

AMIN RANEM, PhD

Machine Learning Researcher · Medical Imaging and Clinical AI

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Machine learning researcher with a PhD in Computer Science, specializing in medical imaging AI. I work on continual learning, multi-modal models that combine clinical data with imaging, and adapting foundation models to medicine. My 13 peer-reviewed **publications** appeared at **CVPR, WACV, MICCAI, MIDL, BMVC** and in **Nature Scientific Reports**. I also care about what happens after publication. I ran quality assurance across 38 German university hospitals ([RACOON](#)), worked on FDA regulatory research (PCCP), and currently prepare models for prospective clinical validation with surgeons and industry partners. Recent Academia & Industry organizer in the MICCAI community and invited speaker at Stanford.

CORE EXPERTISE

Machine Learning	Continual and lifelong learning · multi-modal learning (imaging + structured clinical data) · medical image segmentation and registration · foundation models (SAM) · Neural Cellular Automata · transformers · explainable AI (XAI)
Engineering	Python · PyTorch · Slurm · Git · Linux · reproducible training and evaluation pipelines · large-scale imaging data (CT/MRI/CTA)
Clinical & Regulatory	Prospective multi-center validation studies · quality assurance for clinical AI at national scale · federated learning environments · FDA PCCP and software as a medical device

EXPERIENCE

Postdoctoral Researcher, Medical AI · University of Twente, Mathematics of Imaging & AI, NL Nov 2025 – Present

- Design, implement and train **two multi-modal AI risk models** for the AI4EVAR project. The models combine structured clinical data with CTA imaging to predict re-interventions after endovascular aneurysm repair (ZonMw-funded consortium of three hospitals, two universities and industry partners).
- Train on the RADAR database of **1,000+ EVAR patients**. Both models will be validated prospectively with around 300 patients across three hospitals.
- Embed **explainable AI** into both models so vascular surgeons can understand each multi-modal prediction. The outputs feed shared decision tools developed with clinicians and **Pie Medical Imaging**.

Doctoral Researcher / Research Assistant · TU Darmstadt, MEC-Lab, DE Apr 2022 – Mar 2025 and Jun 2025

- Published **13 peer-reviewed papers** on continual learning for medical image analysis (CVPR, WACV, MICCAI, MIDL, BMVC, Nature Scientific Reports). PhD completed in 3 years.
- Held a key quality assurance role in **RACOON**, Germany's national radiology AI platform. Built QA methods for CT/MRI images and segmentation masks used across **38 university hospitals**.
- Researched regulatory pathways for continually learning medical software and co-authored a peer-reviewed analysis of the **FDA PCCP** framework.
- Supervised BSc and MSc theses and DAAD-WISE research interns. Taught the VAE lecture in Deep Generative Models and the Registration and Continual Learning lectures in Deep Learning for Medical Imaging every year.

Earlier Roles · TU Darmstadt · Deutsche Lufthansa AG · DFKI 2018 – 2022

- Student assistant for RACOON quality assurance at TU Darmstadt (Oct 2020 – Mar 2022).
- Business intelligence intern at Deutsche Lufthansa AG, building Qlik Sense analytics (Nov 2019 – Apr 2020).
- Student assistant for prototype development at the German Research Center for AI, DFKI (Dec 2018 – Nov 2019).

EDUCATION

Ph.D., Computer Science · TU Darmstadt, DE Apr 2022 – Mar 2025

- Thesis: **"Beyond End-to-End — Exploring Extremes in Medical Continual Learning."**

M.Sc., Business Informatics · TU Darmstadt, DE Oct 2020 – Mar 2022

- Thesis: "Continual Learning with Transformer Architectures."

B.Sc., Business Informatics · Saarland University, DE Oct 2017 – Sep 2020

- Thesis: "Development of an evaluation tool for time series analysis of passenger forecasts."

SELECTED PROJECTS

- **RACoon quality assurance.** Built image and segmentation QA pipeline behind Germany's national radiology AI platform, keeping data from 38 hospitals usable for federated research.
- **Lifelong nnU-Net.** Co-developed an open framework that makes continual learning experiments on medical segmentation reproducible and comparable across methods, using the SOTA nnU-Net as backbone. Published in Nature Scientific Reports.
- **Neural Cellular Automata for medical imaging.** Showed with NCAdapt and NCA-Morph that models a fraction of the size of a U-Net can segment and register medical images. Follow-up work trained them directly on edge devices (MICCAI 2024).
- **Foundation models in medicine.** Adapted the Segment Anything Model to continual prostate MRI segmentation (UnCle SAM, MIDL 2024) and studied its behavior on radiology and pathology data.

PUBLICATIONS

Also listed on [Google Scholar](#).

- **A. Ranem**, J. Kalkhof, A. Mukhopadhyay. "NCAdapt: Dynamic adaptation with domain-specific Neural Cellular Automata for continual hippocampus segmentation." **WACV**, 2025.
- S.K. Sivakumar, Y. Frisch, **A. Ranem**, A. Mukhopadhyay. "SASVi: Segment any surgical video." **Int. Journal of Computer Assisted Radiology and Surgery**, 2025.
- N. Babendererde, **A. Ranem**, M. Fuchs, C. Gonzalez, H.J. Krumb, A. Mukhopadhyay. "FDA's PCCP: Opportunities and Gaps." **Workshop on Bridging Regulatory Science & Medical Imaging Evaluation**, 2025.
- **A. Ranem**, J. Kalkhof, A. Mukhopadhyay. "NCA-Morph: Medical Image Registration with Neural Cellular Automata." **BMVC (Oral)**, 2024.
- J. Kalkhof, **A. Ranem**, A. Mukhopadhyay. "Unsupervised Training of Neural Cellular Automata on Edge Devices." **MICCAI**, 2024.
- **A. Ranem**, M.A.M. Aflal, M. Fuchs, A. Mukhopadhyay. "UnCle SAM: Unleashing SAM's Potential for Continual Prostate MRI Segmentation." **MIDL**, 2024.
- **A. Ranem**, C. González, D. Pinto dos Santos, A.M. Bucher, A.E. Othman, A. Mukhopadhyay. "Continual atlas-based segmentation of prostate MRI." **WACV**, 2024.
- **A. Ranem**, N. Babendererde, M. Fuchs, A. Mukhopadhyay. "Exploring SAM Ablations for Enhancing Medical Segmentation in Radiology and Pathology." **arXiv preprint**, 2023.
- C. González, **A. Ranem**, D. Pinto dos Santos, A. Othman, A. Mukhopadhyay. "Lifelong nnU-Net: a framework for standardized medical continual learning." **Nature Scientific Reports**, 2023.
- **A. Ranem**, C. González, A. Mukhopadhyay. "Continual Hippocampus Segmentation with Transformers." **CVPR Workshops**, 2022.
- C. González, **A. Ranem**, A. Othman, A. Mukhopadhyay. "Task-Agnostic Continual Hippocampus Segmentation for Smooth Population Shifts." **DART Workshop, MICCAI**, 2022.
- **A. Ranem**, J. Kalkhof, C. Özer, A. Mukhopadhyay, I. Oksuz. "Detecting respiratory motion artefacts for cardiovascular MRIs to ensure high-quality segmentation." **STACOM Workshop**, 2022.
- C. González, C.L. Harder, **A. Ranem**, R. Fischbach, I.J. Kaltenborn, A. Dadras, A.M. Bucher, A. Mukhopadhyay. "Quality monitoring of federated Covid-19 lesion segmentation." **Bildverarbeitung für die Medizin**, 2022.

INVITED TALKS

- **Stanford CNS Lab:** "Exploring the extremes of medical continual learning" (*Sep 2024*)
- **BMVC 2024, Oral Session:** "NCA-Morph: Medical Image Registration with Neural Cellular Automata" (*Nov 2024*)
- **MICCAI Tutorial, Data-Centric Dynamic Learning:** "Hands-on: Continual Learning with UnCle SAM" (*Oct 2024*)
- **CapsNetwork School:** "Beyond end-to-end continual segmentation" (*Nov 2023*)

LEADERSHIP & COMMUNITY

- **MICCAI Student Board, Professional Events Officer (2024–2025).** Organized the Academia & Industry event, which brought researchers and industry into the same room.
- **Workshop and tutorial organizer.** DGM4MICCAI workshop (MICCAI 2023–present) · Data-Centric Dynamic Learning tutorial (MICCAI 2024) · CapsNetwork school, Darmstadt (2023).
- **Mentoring.** Guided BSc and MSc thesis students and international DAAD-WISE interns at TU Darmstadt and University of Twente (2022–present).

LANGUAGES

English (native) · German (native) · Arabic (intermediate) · French (basic)