

Prof. Dr. Jakob Nikolas Kather, M.Sc.
Medizinische Klinik 1, UK Dresden

jakob_nikolas.kather@tu-dresden.de

@jnkath

www.kather.ai

Dr. KI statt Dr. med.?
Die Zukunft der Hämatologie/Onkologie
im Zeitalter der künstlichen Intelligenz

Disclosures 2023

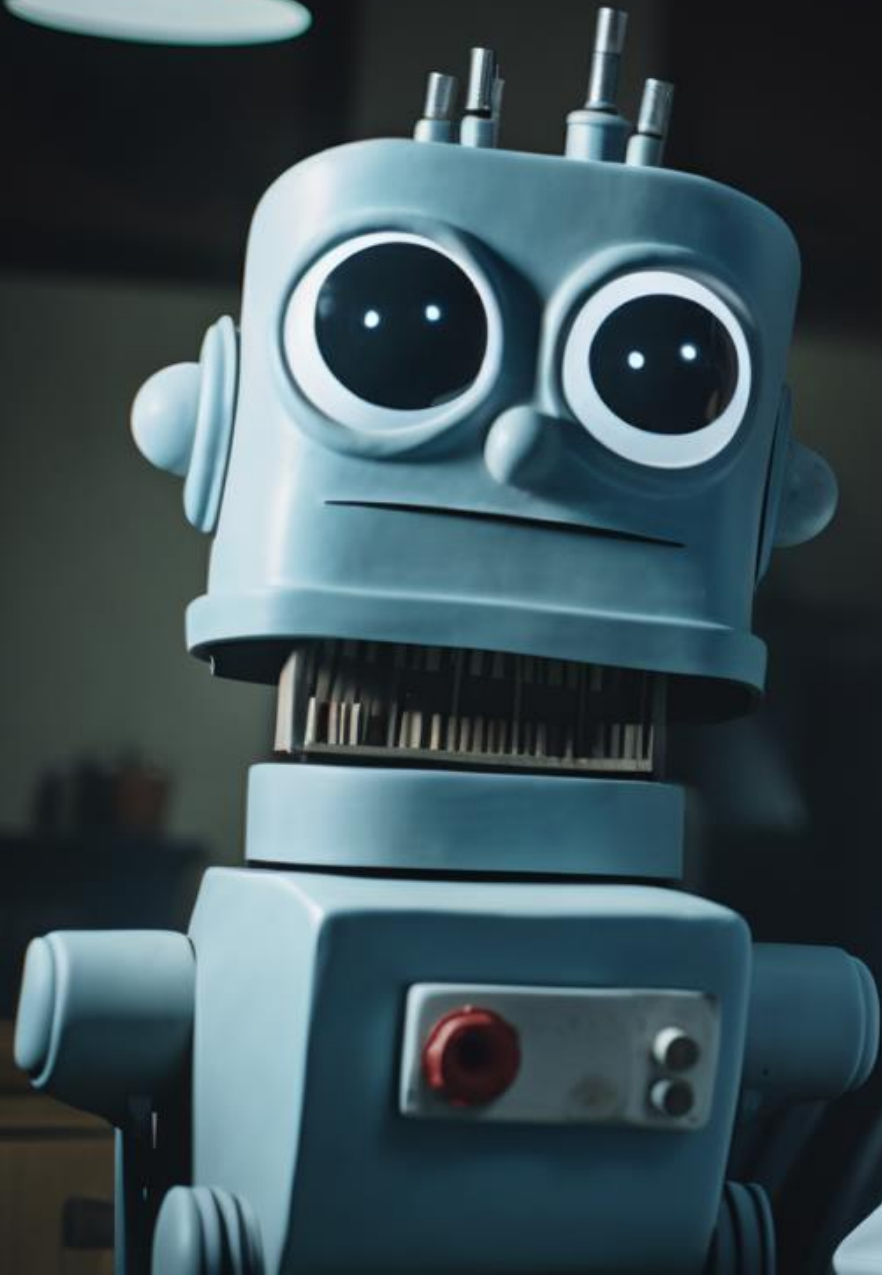
Employee: **University Hospital Dresden, University Hospital Heidelberg**

Scientific advisory board member, consulting: **Owkin** (Paris / New York), **Panakeia** (London), **DoMore Diagnostics** (Oslo), **Histofy** (Warwick)

Shareholder: **StratifAI GmbH** (Germany)

Honoraria for lectures: **MSD, Eisai, Fresenius, Roche, Bayer, BMS, Pfizer**

Alle Illustrationen sind KI-generiert



Was ist KI?

Künstliche Intelligenz

Der Arbeitskreis Künstliche Intelligenz (KI) der DGHO wurde im Oktober 2022 auf der Jahrestagung in Wien gegründet. Gemeinsam setzen sich die Mitglieder zum Ziel, die Integration von Daten, Methoden und Ergebnissen der KI-Forschung in die Klinik, Forschung und Lehre der Hämatologie und Onkologie zu begleiten und zu fördern.

Die Mitglieder des Arbeitskreises beschäftigen sich sowohl mit klinischen als auch mit grundlagenwissenschaftlichen Fragestellungen. Die Forschungsschwerpunkte umfassen unter anderem maschinelles Lernen, künstliche Intelligenz, Bildgebung und Genomik, sowie Biomarker in präklinischer und klinischer Forschung.

Der Arbeitskreis bietet eine Plattform für den Wissenstransfer und die Zusammenarbeit zwischen KI-Forschenden und Ärztinnen und Ärzten. Darüber hinaus soll er als Ansprechpartner für Politik, Industrie und Gesellschaft fungieren und die Interessen der deutschen Hämatologie/Onkologie-Gemeinschaft in nationalen und internationalen Gremien vertreten.

[Zum Aufnahmeantrag](#)



Definitionen von KI

JOURNAL OF Cancer Research Clinical Oncology

An overview and a roadmap for artificial intelligence in hematology and oncology

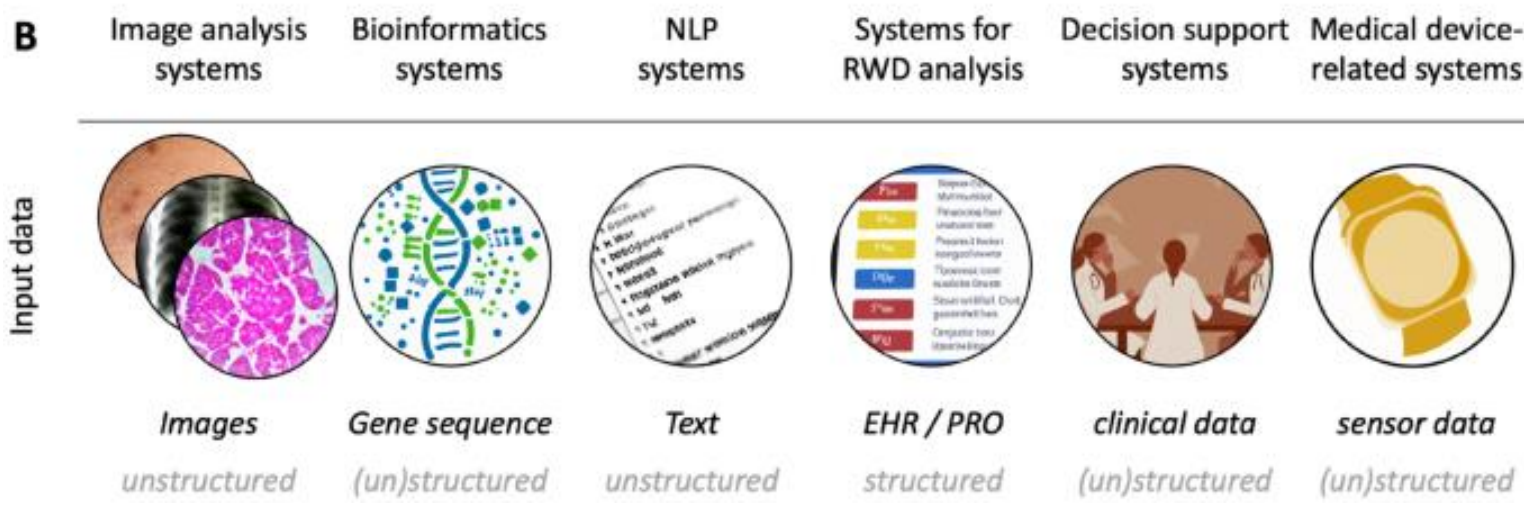
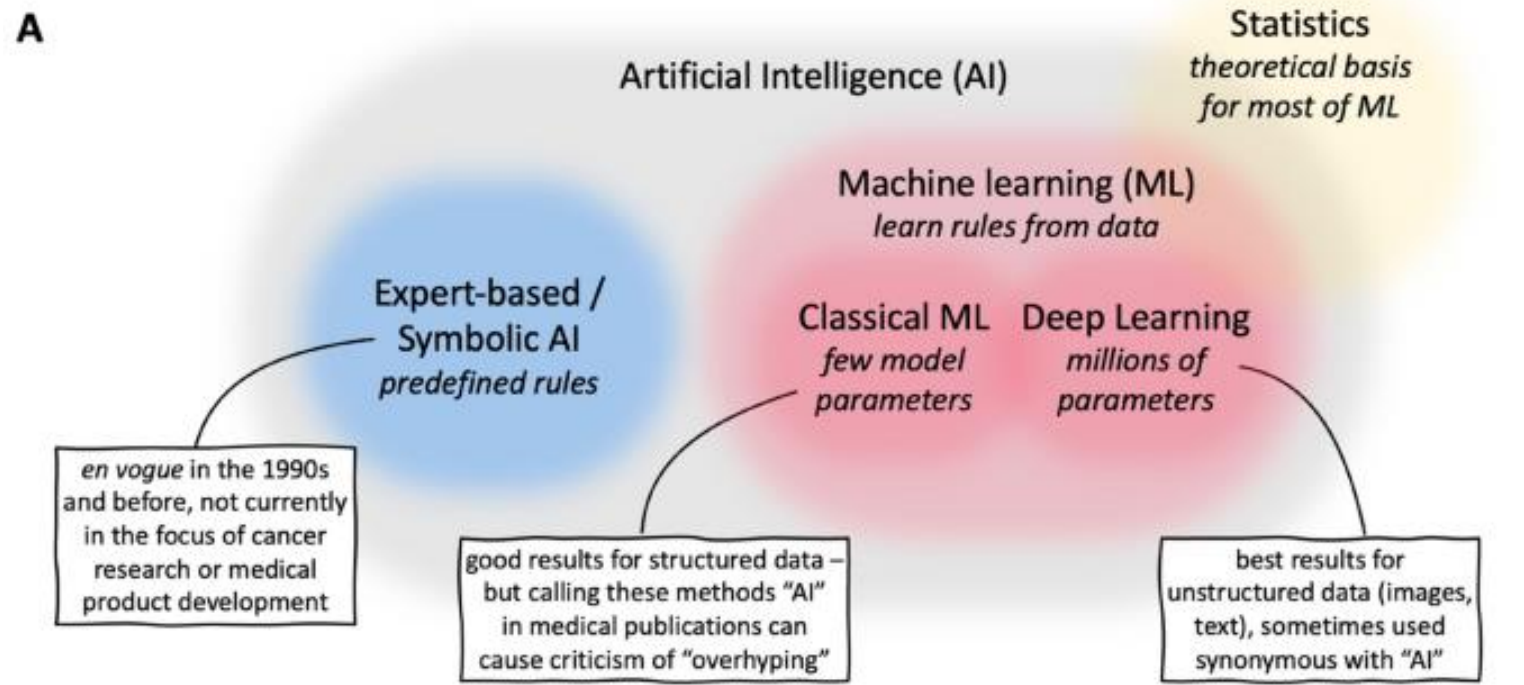
Review | Open access | Published: 15 March 2023 | 149, 7997–8006 (2023)

Wiebke Rösler, Michael Altenbuchinger, Bettina Baeßler, Tim Beissbarth, Gernot Beutel, Robert Bock, Nikolas von Bubnoff, Jan-Niklas Eckardt, Sebastian Foersch, Chiara M. L. Loeffler, Jan Moritz Middeke, Martha-Lena Mueller, Thomas Oellerich, Benjamin Risse, André Scherag, Christoph Schliemann, Markus Scholz, Rainer Spang, Christian Thielscher, Ioannis Tsoukakis & Jakob Nikolas Kather

DGHO DEUTSCHE GESELLSCHAFT FÜR HÄMATOLOGIE UND MEDIZINISCHE ONKOLOGIE

gmDS Deutsche Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie e.V.

GI GESELLSCHAFT FÜR INFORMATIK

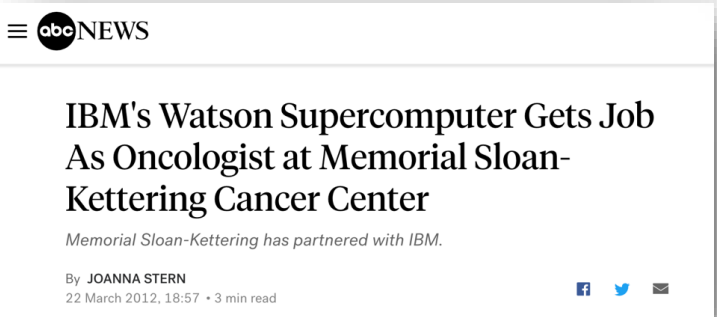
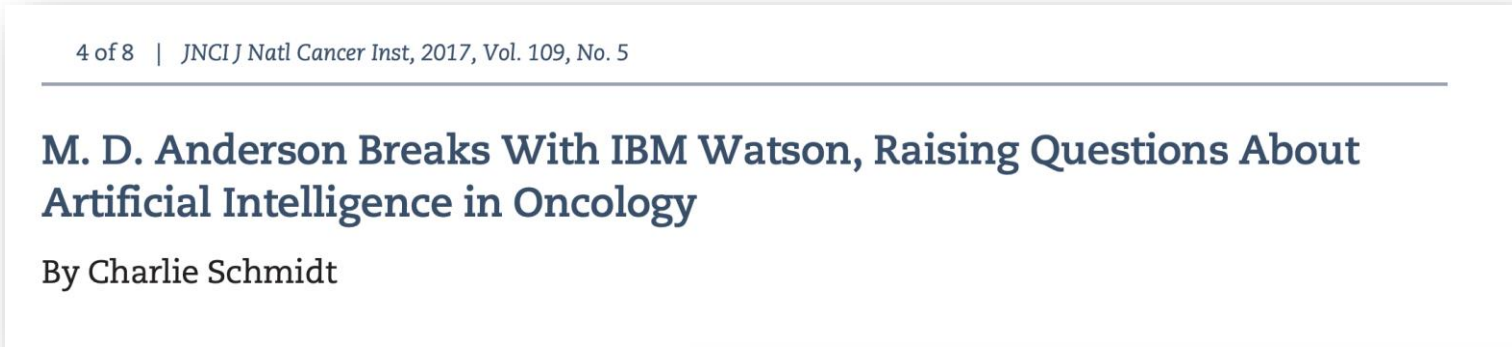


A female scientist with dark hair in a ponytail, wearing a white lab coat, is seated at a desk in a laboratory. She is looking intently at a laptop screen, holding a pen over the keyboard. The scene is dimly lit with a blue tint, and the background shows blurred lights and laboratory equipment like bottles and a glass. A semi-transparent white box with dark blue text is overlaid on the right side of the image.

KI-Anwendungen in der Krebsmedizin

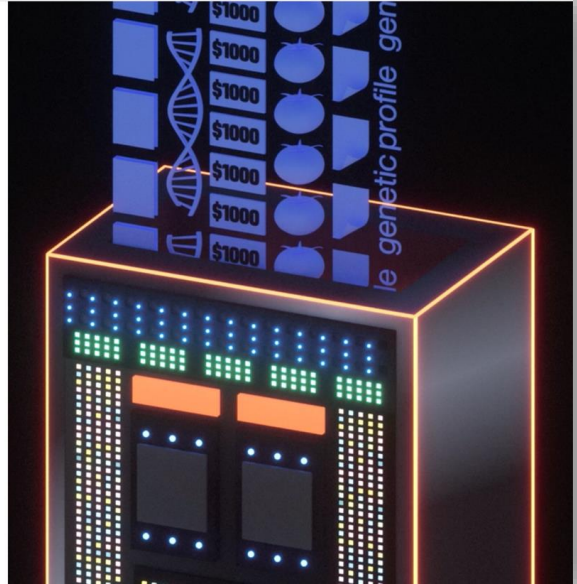
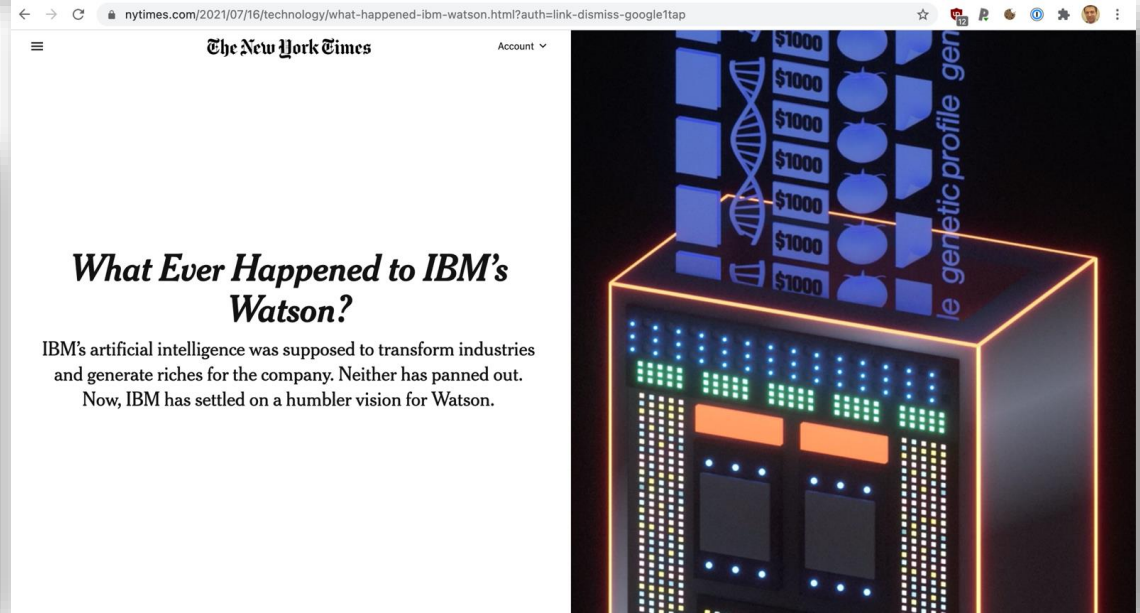
KI in der Onkologie: 2012 – 2017 – 2021

<https://www.bbc.com/news/technology-20159531>
<https://abcnews.go.com/Technology/ibms-watson-supercomputer-job-memorial-sloan-kettering-cancer/story?id=15979580>
<https://www.forbes.com/sites/bruceupbin/2013/02/08/ibms-watson-gets-its-first-piece-of-business-in-healthcare/>
<https://www.nytimes.com/2021/07/16/technology/what-happened-ibm-watson.html>

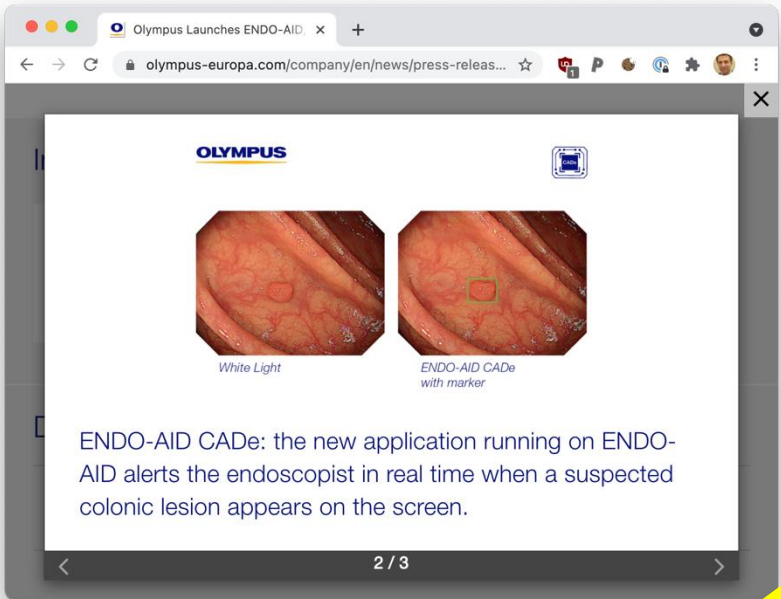
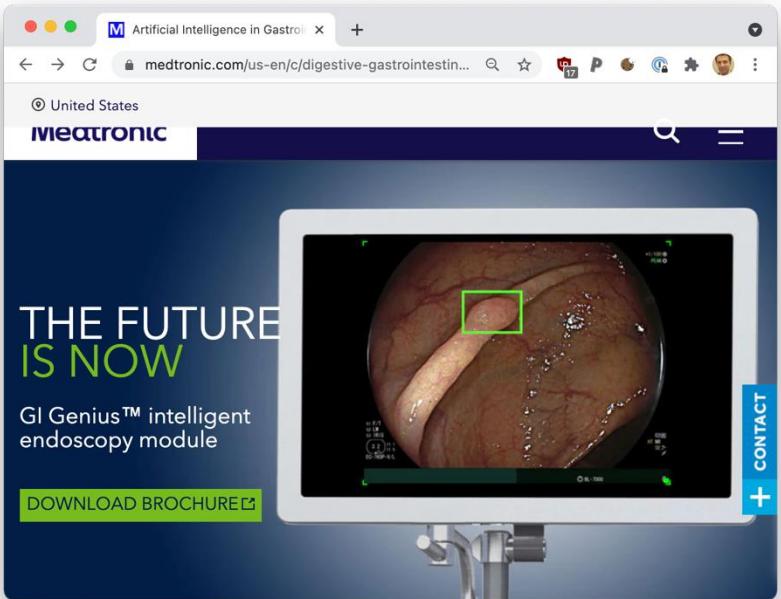


In 2012, the University of Texas M. D. Anderson Cancer Center in Houston partnered with IBM to develop the artificial intelligence program, called IBM Watson, as a clinical decision tool in oncology. Five years and \$62 million later, M. D. Anderson let its contract with IBM expire before anyone used Watson on actual patients.

Last February, a university audit of the project exposed many procurement problems, cost overruns, and delays.



KI im Darmkrebscreening



**incomplete selection
no COIs**



KI in der Radiologie

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aidence
 human sense in artificial intelligence
Veye Lung Nodules, your AI solution for pulmonary nodule management
 The second pair of eyes in the search for lung nodules on chest CT scans
 Veye Lung Nodules supports the improvement of patient outcomes by delivering fast results, lowering the risk of misdiagnosis, and by detecting and segmenting possible early-stage lung cancer.
 Why use Veye Lung Nodules Clinical features

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lucidamedical.com/pi/
 The figure above illustrates the RTSTRUCT format segmentations output by the software. The segmentations are overlaid, on a 3D multi-planar reconstruction of an axial image, together with the 3D model of the prostate. Colours shown are:
 • Red: index lesion
 • Blue: prostate
 • Grey: segmentation
incomplete selection no COIs

imagebiopsy.com/pr...
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 Get Demo
 Bone age estimation [1]
 Chronological Age (CA)/Patient Sex
 8 Years 0 Months
 8 Years 9 Months / M
 Bone Age
 8 Years 0 Months
 8 Years 9 Months / M
 Natural standard Deviation (SD) [2]
 9.1 Months
 Status (based on 2SD) [2]
ADVANCED
 Height estimation [3]
 Growth potential
 78.6 % achieved
 Height calculation
 128 cm * 100 / 78.6 =
 162.8 cm ± 2.5 cm
 To calculate the growth potential including standard deviation, use the formula above.
 Schedule a demo

arterys.com/clinica...
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mdbrain
 KI-BASIERTES TOOL FÜR DIE QUANTITATIVE NEURO-MRT
 mdbrain ist eine präzise, schnelle und damit auch effiziente Software-Lösung für neuroradiologische Fragestellungen von Demenz bis Multiple Sklerose. Die Produktfamilie bietet u.a. Werkzeuge für Gehirnvolumetrie, Läsionscharakterisierung, Aneurysmadetektion und

Klinische Evidenz für KI

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Mammography Screening With Artificial Intelligence (MASAI) (MASAI)

Study Design

Go to

Study Type ⓘ : Interventional (Clinical Trial)

Actual Enrollment ⓘ : 100000 participants

Allocation: Randomized

Intervention Model: Parallel Assignment

Masking: Single (Participant)

Masking Description: Participants have the possibility to opt-out. If they do not opt-out, neither the participant nor the nurse performing the screen exam will know to what study arm the participant was allocated. The radiologist reading the screen exam will however not be blinded to allocation information.

Primary Purpose: Screening

Official Title: A Randomized, Single-blinded, Controlled Trial on the Efficacy of Mammography Screening With Artificial Intelligence - the MASAI Study

Actual Study Start Date ⓘ : April 12, 2021

Estimated Primary Completion Date ⓘ : November 12, 2024

Estimated Study Completion Date ⓘ : April 12, 2025



Lang et al., Lancet Oncology 2023; NCT04838756
Transpara AI <https://screenpoint-medical.com/fusion-ai/>

THE LANCET
Oncology

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ARTICLES | VOLUME 24, ISSUE 8, P936-944, AUGUST 2023

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Artificial intelligence-supported screen reading versus standard double reading in the Mammography Screening with Artificial Intelligence trial (MASAI): a clinical safety analysis of a randomised, controlled, non-inferiority, single-blinded, screening accuracy study

Kristina Lång, PhD • Viktoria Josefsson, MD • Anna-Maria Larsson, PhD • Stefan Larsson, PhD • Charlotte Högberg, MA • Hanna Sartor, PhD • Prof Solveig Hofvind, PhD • Ingvar Andersson, PhD • Aldana Rosso, PhD • [Show less](#)

Published: August, 2023 • DOI: [https://doi.org/10.1016/S1470-2045\(23\)00298-X](https://doi.org/10.1016/S1470-2045(23)00298-X) • [Check for updates](#)

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The advance in deep learning radiologists have been waiting for

Slide 10

Universitätsklinikum
Carl Gustav Carus
THE DRESDENERS.



EKFZ
Digital Health

KATHER
LAB

KI in der Pathologie

Introducing FDA-Approved Paige Prostate

Paige Prostate

Software to Enhance Confidence in Prostate Cancer Diagnosis

Introducing Paige Prostate, the first AI-based pathology product to receive FDA marketing authorization for in vitro diagnostic (IVD) use in detecting cancer in prostate needle biopsies.

First CE-IVD marked AI solution for prognostic risk stratification of breast cancer patients.

Stratipath

Stratipath, a global leader in AI-based precision diagnostic solutions, today announced that its AI software for prognostic risk stratification of breast cancers, Stratipath Breast, is now CE-IVD marked.

June 01, 2022 03:59 ET | Source: [Stratipath](#)

Mindpeak News | BreastIHC CE-IVD certified

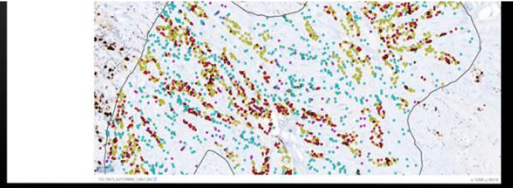
mindpeak

Mindpeak Blog

Home > Blog > BreastIHC CE-IVD certified

May 25, 2021

BreastIHC CE-IVD certified



Products | Panakeia

Home Products Technology Impact About

PANProfiler Breast (ER, PR, HER2)

UK CA CE

Breast cancer diagnostic tool that reports tissue ER, PR, HER2 by analysing H&E slides. Seamlessly integrates with existing workflow and reduces the need for time consuming lab tests, returning results sooner to patients and multidisciplinary teams.

The device is available only in Great Britain (UKCA) and the EU (CE) as an IVD. It is not yet available in the United States. [Request documentation](#)

Aiforia adds fourth CE-IVD marked clinical AI Model to its rapidly expanding portfolio of novel tools for cancer diagnostics

aiforia

Book a demo

Aiforia announces the CE-IVD marking of the Aiforia® Clinical AI Model for Breast Cancer, PR. The news comes just recently after the company released another CE-IVD marked clinical algorithm, the ER AI model, for the same disease.

May 25, 2022 Written by Aiforia

DoMore Diagnostics achieves CE-IVD mark for Histotype Px® Colorectal, an AI algorithm that predict patient outcomes in colorectal cancer patients by analyzing standard histology images

DoMore

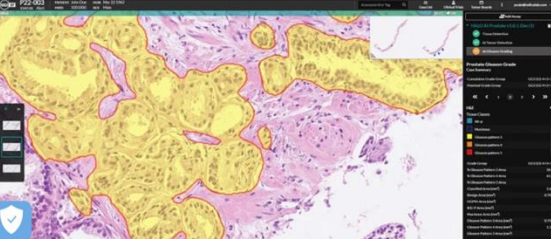
May 25

Oslo, Norway - DoMore Diagnostics, a leader in cancer outcome prediction with

Indica Labs receives CE-IVD Mark for prostate cancer screening tool

NEWS | May 24, 2022

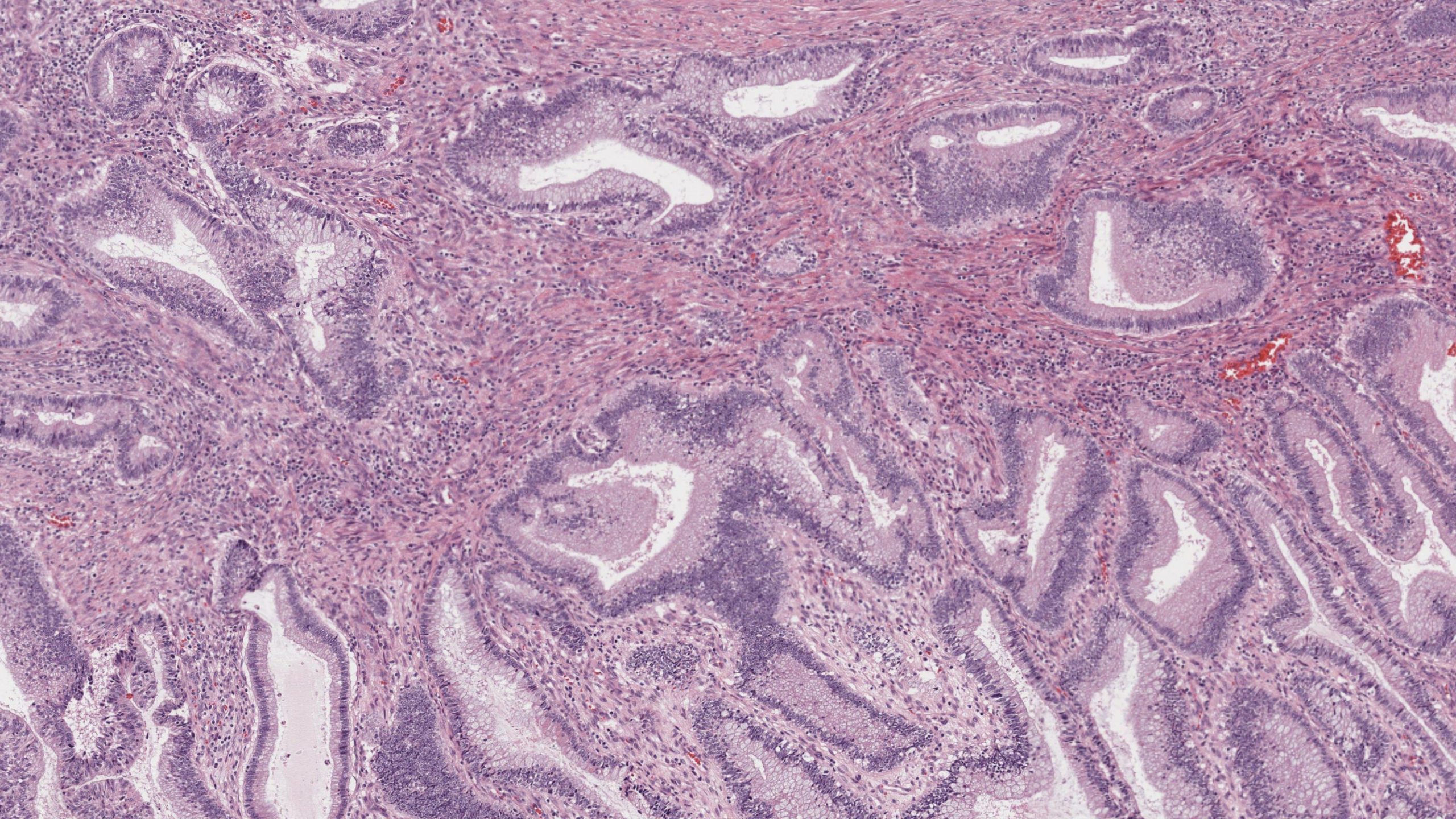
The study was conducted on 4,973 core needle biopsies obtained from three independent arms.



**incomplete selection
COI: scientific advisor for
Owkin and Panakeia**

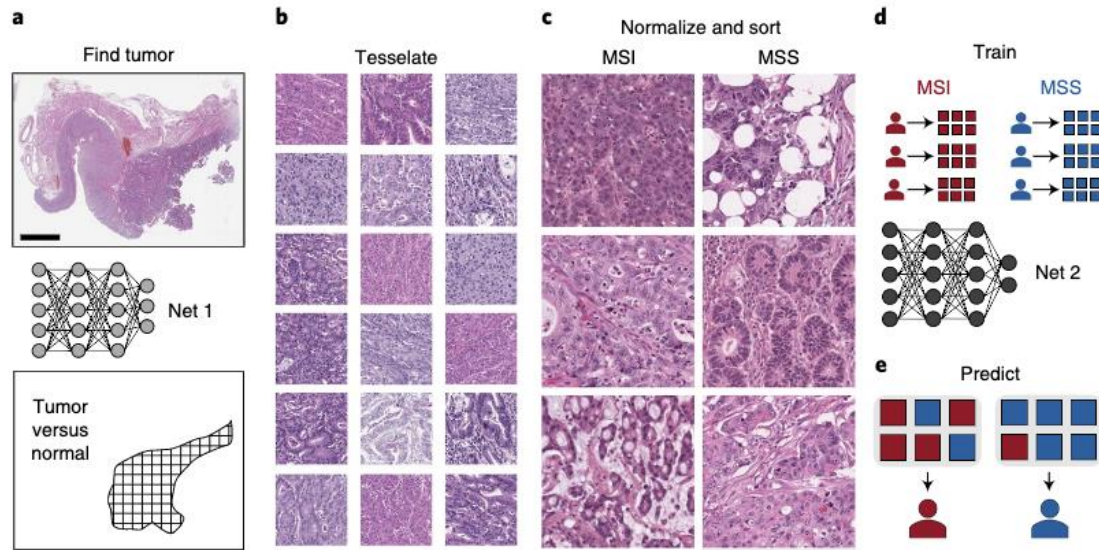
A man in a white lab coat stands with his back to the camera, looking out over a vast, golden landscape. The terrain is covered in low-lying vegetation and features a complex, winding path that leads towards the horizon. The sky is filled with soft, golden light, suggesting a sunrise or sunset. The overall atmosphere is one of contemplation and discovery.

**Übersicht KI-basierte Biomarker in
der Präzisionsonkologie**

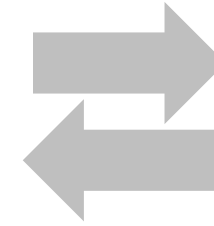


Deep learning can predict microsatellite instability directly from histology in gastrointestinal cancer

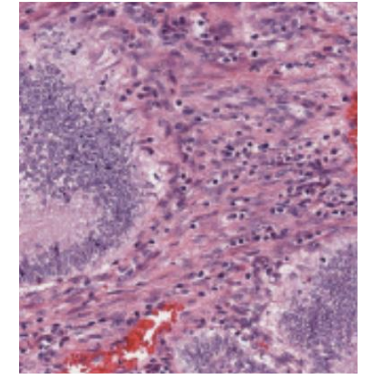
Jakob Nikolas Kather ^{1,2,3,4,5*}, Alexander T. Pearson⁴, Niels Halama ^{2,5,6}, Dirk Jäger^{2,3,5}, Jeremias Krause ¹, Sven H. Loosen¹, Alexander Marx⁷, Peter Boor ⁸, Frank Tacke⁹, Ulf Peter Neumann¹⁰, Heike I. Grabsch ^{11,12}, Takaki Yoshikawa^{13,14}, Hermann Brenner^{2,15,16}, Jenny Chang-Claude^{17,18}, Michael Hoffmeister¹⁵, Christian Trautwein¹ and Tom Luedde ^{1*}



Genotype determines
the phenotype



Deep Learning
predicts genotype



OWKIN

MSIntuit CRC

MSIntuit™ CRC is a CE-marked AI diagnostic that optimizes MSI testing for colorectal cancer through a prescreening approach with digital H&E slides.

CE 

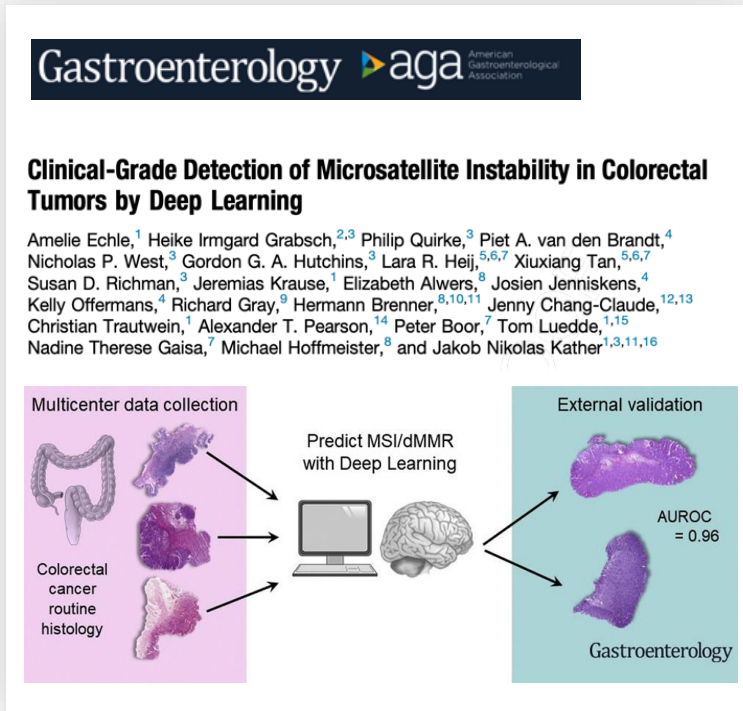
Contact →



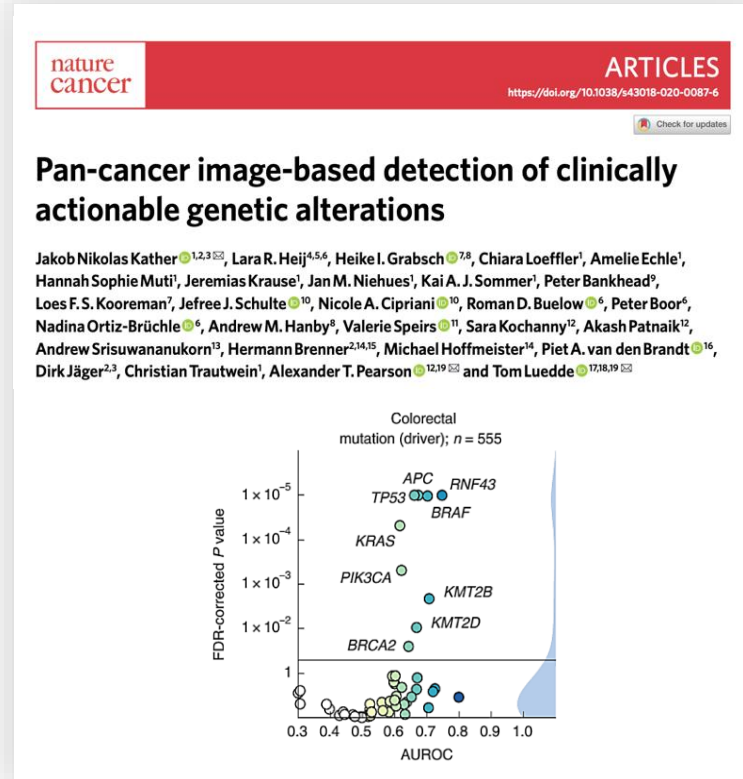
AI is trained with retrospective patient clinical data paired with WGS.

now available as a
product for clinical
use in the EU

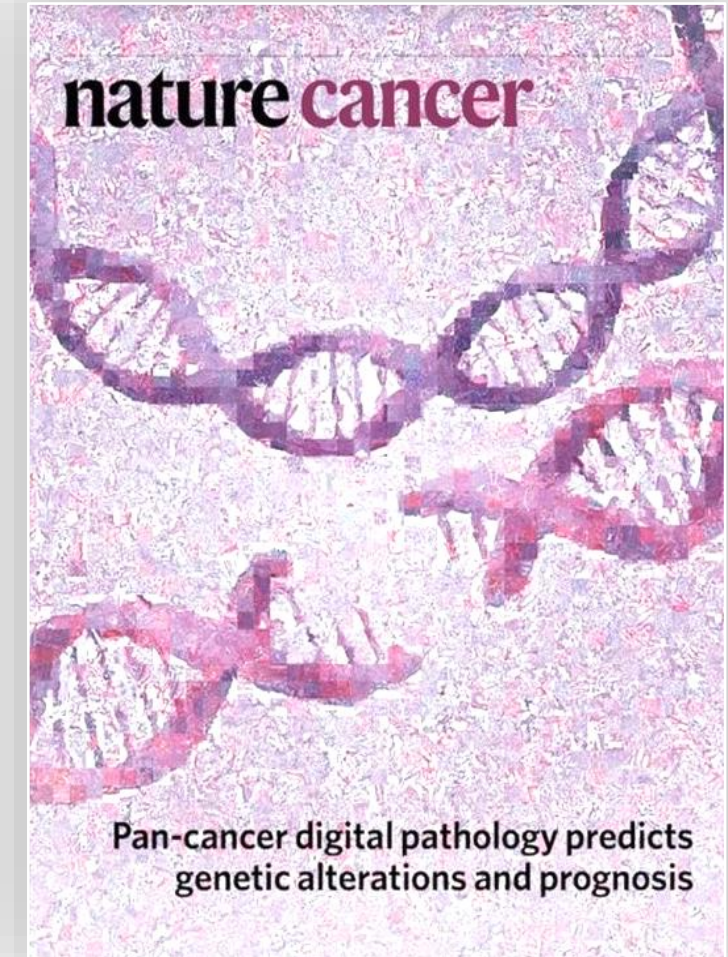
Large-scale validation & pan-cancer extension



Echle et al.,
Gastroenterology, 2020




Kather et al.,
Nature Cancer 2020



Prädiktion von Immuntherapie-Response

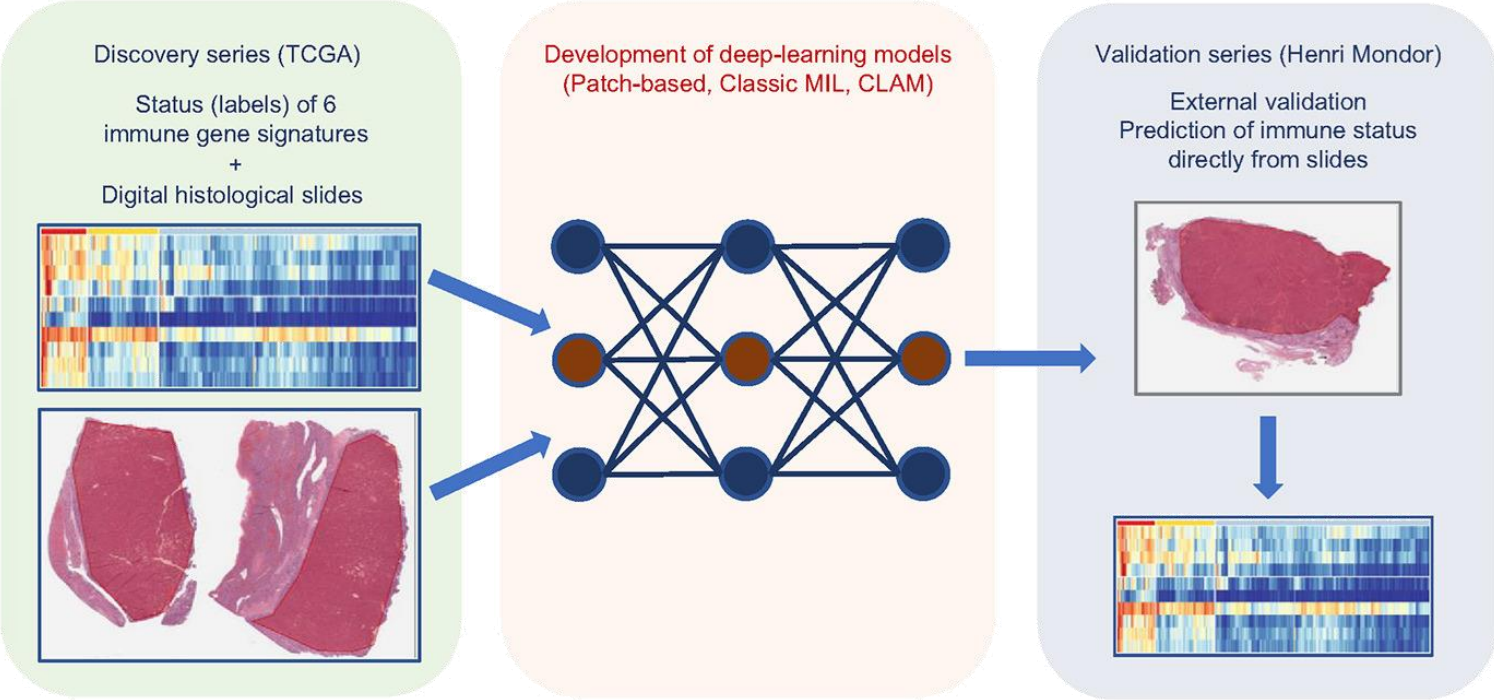
Zeng et al.
Journal of Hepatology 2022

JOURNAL OF HEPATOLOGY 
The Home of Liver Research

Artificial intelligence predicts immune and inflammatory gene signatures directly from hepatocellular carcinoma histology

Qinghe Zeng [†] • Christophe Klein [†] • Stefano Caruso • Pascale Maille • Narmin Ghaffari Laleh • Daniele Sommacale • Alexis Laurent • Giuliana Amaddeo • David Gentien • Audrey Rapinat • H el ene Regnault • C ecile Charpy • Cong Trung Nguyen • Christophe Tournigand • Raffaele Brustia • Jean Michel Pawlotsky • Jakob Nikolas Kather • Maria Chiara Maiuri • Nicolas Lom enie [#] • Julien Calderaro [ ] [#] [ ] • [Show less](#) • [Show footnotes](#)

Published: February 07, 2022 • DOI: <https://doi.org/10.1016/j.jhep.2022.01.018> •  Check for updates

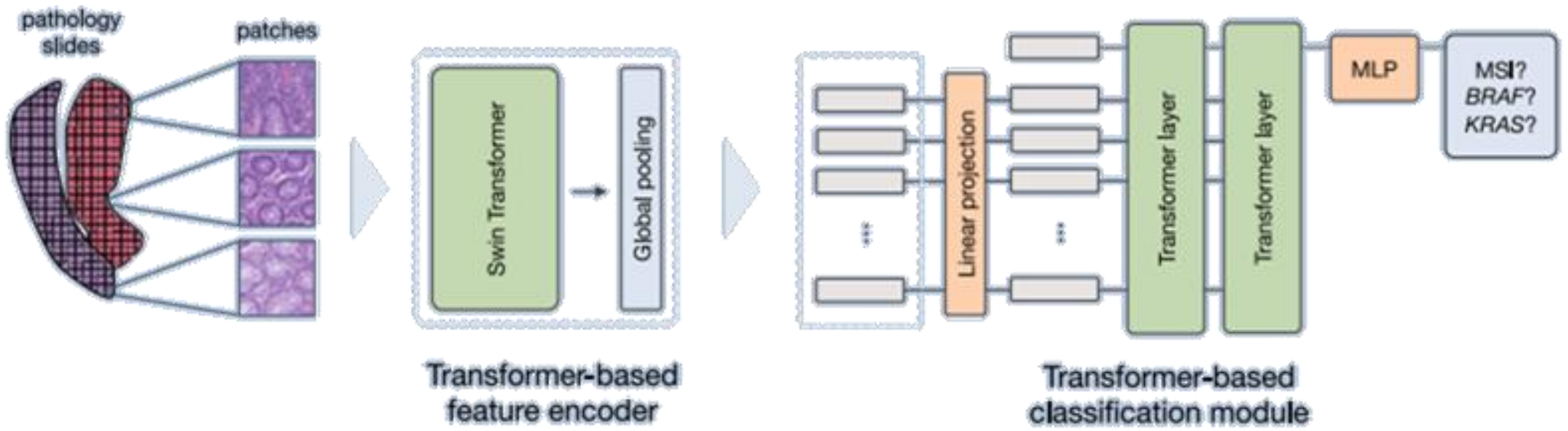


Cancer Cell

Transformer-based biomarker prediction from colorectal cancer histology: A large-scale multicentric study

Authors

Sophia J. Wagner,
Daniel Reisenbüchler,
Nicholas P. West, ..., Melanie Boxberg,
Tingying Peng, Jakob Nikolas Kather



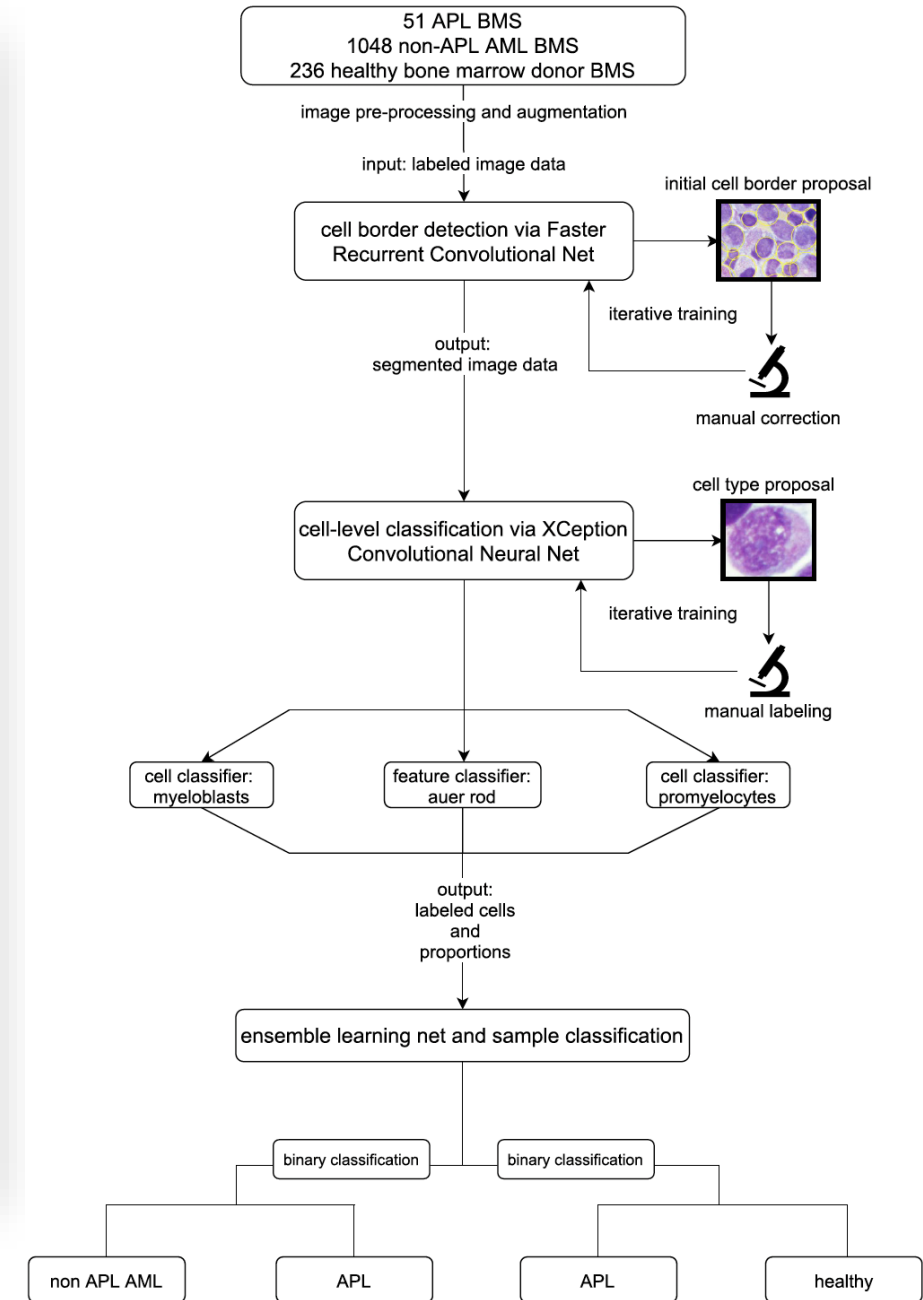
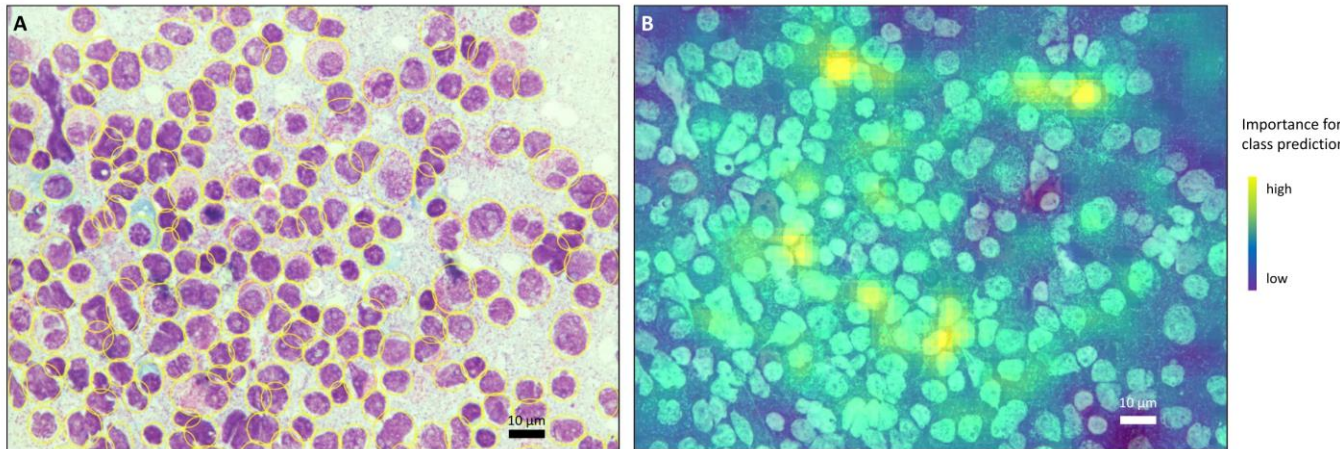
RESEARCH

Open Access

Deep learning identifies Acute Promyelocytic Leukemia in bone marrow smears



Jan-Niklas Eckardt^{1*}, Tim Schmittmann², Sebastian Riechert², Michael Kramer¹, Anas Shekh Sulaiman¹, Katja Sockel¹, Frank Kroschinsky¹, Johannes Schetelig¹, Lisa Wagenführ¹, Ulrich Schuler¹, Uwe Platzbecker³, Christian Thiede¹, Friedrich Stölzel¹, Christoph Röllig¹, Martin Bornhäuser^{1,4,5}, Karsten Wendt^{2†} and Jan Moritz Middeke^{1†}



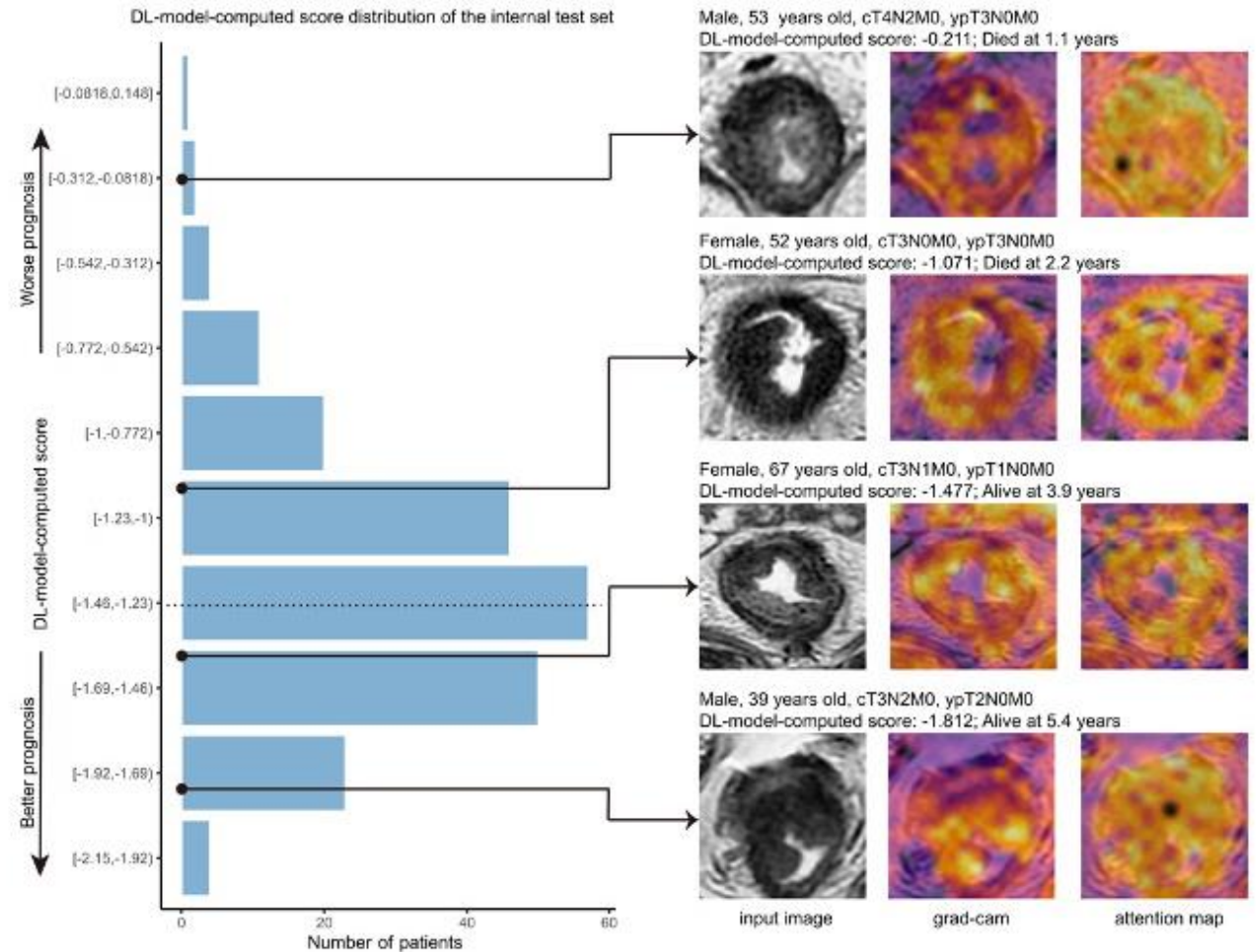
KI-basierte Ende-zu-Ende Analyse in der Radiologie

Radiology

RSNA

An MRI Deep Learning Model Predicts Outcome in Rectal Cancer

[ID](#) Xiaofeng Jiang*, [Hengyu Zhao*](#), [Oliver Lester Saldanha](#), [ID](#) Sven Nebelung, [ID](#) Christiane Kuhl, [ID](#) Iakovos Amygdalos, [ID](#) Sven Arke Lang, [ID](#) Xiaojian Wu, [ID](#) Xiaochun Meng, [ID](#) Daniel Truhn, [ID](#) Jakob Nikolas Kather** ✉, [Jia Ke**](#)



Large language models

A woman with blonde hair tied back, wearing a white blazer and a lanyard, stands in a conference room. She is gesturing with her hands as if presenting. In the foreground, a laptop is open on a table. The background is filled with a blurred audience of people sitting at tables, all looking towards the speaker. The room is dimly lit with blue ambient lighting, and a large screen is visible in the background.

Wissensfragen für GPT-4

I am a medical doctor. I have a patient with HCC and liver cirrhosis (BCLC C) and I am unsure if I should prescribe Atezo/Bev or a TKI as first line systemic therapy. Is there a clinical trial that compared these options? What are the most important considerations whether to choose one or the other? Be concise.

Yes, the IMbrave150 trial is a clinical trial that compared Atezolizumab (Atezo) plus Bevacizumab (Bev) with Sorafenib, a tyrosine kinase inhibitor (TKI), as a first-line treatment for patients with unresectable hepatocellular carcinoma (HCC) and liver cirrhosis (BCLC C).

Key considerations in choosing between Atezo/Bev and a TKI are:

1. **Efficacy:** IMbrave150 trial demonstrated that Atezo/Bev significantly improved overall survival (OS) and progression-free survival (PFS) compared to Sorafenib, leading to its approval as a first-line treatment.

2. **Safety:** Atezo/Bev showed a more favorable safety profile, with fewer grade 3 or higher adverse events compared to Sorafenib.
3. **Patient factors:** Consider individual patient factors, such as comorbidities, performance status, and contraindications for immunotherapy or antiangiogenic agents.
4. **Drug availability and cost:** Availability and cost of Atezo/Bev may vary across regions and might affect the choice of therapy.

Overall, Atezo/Bev is generally preferred as first-line systemic therapy for patients with advanced HCC (BCLC C) based on the IMbrave150 trial results, but individual patient factors and drug availability should also be considered.

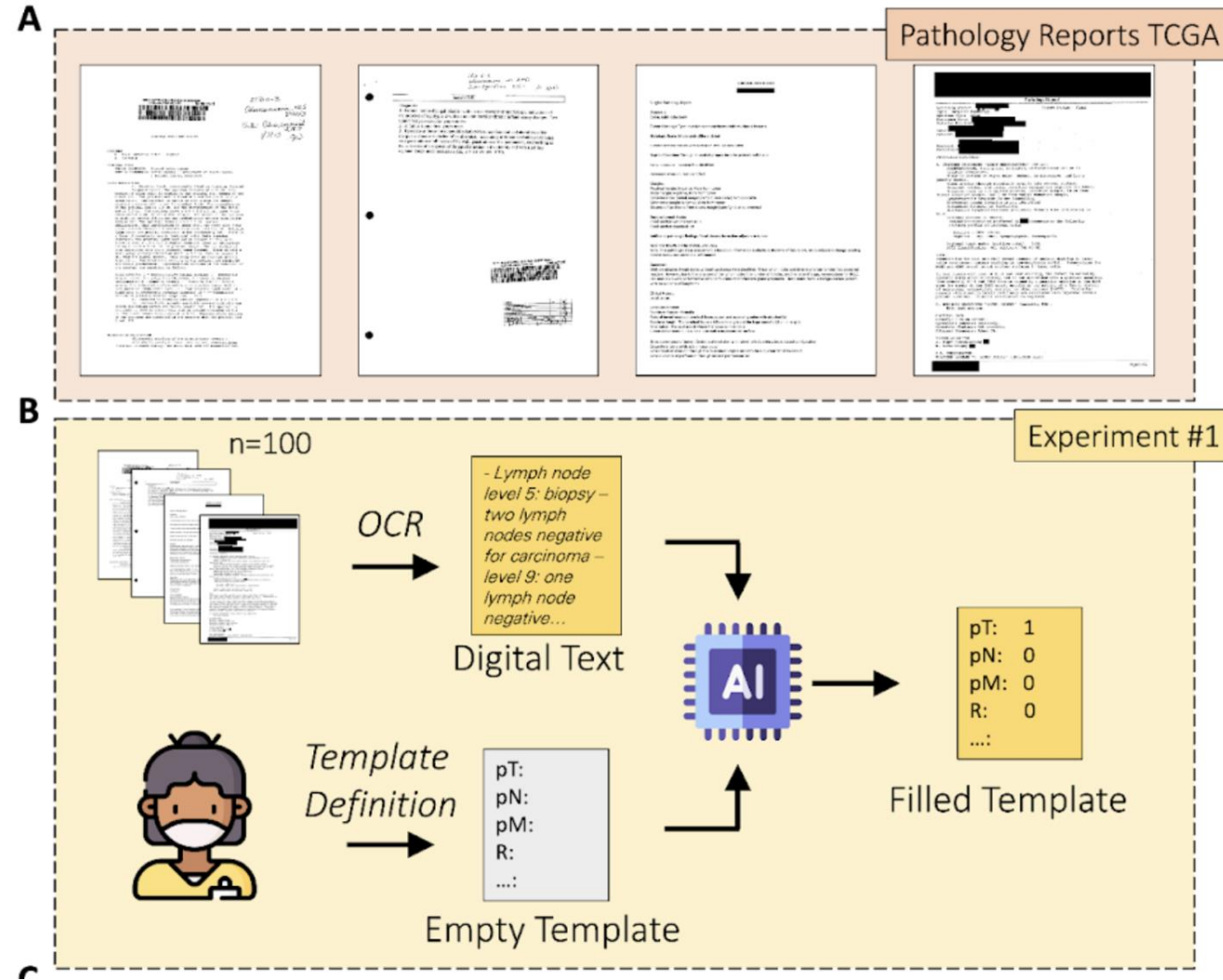
Unstrukturierte Daten strukturieren

Gross Anatomic Description

Specimens received in five containers.

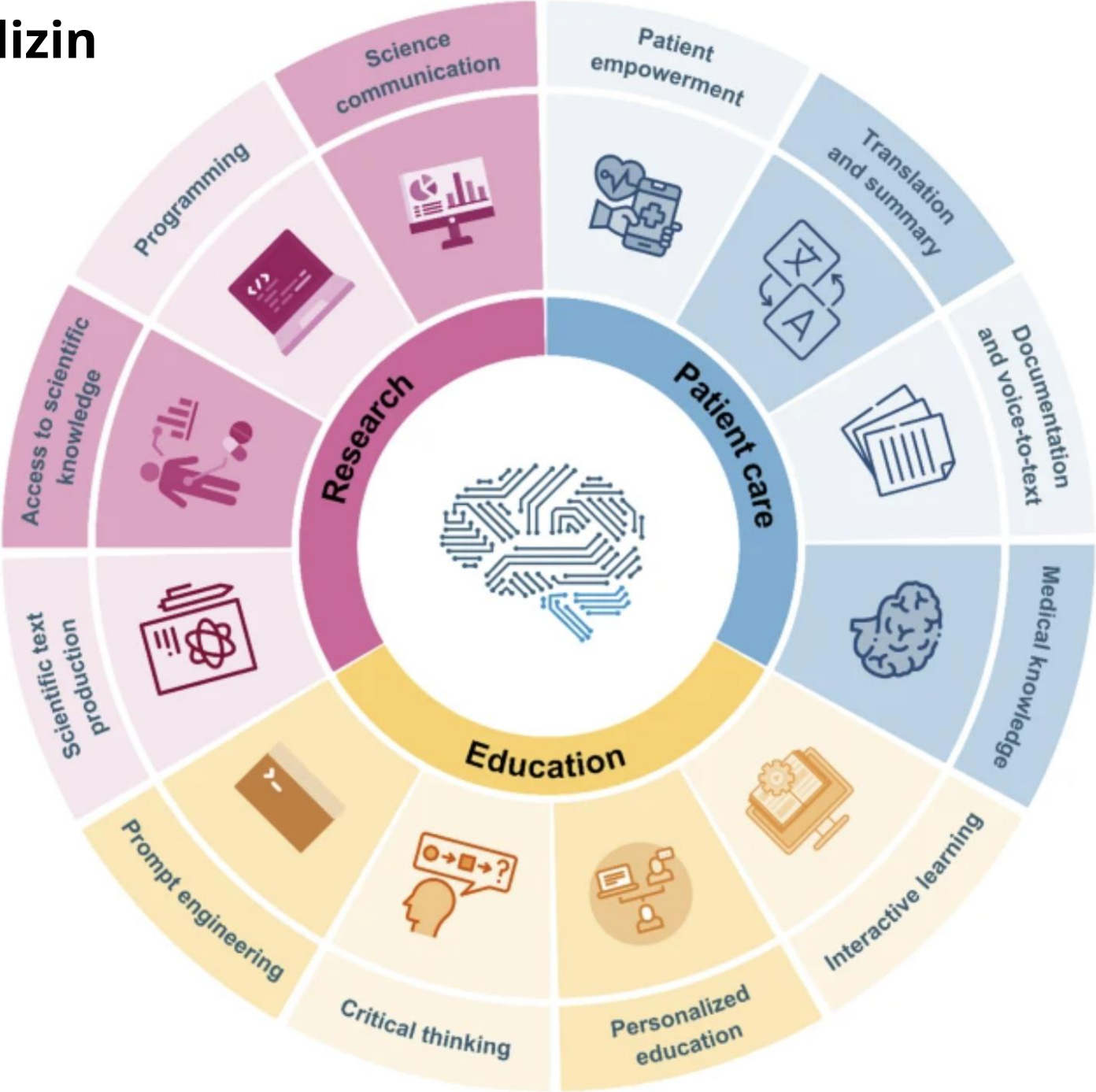
Specimen A: Designated "right colon distal ileum" is received in formalin labeled with the patient's name and "right colon distal ileum". Specimen consists of a portion of ileum with attached right colon which measures a total of 35.3 cm in length. The small intestine measures 17.2 cm in length x 3.5 cm in cross sectional diameter. The colon measures 18.1 cm in length and the cross sectional diameter ranges from 5.6 cm distally to 10.2 cm surrounding an enlarged area with focal puckering of the serosal surface. Attached to the colon is a portion of muscle and connective tissue located posteriorly which measures 12.5 x 6.3 x 5.1 cm. The remainder of the serosal surface of both the ileum and right colon are smooth, tan/pink and unremarkable. Attached pericolic fibroadipose tissue is present. This area of puckering measures 9.5 cm from the colonic resection margin. The area composed of the muscle and connective tissue is inked green. The ileal wall measures 0.2 cm in thickness and the mucosal surface of the ileum with grossly unremarkable. Grossly adjacent to the ileal cecal valve is a large variegated polypoid exophytic pink to green colored bosselated mass measuring 9.5 x 8.0 cm and extends to a depth of 8.5 cm. Focally the mass extends to the inked green muscle connective tissue resection margin. The remainder of the colonic mucosa is grossly unremarkable and free of additional polyps or diverticuli. The average wall thickness of the colon measures 0.2 cm to 0.3 cm. Gross photographs are taken. Multiple lymph nodes are identified ranging from 0.2 cm up to 3.1 cm in greatest dimension. The appendix is identified upon cross sectioning of the muscle and soft tissue. The appendix is totally encased within the soft tissue making a measurement of length not possible. The cross-sectional diameter averages 0.6 cm with an intact lumen that is 0.2 cm. The tumor does appear grossly to involve the appendix. Gross photographs are taken.

Section code: A1 – colon resection margin; A2 – ileal resection margin; A3 – additional representative section of unremarkable colon and ileum; A4-A7 – representative sections tumor; A8-A10 – sections of tumor with deepest muscle and soft issue invasion extending to the inked margin; A11 – three



LLMs in der Medizin

Clusmann*, Kolbinger*, Muti*, et al., Comms Med 2023



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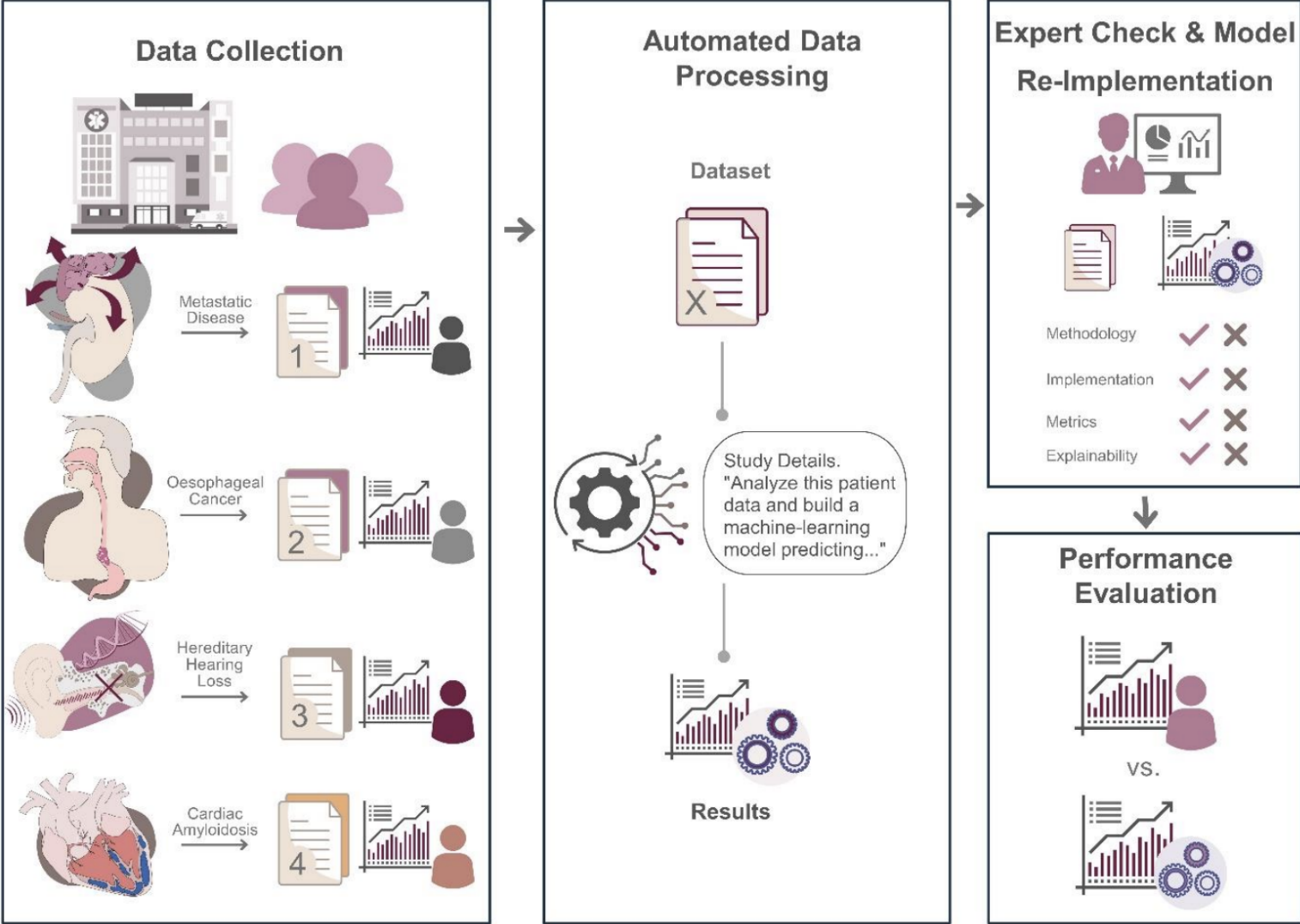
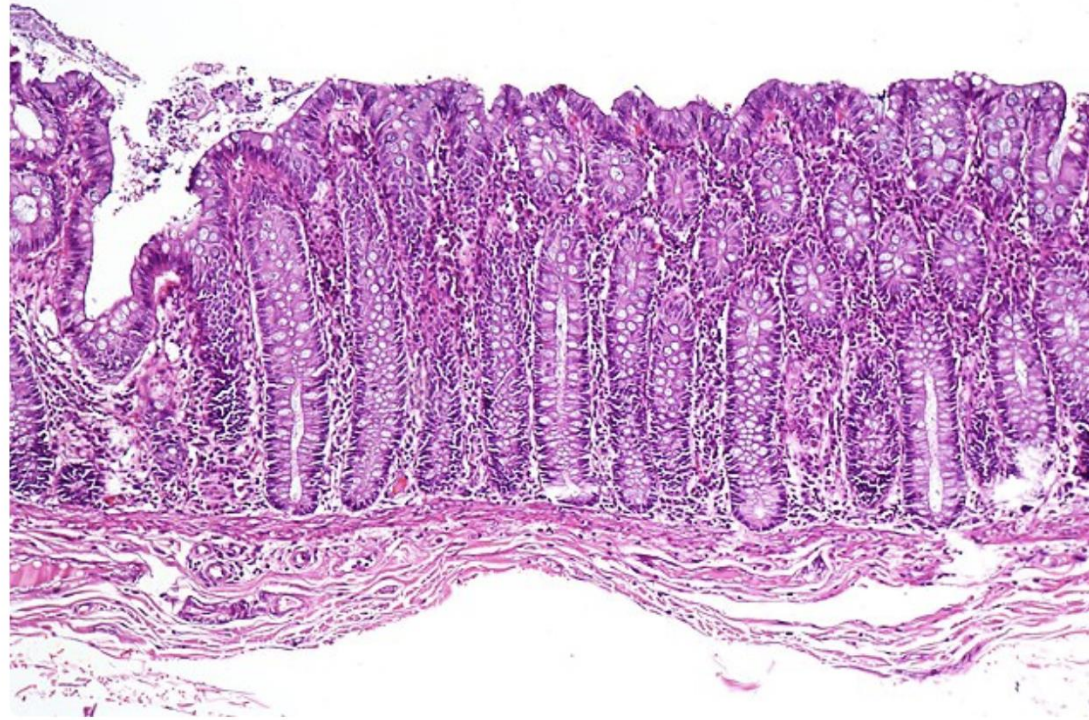


Figure 1: Study Design. Real-world datasets and study details from four large clinical trials were collected and input into the ChatGPT Advanced Data Analysis (ADA) tool. The tool autonomously selected the appropriate machine-learning models for the analysis following prompting. The models were expert-checked and comprehensively evaluated. The ChatGPT ADA-based predictions were compared to the original studies (benchmark publication) and the validity predictions following the re-implementation of the models.

GPT-4-vision



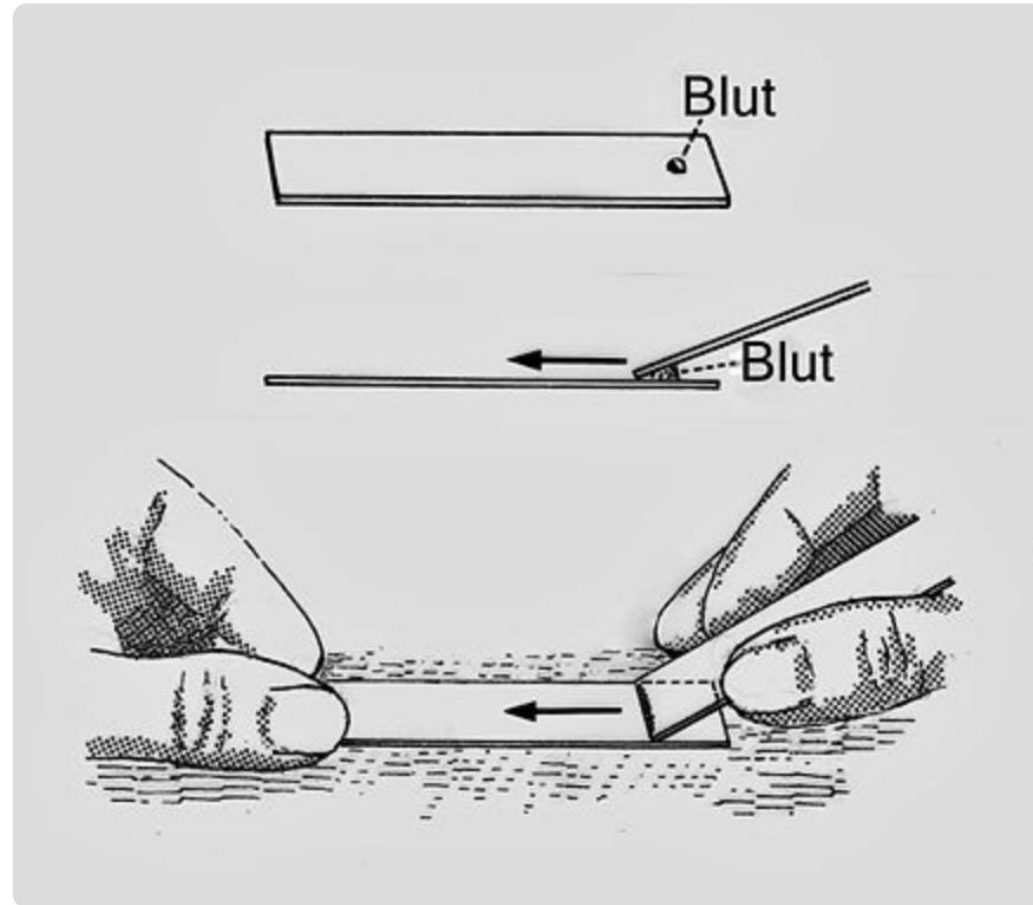
what is this



This is a histological section of tissue that has been stained, likely with hematoxylin and eosin (H&E). It appears to be a section of the epithelial lining of an organ, possibly the intestine or another part of the gastrointestinal tract. The prominent, finger-like projections are called villi, which increase the surface area for absorption. The cells lining the villi are epithelial cells. The underlying layer with a wavy appearance is the lamina propria, which contains connective tissue, blood vessels, and other cell types.

https://commons.wikimedia.org/wiki/File:Colon,_in_termed._mag.jpg

GPT-4-vision



Was passiert hier? Beschreibe es mir kurz.



Das Bild zeigt eine Illustration von Blutentnahme- oder Injektionstechniken.

- Im oberen Teil des Bildes gibt es zwei Illustrationen von Nadeln. Die Nadel im oberen Diagramm hat ein Blutropfen am Ende, was darauf hindeutet, dass Blut entnommen wurde. Die Nadel im mittleren



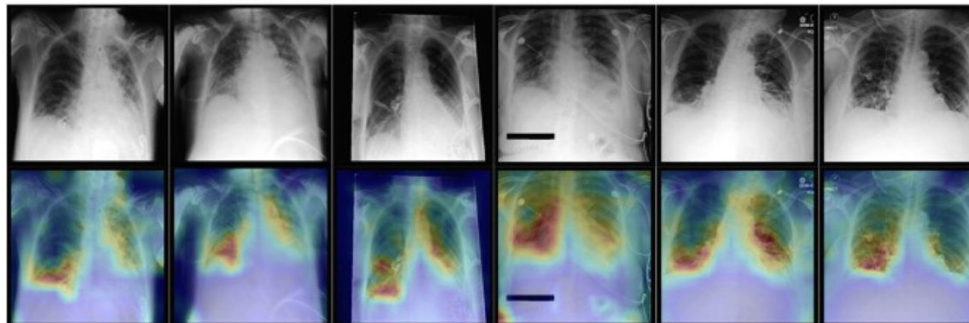
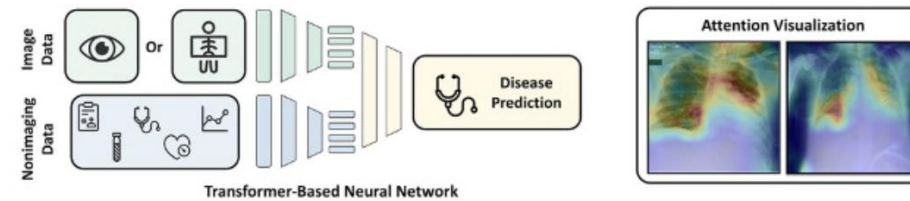
Multimodale KI in der Medizin

Radiology

ORIGINAL RESEARCH • COMPUTER APPLICATIONS

Multimodal Deep Learning for Integrating Chest Radiographs and Clinical Parameters: A Case for Transformers

Firas Khader, MSc • Gustav Müller-Franzes, MSc • Tianci Wang, BSc • Tianyu Han, MSc • Soroosh Tayebi Arasteh, MSc • Christoph Haarburger, PhD • Johannes Stegmaier, PhD • Keno Bressemer, MD • Christiane Kuhl, MD • Sven Nebelung, MD • Jakob Nikolas Kather, MD • Daniel Truhn, MD, PhD**



- Transformer DL model was trained to diagnose 25 diseases using multimodal data from retrospective chest radiographs and clinical parameters (training; $n = 33\,893$, $n = 28\,809$).
- The multimodal model when tested on a public dataset, Medical Information Mart for Intensive Care, had mean AUC of 0.77, compared with 0.70 for model using chest radiographs only and 0.72 for model using clinical parameters only.

Khader et al.,
Radiology
2023

Multimodale Pathologie: KI-Immunoscore

nature medicine

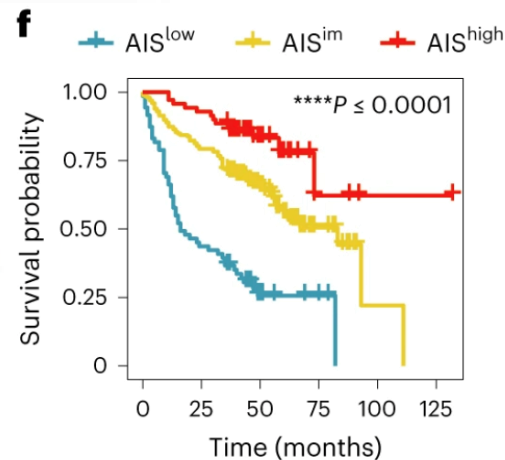
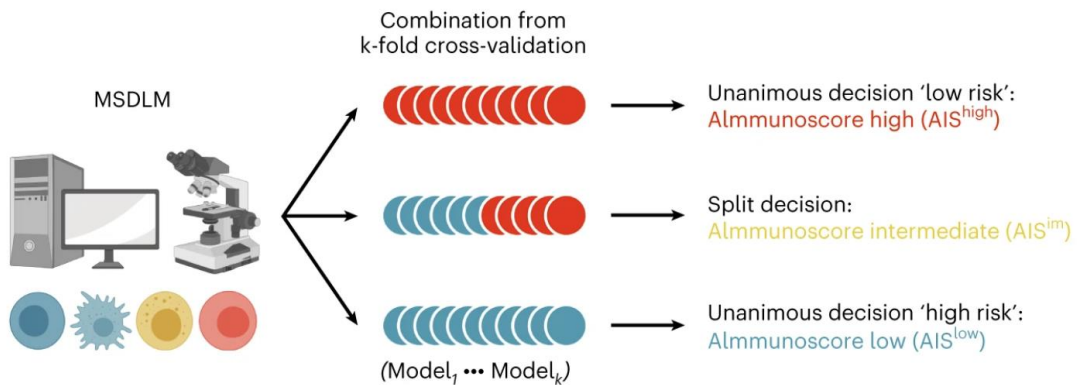
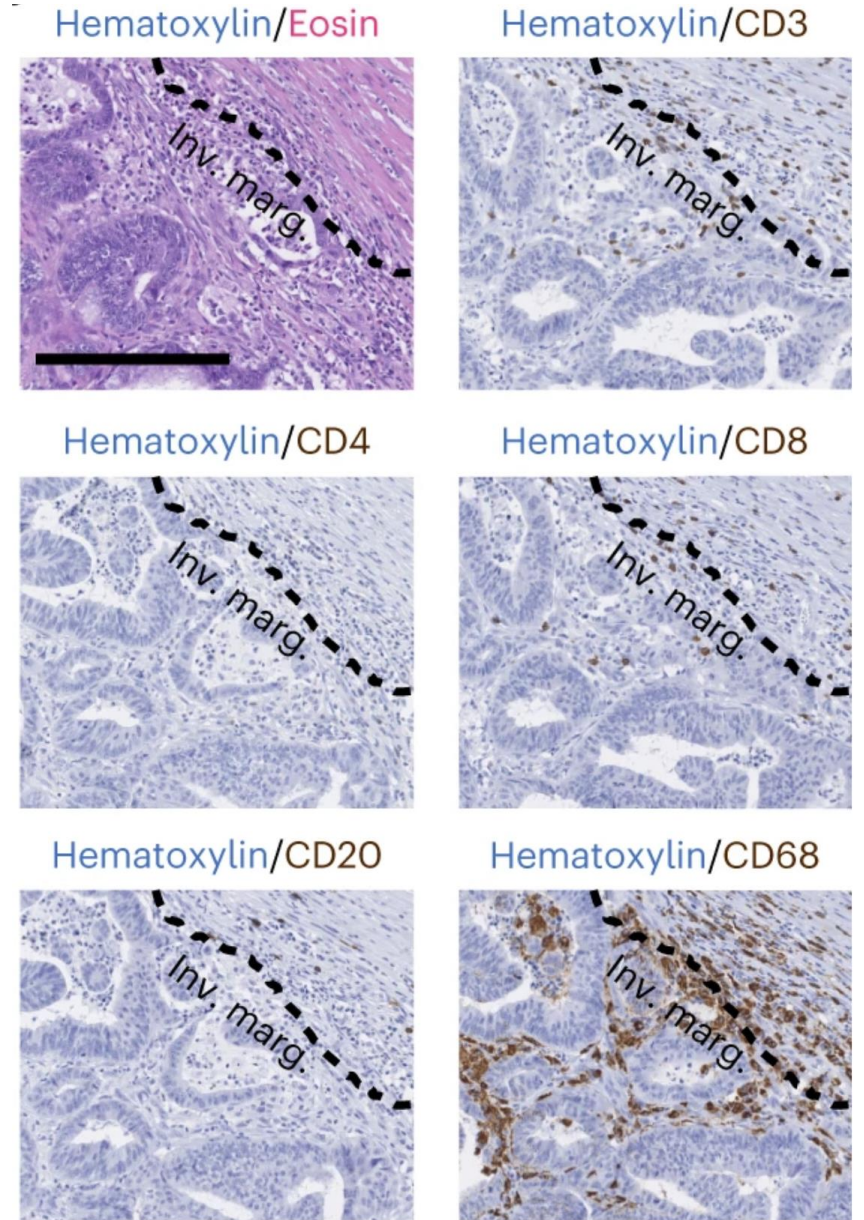
Article <https://doi.org/10.1038/s41591-022-02134-1>

Multistain deep learning for prediction of prognosis and therapy response in colorectal cancer

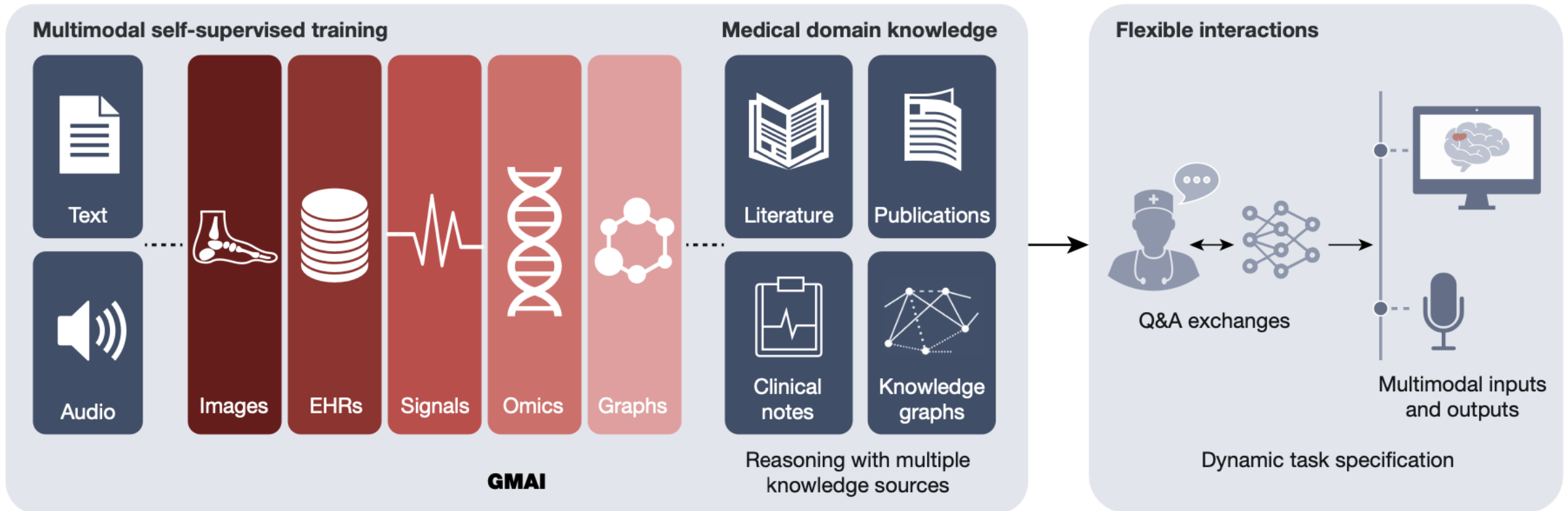
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Sebastian Foersch¹✉, Christina Glasner¹, Ann-Christin Woerl^{1,2}, Markus Eckstein³, Daniel-Christoph Wagner¹, Stefan Schulz¹, Franziska Kellers^{1,4}, Aurélie Fernandez¹, Konstantina Tserea¹, Michael Kloth¹, Arndt Hartmann³, Achim Heintz⁵, Wilko Weichert⁶, Wilfried Roth¹, Carol Geppert³, Jakob Nikolas Kather^{7,8,9} & Moritz Jesinghaus^{6,10}

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 jakob_nikolas.kather@tu-dresden.de

 kather.ai  @katherlab

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