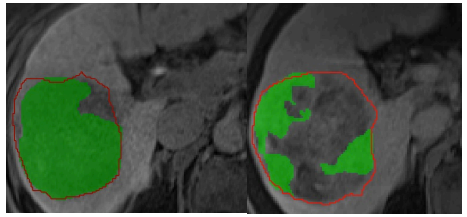
“INTEGRATED DIAGNOSTICS”

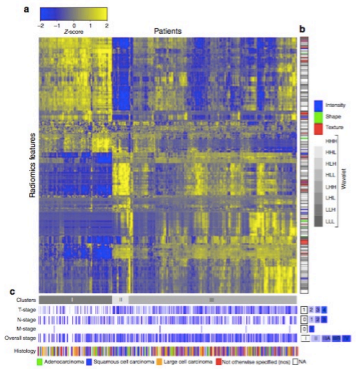
Am Bsp. der bildgebenden Diagnostik

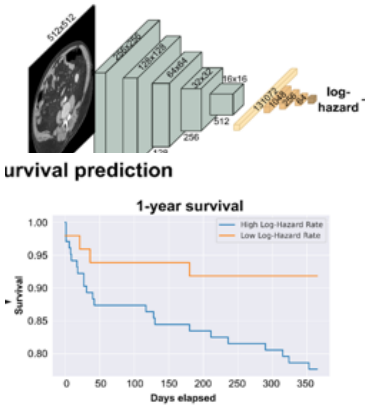
Heute



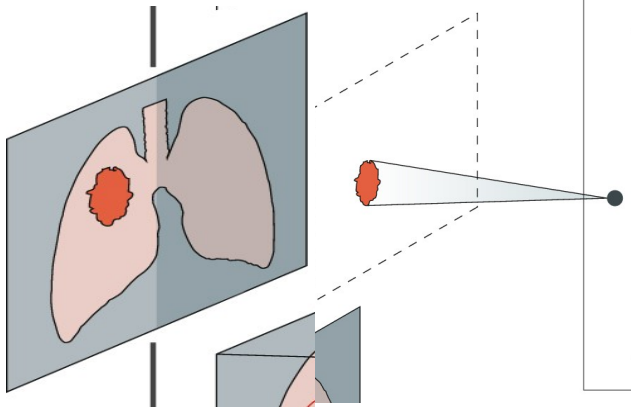
Zukunft

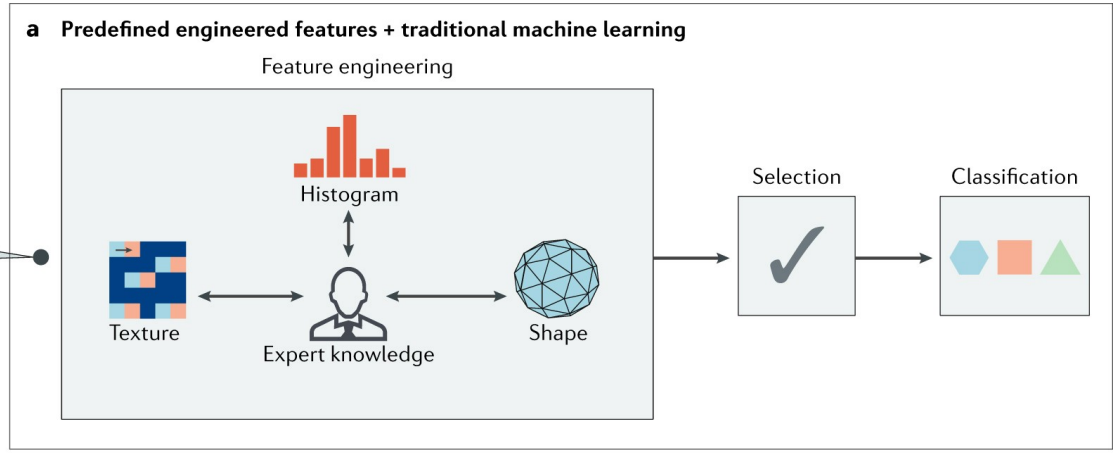






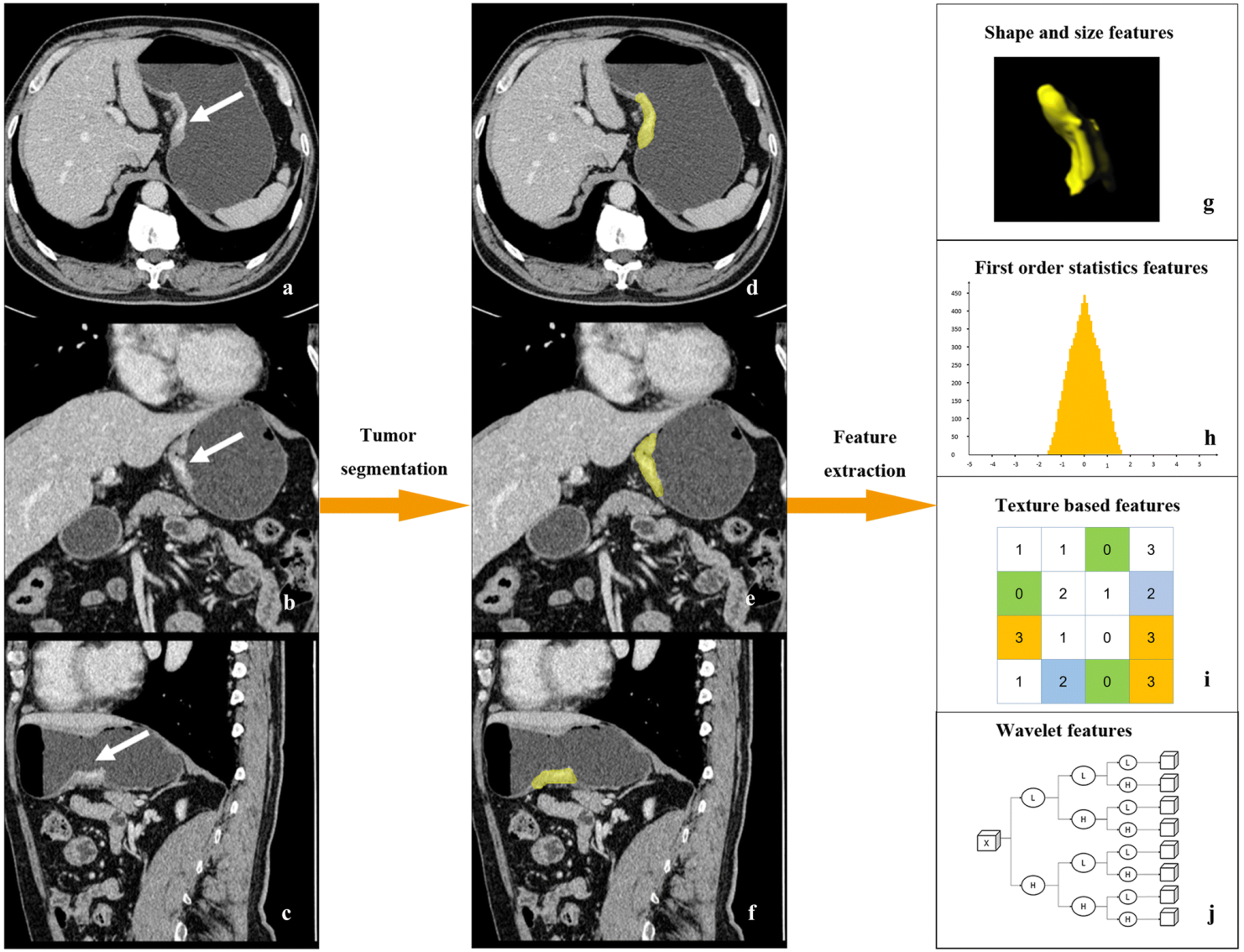
Größe, Form → **Annotationen** → **Datenintegration** → **Multiomics Profiling** → **Prädiktion**





Budjan J,…., Attenberger UI, Anticancer Res 2016
Lee G et al, European Journal of Radiology 2017
Aerts et al 2014
Theis M et al, European Journal of Radiology, accepted
Hosny, A. et al., Nat Rev Cancer 2018

CT RADIOMICS ZUR DDx DES MAGENKARZINOMS



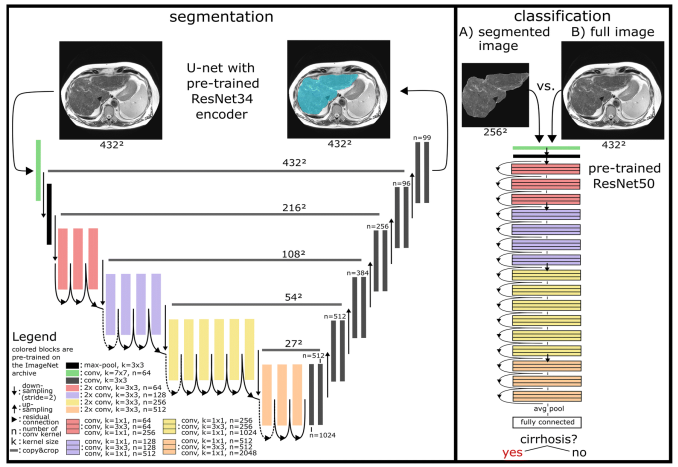
The nomogram yielded excellent performance for distinguishing intestinal-type adenocarcinoma, with AUCs of 0.928 (95%: 0.875, 0.964) and 0.904 (95% CI: 0.761, 0.976).

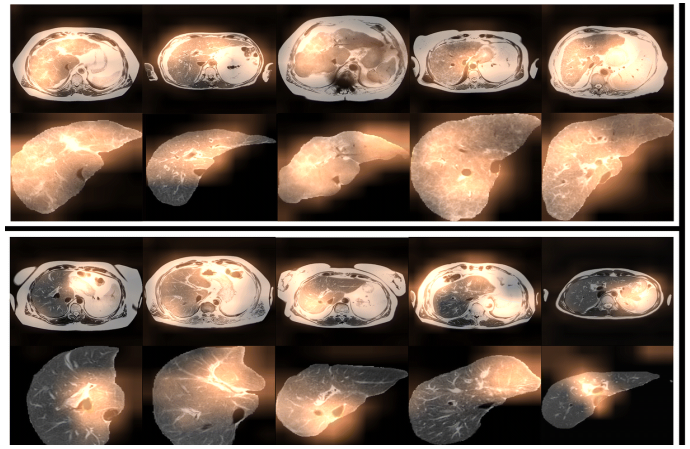
Wang Y et al, European Radiology 2020

“MENSCH VS MASCHINE”

KI für die Detektion und DDx der Ursachen der Leberzirrhose

Dr. rer. nat. Sebastian Nowak

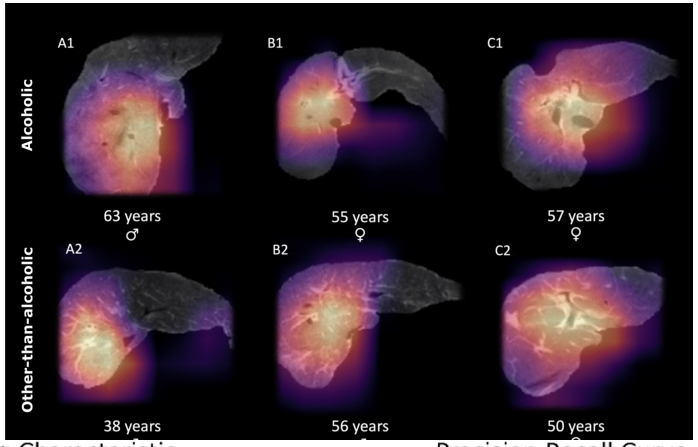


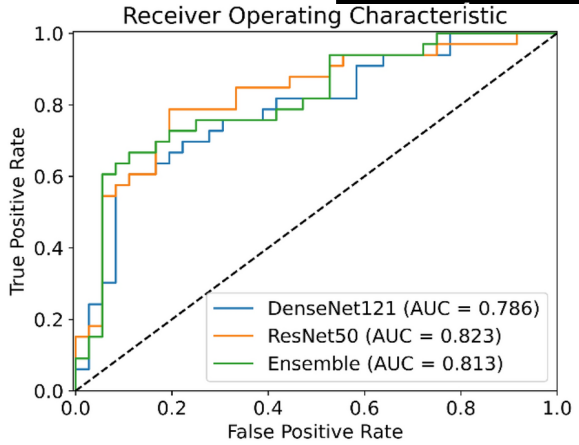


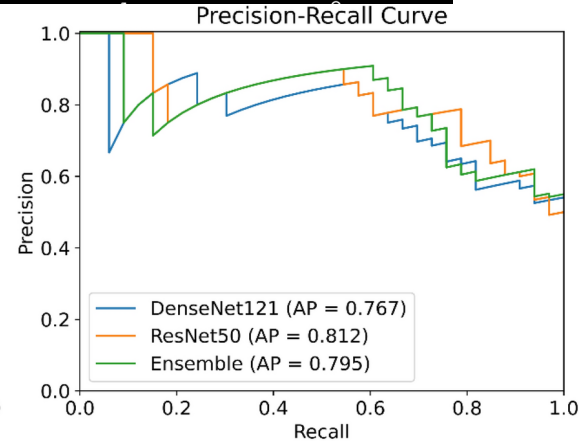
The classification accuracy of liver cirrhosis on validation (vACC) and test (tACC) data for the DTL pipeline (vACC = 0.99, tACC = 0.96) was significantly higher compared to the resident (vACC = 0.88, $p < 0.01$; tACC = 0.91, $p = 0.01$) and to the board-certified radiologist (vACC = 0.96, $p < 0.01$; tACC = 0.90, $p < 0.01$).

Nowak S et al, Eur Radiol 2021

PD Dr. Julian Luetkens







The highest classification performance on test data was observed for ResNet50 with unfrozen pre-trained parameters, yielding an area under the receiver operating characteristic curve of 0.82 (95% confidence interval (CI) 0.71–0.91) and an accuracy of 0.75 (95% CI 0.64–0.85).

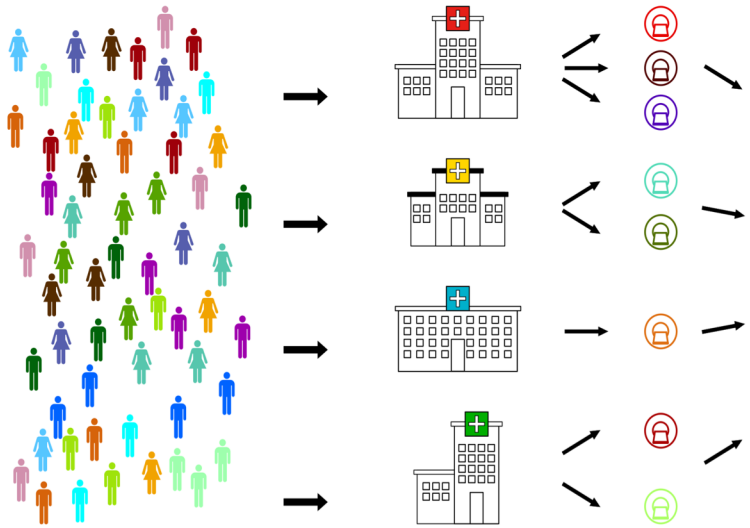
Luetkens JA et al, Scientific Reports 2022

GEGENWÄRTIGE LIMITATIONEN VON KI

Are We There Yet? The Value of Deep Learning in a Multicenter Setting for Response Prediction of Locally Advanced Rectal Cancer to Neoadjuvant Chemoradiotherapy

Barbara D. Wichtmann, Steffen Albert, Wenzhao Zhao, Angelika Maurer, Claus Rödel, Ralf-Dieter Hofheinz, Jürgen Hesser, Frank G. Zöllner and Ulrike I. Attenberger

Rectal cancer patients



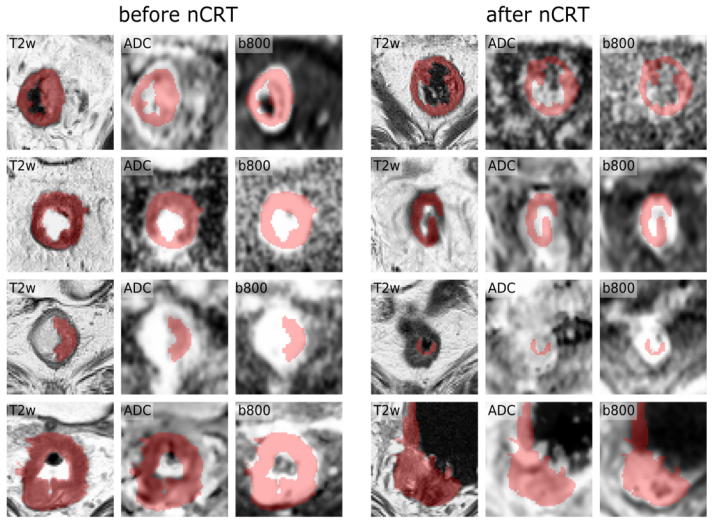
Significant differences in the characteristics of patients

CAVE: Selection bias

Significant differences regarding the time interval between initial staging, restaging, and surgery

Significant differences in terms of acquisition parameters

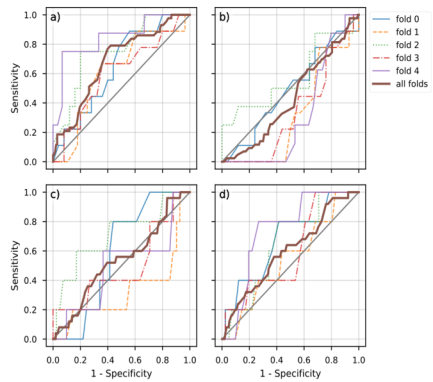
Time expensive data preparation, including data curation, annotation, and image processing



Data heterogeniety
Misaligned slice positioning

Training of a state-of-the-art multitask Deep Learning model

Predictive performance of Deep Learning model drops significantly

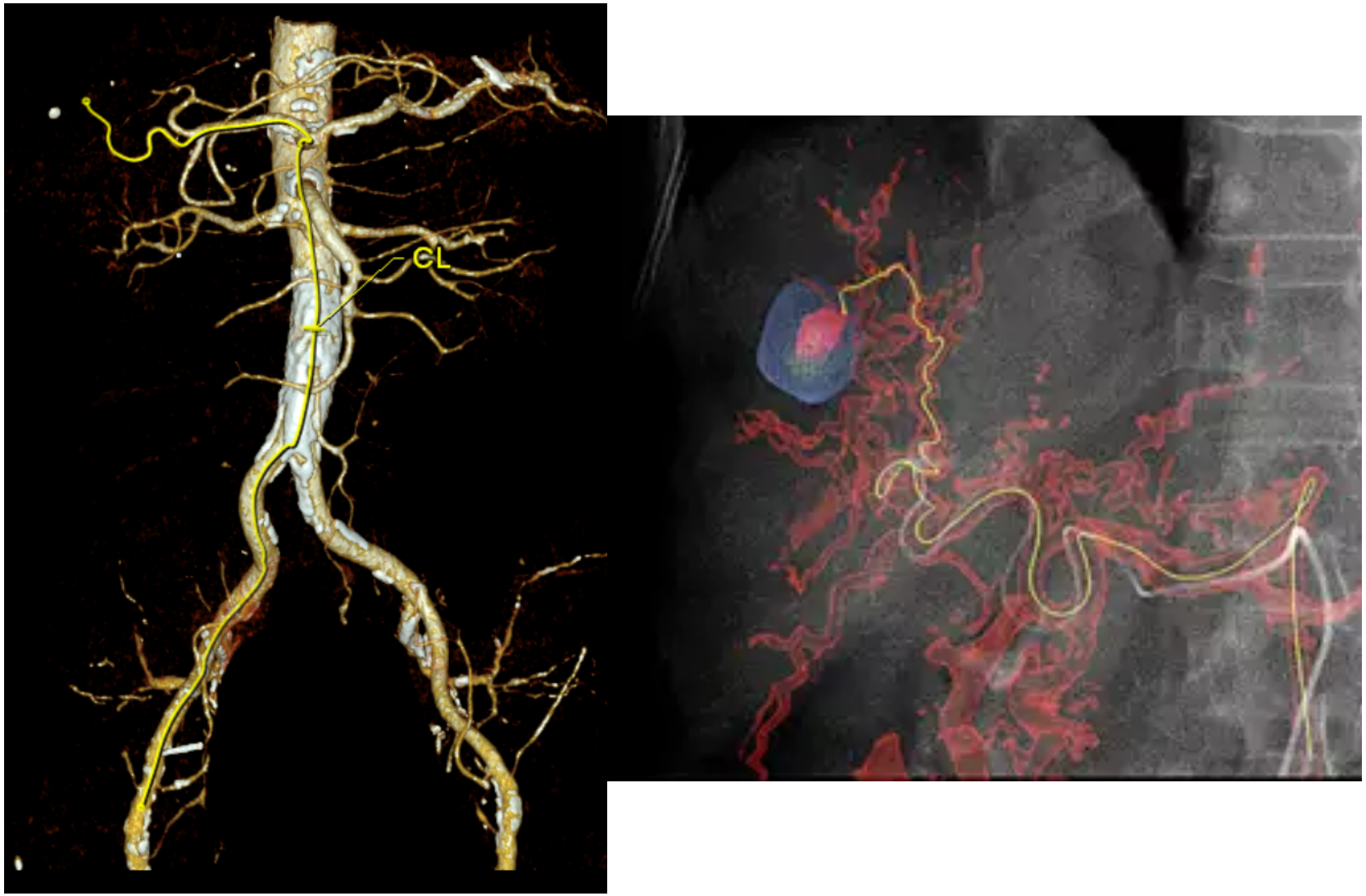


Poor generalizability

Testing the network on an external clinical routine dataset yielded an AUC of 0.54 (95% CI: 0.41, 0.65), when using only pre- and post-therapeutic T2w images as input, and 0.60 (95% CI: 0.48, 0.71), when using the combination of pre- and post-therapeutic T2w, DW images, and ADC maps as input.

KI FÜR DIE BEHANDLUNGSPLANUNG

Simulation des optimalen Katheterpfades für die Embolisation



PD Dr. Daniel Kütting

Case Courtesy PD Dr. Daniel Kütting, UKB&Philips GmbH

Cardiovasc Intervent Radiol
https://doi.org/10.1007/s00270-022-03204-0

Pilot Animal Study on Robotic-Assisted Endovascular Visceral Interventions

Kupczyk, Attenberger, … Kütting , Cardiovasc Intervent Radiol 2022

REMOTE VERSORGUNG

First-in-Human Telerobotik Herzkatheterfall

Contents lists available at ScienceDirect

EClinicalMedicine

journal homepage: https://www.journals.elsevier.com/eclinicalmedicine

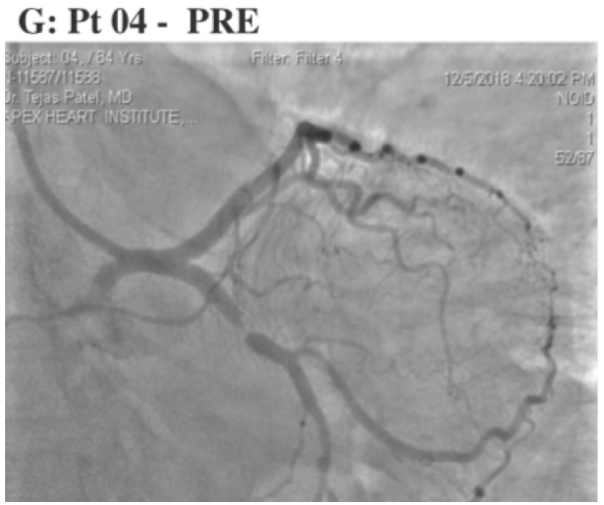
EClinicalMedicine
Published by THE LANCET

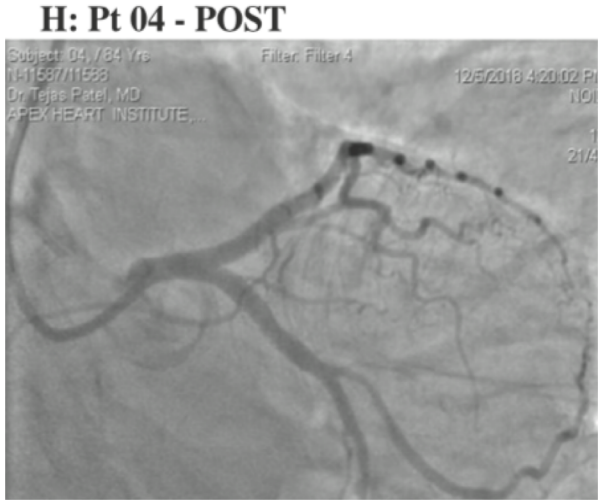
Long Distance Tele-Robotic-Assisted Percutaneous Coronary Intervention: A Report of First-in-Human Experience

Tejas M. Patel [a,*], Sanjay C. Shah [a], Samir B. Pancholy [b]

[a] Apex Heart Institute, Ahmedabad, India
[b] The Wright Center for Graduate Medical Education, Geisinger Commonwealth School of Medicine, Scranton, PA, USA

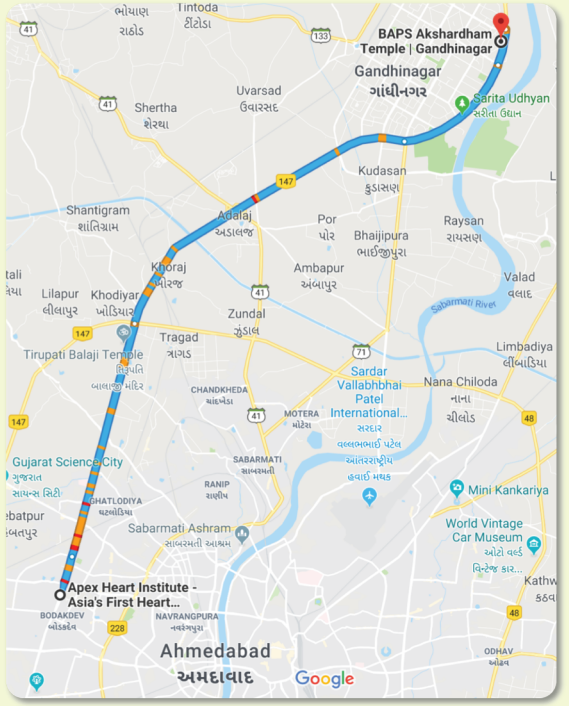
Dr. Tejas Patel conducting first-in-human telerobotic procedures from Ahmedabad, India





Akshardham Temple

Remote operator site approximately **20 miles** from Apex Heart Institute



Patel TM et al, Eclinical Medicine 2019;14:53-58.

> 450.000 Patient*innen/ Jahr

> 8.800 Mitarbeiter* innen

NEWS

Unveiling the Future of Healthcare: The Innovative Secure Medical Campus at University Hospital Bonn UKB

Revolutionizing Medicine with Medical Virtual and Augmented Reality, AI, and Robotics.

August 2023

UNIVERSITÄT BONN ukb universitätsklinikumbonn FREUDE. JOY. JOIE. BONN. Ministerium für Wirtschaft, Industrie, Klimaschutz und Energie des Landes Nordrhein-Westfalen KINRW POWERED BY

DER UKB CAMPUS ALS REALLABOR

Im Mittelpunkt der Mensch

DIGITALISIERTE PROZESSE

Optimierte Patient Journey

KI-BASIERTE MEDIZIN

In Diagnose und Therapie

CYBER SECURITY BY DESIGN

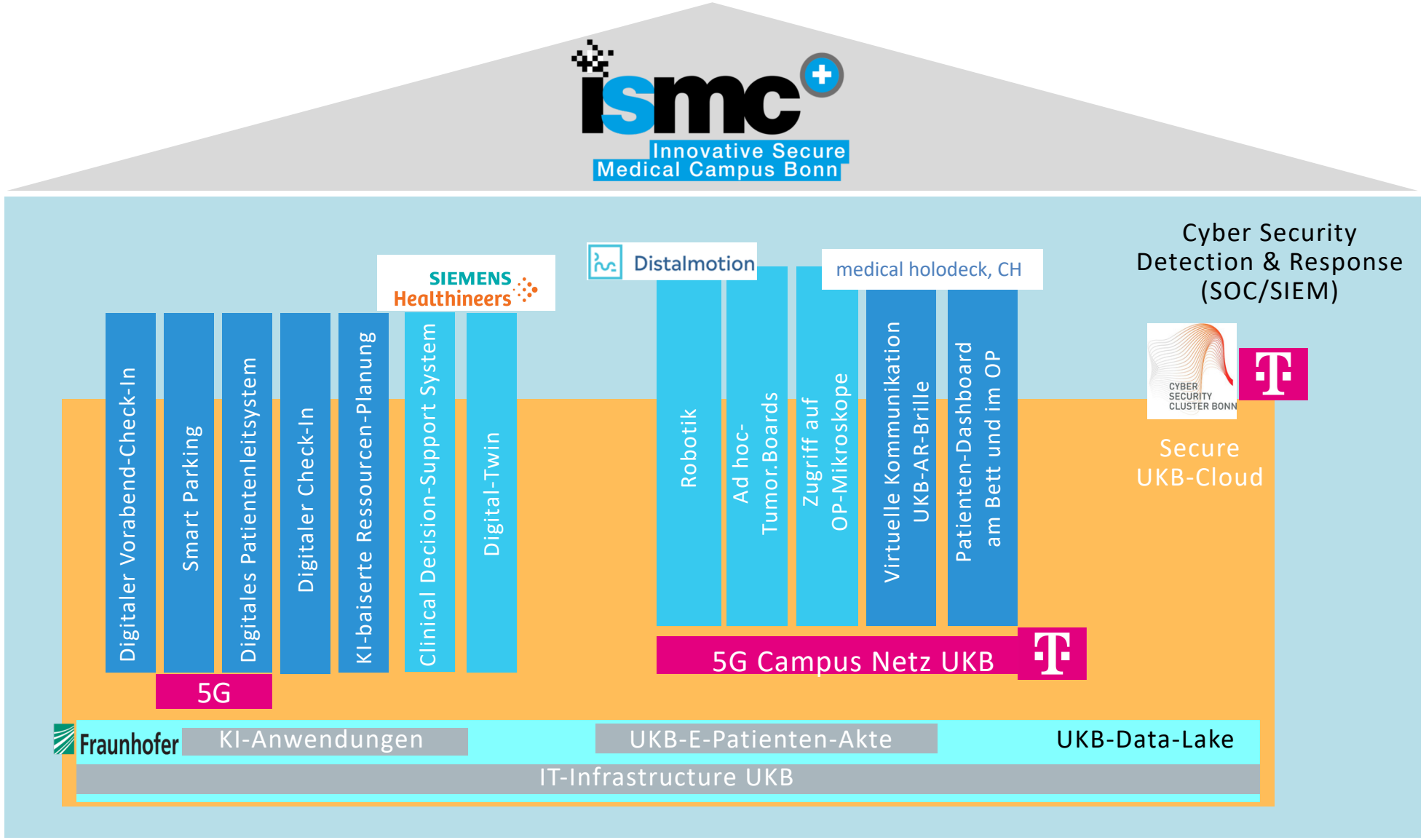
DIE STRUKTUR

Innovative Secure Medical Campus

AI-BASIERTE MEDIZIN

DIGITALISIERTE PROZESSE

CYBER-SECURITY



UMSETZUNGSMATRIX

Förderjahr 1 ISMC

Check-In per ID-Wallet

Shuttle Pod

Cyber Security by Design

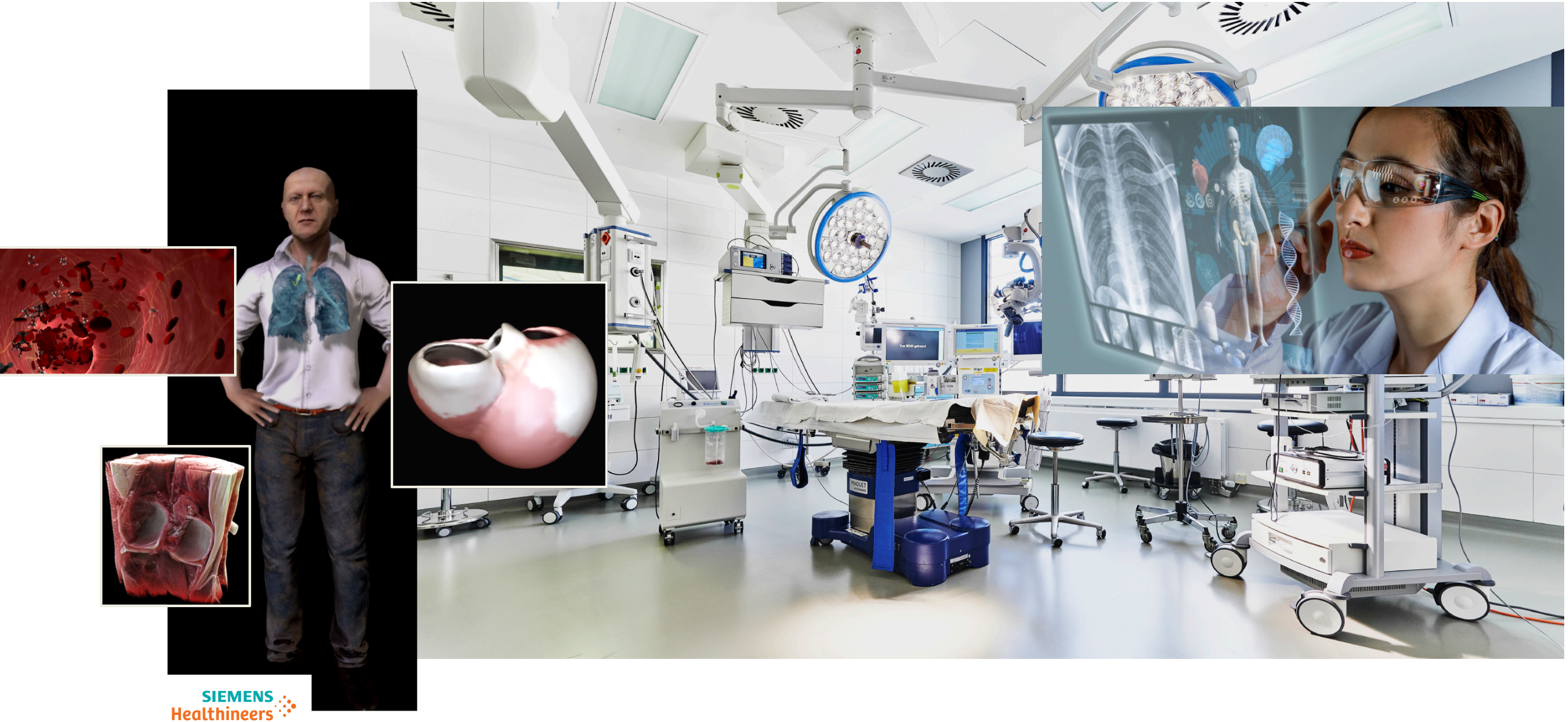
KI-basierte Diagnostik

Virtual Reality

Robotik

AI-BASIERTE MEDIZIN

Topics der verbleibenden Förderphase

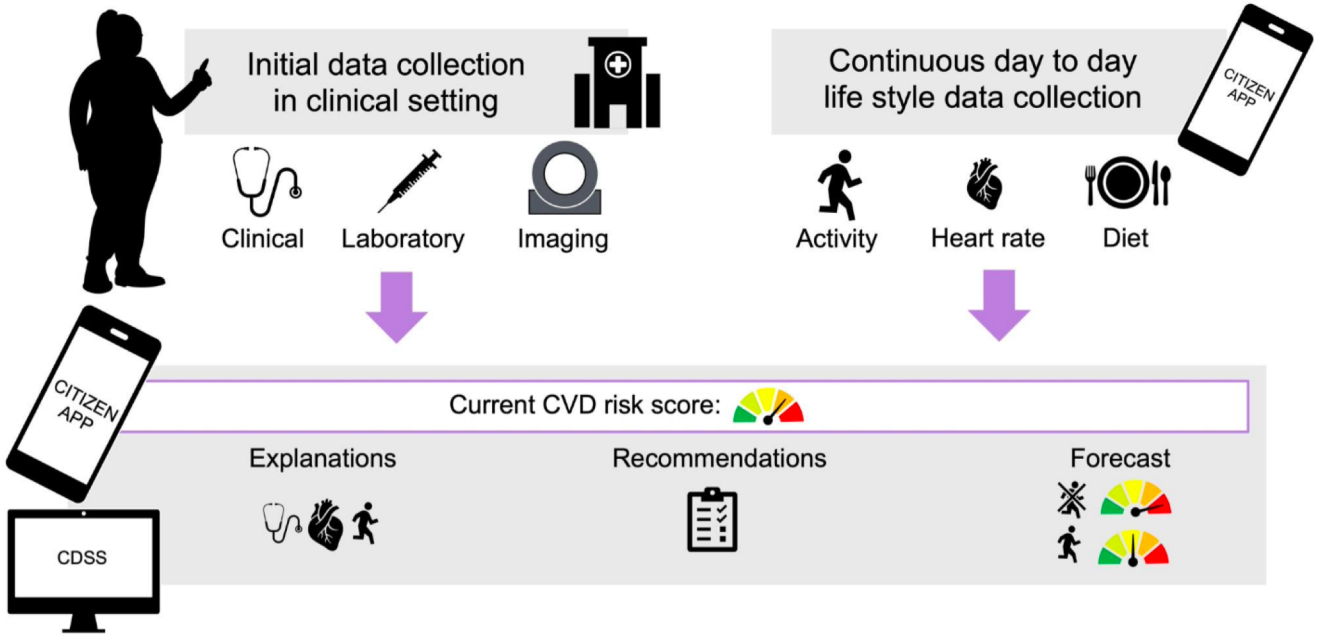


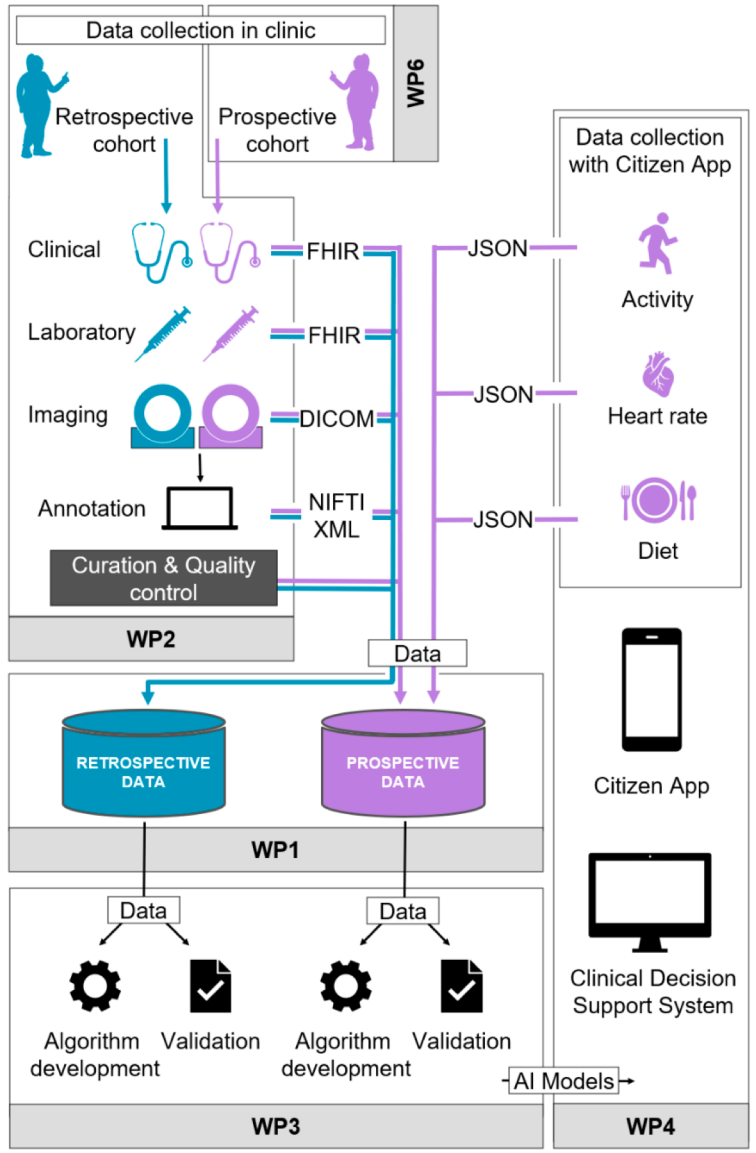
SIEMENS Healthineers

AI for the Prediction of Obesity-Related Vascular Diseases (AI-POD)

AI-POD

Integration unser Patienten*innen in die Diskussion





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Universität Zürich[UZH]

Imperial College London

KU LEUVEN

CHARLES UNIVERSITY

BRIGHTFISH

medicalvalues

COLLECTIVE MINDS RADIOLOGY

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Medizinische Fakultät Mannheim der Universität Heidelberg
Universitätsklinikum Mannheim

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