Katharina V. Hoebel, MD, PhD

Research Fellow · Department of Data Science

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Education

Massachusetts Institute of Technology *Cambridge, MA, USA*

PhD Medical Engineering and Medical Physics

Harvard-MIT Division of Health Sciences and Technology *09/2017 - 02/2023*

- Concentration area: Computer Science
- cGPA: 5.0/5.0
- Research advisor: Prof. Jayashree Kalpathy-Cramer, Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, USA
- Thesis title: "Domain and User-Centered Machine Learning for Medical Image Analysis." Access via MIT Libraries

Kiel University *Kiel, Germany*

Doctor of Medicine (Dr. med.) *08/2017*

- Thesis title (translation): "CANDIS - The Role of ADAM17's Stalk-Region for its Activity and Identification of the Human Interleukin-6 Receptor Binding Epitope to its Sheddase ADAM17", supervisor: Prof. Joachim Grötzinger, Institute for Biochemistry, Christian Albrechts Universität zu Kiel. Access via University of Kiel Libraries (in German)
- Grade: Magna cum laude

Heidelberg University *Heidelberg, Germany*

Doctor of Medicine (MD) *06/2017*

- With practical traineeships in Perth, Australia and Oslo, Norway
- Grade: 1.33 (excellent)

Kiel University *Kiel, Germany*

Bachelor of Science, Physics *03/2016*

- Minor in Computer Science
- Thesis title: "Modeling and Experimental Validation of *Ex Vivo* Thermal Therapy", supervisor: Prof. Brett Bouma, Wellman Center for Photomedicine, Massachusetts General Hospital

Professional Experience

2023 - date **Research Fellow**, Lotter Lab, Department of Data Science, Dana-Farber Cancer Institute and Department of Pathology, Harvard Medical School, Boston, MA, USA

2018 - 2023 **PhD Research Assistant**, Quantitative Imaging in Medicine Lab, Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, USA

2019 -2021 **Head Teaching Assistant - Human Pathology**, Harvard Medical School, Boston, MA, USA

2015-2016 **Research Assistant**, Wellman Center for Photmedicine, Massachusetts General Hospital, Boston, MA, USA

2012-2013 **Graduate (MD) Research Assistant**, Institute for Biochemistry, Christian-Albrechts Universität zu Kiel, Kiel, Germany

Publications

Published

Hoebel, K., Bridge, C.P., Kim, A., Gerstner E., Ly, K.I., Deng F., DeSalvo M.N., Diettrich J., Huang R., Huang S.Y., et al., Not without context - A multiple methods study on evaluation and correction of automated brain tumor segmentations by experts. Academic Radiology 31(4)

Kim, A.E., Lou, K.W., Giobbie-Hurder, A., Chang, K., Gidwani, M., **Hoebel,K.**, Patel, J.B., Cleveland M.C., et al. 2024. Abnormal vascular structure and function within brain metastases is linked to pembrolizumab resistance. Neuro-oncology, 26(5)

Hoebel, K., Bridge, C.P., Ahmed, S., Akintola, O., Chung, C., Huang, R., Johnson, J., Kim, A., Ly, K.I., Chang, K. and Patel, J. et al., 2024. Expert-centered evaluation of deep learning segmentation algorithms for brain tumor segmentation. Radiology: Artificial Intelligence, 6(1).

Deng, B., Gu, H., Zhu, H., Chang, K., **Hoebel, K.**, Patel B., Kalpathy-Cramer J., Carp S., 2023. FDU-Net: Deep Learning-Based Three-Dimensional Diffuse Optical Image Reconstruction. IEEE Transactions on Medical Imaging

Gidwani, M., Chang, K., Patel, J., **Hoebel, K.**, Ahmed, S.R.; Singh, P., Fuller, C., Kalpathy-Cramer, J., 2022. Inconsistent partitioning and unproductive feature associations yield idealized radiomic models. Radiology: 220715

Lemay, A., **Hoebel, K.**, Bridge, C.P., Befano, B., De Sanjosé, S., Egemen, D., Rodriguez, A.C., Schiffman, M., Campbell, J.P. and Kalpathy-Cramer, J., 2022. Improving the repeatability of deep learning models with Monte Carlo dropout. npj Digital Medicine, 5(173)

Arun, N., Gaw, N., Singh, P., Chang, K., Aggarwal, M., Chen, B., **Hoebel, K.**, Gupta, S., Patel, J., Gidwani, M. and Adebayo, J., 2021. Assessing the trustworthiness of saliency maps for localizing abnormalities in medical imaging. Radiology: Artificial Intelligence, 3(6).

Hoebel, K.V., Patel, J.B., Beers, A.L., Chang, K., Singh, P., Brown, J.M., Pinho, M.C., Batchelor, T.T., Gerstner, E.R., Rosen, B.R. and Kalpathy-Cramer, J., 2021. Radiomics repeatability pitfalls in a scan-rescan MRI study of glioblastoma. Radiology: Artificial Intelligence, 3(1).

Beers, A., Brown, J., Chang, K., **Hoebel, K.**, Patel, J., Ly, K.I., Tolaney, S.M., Brastianos, P., Rosen, B., Gerstner, E.R. and Kalpathy-Cramer, J., 2021. DeepNeuro: an open-source deep learning toolbox for neuroimaging. Neuroinformatics, 19(1), pp.127-140.

Chang, K., Beers, A.L., Brink, L., Patel, J.B., Singh, P., Arun, N.T., **Hoebel, K.V.**, Gaw, N., Shah, M., Pisano, E.D. and Tilkin, M., 2020. Multi-institutional assessment and crowdsourcing evaluation of deep learning for automated classification of breast density. Journal of the American College of Radiology, 17(12), pp.1653-1662.

Li, M.D., Chang, K., Bearce, B., Chang, C.Y., Huang, A.J., Campbell, J.P., Brown, J.M., Singh, P., **Hoebel, K.V.**, Erdoğmuş, D. and Ioannidis, S., 2020. Siamese neural networks for continuous disease severity evaluation and change detection in medical imaging. NPJ Digital Medicine, 3(1), pp.1-9.

Lo, W.C., Uribe-Patarroyo, N., **Hoebel, K.**, Beaudette, K., Villiger, M., Nishioka, N.S., Vakoc, B.J. and Bouma, B.E., 2019. Balloon catheter-based radiofrequency ablation monitoring in porcine esophagus using optical coherence tomography. Biomedical Optics Express, 10(4), pp.2067-2089.

Düsterhöft, S., **Höbel, K.**, Oldefest, M., Lokau, J., Waetzig, G.H., Chalaris, A., Garbers, C., Scheller, J., Rose-John, S., Lorenzen, I. and Grötzinger, J., 2014. A disintegrin and metalloprotease 17 dynamic interaction sequence, the sweet tooth for the human interleukin 6 receptor. Journal of Biological Chemistry, 289(23), pp.16336-16348.

In Preparation

Hoebel, K., Lemay, A., Campbell, J.P., Ostmo, S., Chiang, M., Bridge, C., Li, M., Singh, P., Coyner, A. and Kalpathy-Cramer, J., A generalized framework to predict continuous scores from medical ordinal labels

Conference Proceedings

Hoebel, K., Bridge, C.P., Ahmed, S., Akintola, O., Chung, C., Huang, R., Johnson, J., Kim, A., Ly, K.I., Chang, K. and Patel, J., 2022, April. Is this good enough? On expert perception of brain tumor segmentation quality. In Medical Imaging 2022: Image Perception, Observer Performance, and Technology Assessment (Vol. 12035, pp. 165-175). SPIE.

Hoebel, K., Bridge, C., Lemay, A., Chang, K., Patel, J., Rosen, B. and Kalpathy-Cramer, J., 2022, April. Do I know this? Segmentation uncertainty under domain shift. In Medical Imaging 2022: Image Processing (Vol. 12032, pp. 261-276). SPIE.

Lu, C., Lemay, A., Chang, K., **Hoebel, K.** and Kalpathy-Cramer, J., 2022. Fair conformal predictors for applications in medical imaging. Proceedings of the AAAI Conference on Artificial Intelligence 2022

Hoebel, K., Andrearczyk, V., Beers, A., Patel, J., Chang, K., Depeursinge, A., Müller, H. and Kalpathy-Cramer, J., 2020, March. An exploration of uncertainty information for segmentation quality assessment. In Medical Imaging 2020: Image Processing (Vol. 11313, pp. 381-390). SPIE.

Presentations

ORAL CONFERENCE PRESENTATIONS

Hoebel, K., Bridge, C.P., Ahmed, S., Akintola, O., Chung, C., Huang, R., Johnson, J., Kim, A., Ly, K.I., Chang, K. and Patel, J., Is this good enough? On expert perception of brain tumor segmentation quality.
Oral Presentation at SPIE medical imaging 2022, San Diego, CA

Hoebel, K., Bridge, C., Lemay, A., Chang, K., Patel, J., Rosen, B. and Kalpathy-Cramer, J., Do I know this? segmentation uncertainty under domain shift.
Oral Presentation at SPIE medical imaging 2022, San Diego, CA

Hoebel, K., Andrearczyk, V., Beers, A., Patel, J., Chang, K., Depeursinge, A., Müller, H. and Kalpathy-Cramer, J., An exploration of uncertainty information for segmentation quality assessment.
Oral Presentation at SPIE Medical Imaging 2020, Houston, TX

Hoebel, K., Beers, A., Chang, K., Patel, J., Pinho, M., Brown, J., Rosen, B., Batchelor, T., Gerstner, E., Kalpathy-Cramer, J., How not to do radiomics - Observations from a double baseline study in glioblastoma
Oral Presentation at RSNA Annual Meeting 2019, Chicago, IL

Hoebel, K., Kollar, B., Chang, K., Beers, A., Brown, J., Patel, J., Pomahac, B. and Kalpathy-Cramer, J., Deep Learning Vessel Segmentation for Microsurgical Free Tissue Transfer.
Oral presentation at American Physical Society March Meeting 2019, Boston, MA

POSTER PRESENTATIONS

Hoebel, K., Lindsay, J., Alessi, J., Weirather, J., Dryg, I., Altreuter, J., Awad, M., Rodig, S., Lotter, W. Deep-learning model trained on multiplex immunofluorescence-stained tissue samples predicts the survival of patients with non-small cell lung cancer better than PD-L1 TPS alone
Poster Presentation at AACR Annual Meeting 2024, San Diego, CA

Hoebel, K., Bridge, C., Patel, J., Chang, K.,Pinho, M., Ma, X., Rosen, B., Batchelor, T., Gerstner, E., Kalpathy-Cramer, J., Do you agree? An Exploration of Inter-rater Variability and Deep Learning Segmentation Uncertainty
Poster Presentation at ISMRM Annual Meeting 2021, virtual

Hoebel, K., Chang, K., Patel, P., Singh, P. and Kalpathy-Cramer, J., Give me (un)certainty - An exploration of parameters that affect segmentation uncertainty
Extended Abstract Poster Presentation at NeurIPS ML4Health Workshop 2019, Vancouver, Canada

Hoebel, K., Beers, A., Brown, J., Chang, K., Patel, J., Pinho, M., Rosen, B., Batchelor, T., Gerstner, E., Kalpathy-Cramer, J., Repeatability of radiomics features in double baseline MR imaging of glioblastomas
Poster Presentation at ISMRM Annual Meeting 2019, Montreal, Canada

Hoebel, K., Yeap, B., Wo, J., Eyler, C., Wolfgang, J., Paganetti, H., Hong, T., and Grassberger, C., Proton Therapy and the Role of Dosimetric Parameters as Predictors for Normal Tissue Complications after Liver-Directed Stereotactic Body Radiation Therapy
Poster Presentation at ASTRO Annual Meeting 2018, San Antonio, TX

INVITED TALKS

May 2024. *Bridging the Discrete and Continuous - Towards Reliable and Fair Algorithms in Medical Imaging*. Invited talk at Society for Industrial and Supplied Mathematics Conference on Imaging Science, Mini-symposium "Increasing Fairness in ML Through Improved Data Assessment and Standardization in Medical Imaging and Beyond"

April 2024. *Unveiling Immune Microenvironments: Analysis of NSCLC using Multiplex Immunofluorescence Imaging and Graph Neural Networks*. Invited by Prof. F. Stephen Hodi; Center for Immuno-Oncology Lecture Series, Dana-Farber Cancer Center, Boston, MA

October 2023. *Unveiling Immune Microenvironments: Analysis of NSCLC using Multiplex Immunofluorescence Imaging and Graph Neural Networks*. Invited by Prof. Peter Schueffler; Special Research Seminar, Department of Pathology, Technical University of Munich, Munich, Germany

October 2023. *Expert-Centered Evaluation of Deep Learning Brain Tumor Segmentation*. Invited by Prof. Michael Ingrisch; Clinical Data Science Research Seminar, Klinikum Großhadern, Ludwig-Maximilians University, Munich, Germany

May 2023. *Expert Perception and Evaluation Criteria for Deep Learning-Based Brain Tumor Segmentation*. Invited by Dr. Christian Guthier, Brigham and Women's/Dana-Farber Cancer Institute Medical Physics Seminar, Boston, MA.

February 2020. *Give me uncertainty - The role of segmentation uncertainty in automatic quality assessment.* Invited by Prof. Carlos Cardenos, MD Anderson Medical Physics/Auto-planning Systems Seminar, Houston, TX.

Awards & Fellowships

2024-2025 **National Cancer Center Postdoctoral Fellowship**, For my work on spatial and genetic interactions in the tumor microenvironment of non-small cell lung cancer using graph neural networks *$ 60.000*

2023 **Radiology: Artificial Intelligence Editor's Recognition Award**, Honored for outstanding contributions to the peer review process, demonstrating exceptional expertise, diligence, and commitment to advancing the quality of published research in the field of medical imaging and artificial intelligence.

2022 **Image Processing Student Paper Award, Runner up**, SPIE Medical Imaging 2022, For my submission: "Do I know this? Segmentation uncertainty under domain shift."

2021 **Best Project Award, Runner up**, Hamlyn Winter School on Surgical Imaging and Vision at Imperial College London

2020 **Early Career Medical Physicist Scholarship Award**, Winter Institute of Medical Physics

2018-2019 **Martinos Family Research Scholar**, Martinos Center for Biomedical Imaging

2017-2018 **HST First-year Graduate Student Fellowship**, Harvard-MIT Division of Health Sciences and Technology

2015 **Research Fellowship**, German Academic Exchange Service (DAAD), PROMOS Program for International Mobility

2012 **Graduate Research Fellowship**, German Research Foundation (DFG), Program supporting graduate students in the Integrated Research Training Group Program

2012-2017 **German National Academic Foundation Scholarship**, German National Academic Foundation, Scholarship granted to the best 0.5% of German university students

Teaching Experience

2019-2021 **Head Teaching Assistant and Instructor**, HST.030 Human Pathology, Harvard Medical School

Mentoring

2023 **Jesseba Fernando**, Research intern, now PhD student in Network Science at Northeastern University

2021 **Andreanne Lemay**, Master student intern, now at Sony AI

2019-2022 **Eshika Saxena**, Undergraduate student, Harvard College, now at Meta (Fundamental AI Research team)

Service & Professional Development

SERVICE

2024-date	**German Academic International Network (GAIN)**, Member of the Advisory Board. A collaborative initiative supported by the Alexander von Humboldt Foundation, the German Academic Exchange Service (DAAD), and the German Research Foundation (DFG) to foster international academic exchange and promoting excellence and innovation in science.
2022	**Health Sciences and Technology MD Curriculum Innovation Task Force at Harvard Medical School**, Committee member
2020-2022	**Harvard Medical School Health Sciences and Technology MD Curriculum Committee**, Committee member
2018-2019	**Topical Group on Medical Physics, American Physical Society**, Student representative
2018-2020	**Harvard German American Conference**, Co-chair; Student-led conference on science, society, and entrepreneurship

DEVELOPMENT

2023-date	**Trainee Editorial Board, Radiology: Artificial Intelligence**, 2-year program to including education peer review, biostatistics, research design and journalistic ethics, participation in the editorial process and mentored peer-review
2023-2024	**Career Catalyst**, yearlong intensive career mentoring program for early career researchers; selected among 50 participants from from a highly competitive pool of more than 150 postdoctoral fellows and researchers at Harvard Medical School
2022	**Kaufman Teaching Certificate Program, Massachusetts Institute of Technology,** Workshop series intended for late-program graduate students and postdocs interested in enhancing their teaching skills
2021-2022	**Introduction to Designing and Conducting Mixed Methods Research, Harvard Catalyst Education Program**, Three-month introductory program to qualitative and mixed methods research for quantitative researchers
2021	**The Hamlyn Winter School on Surgical Imaging and Vision, Imperial College London**, One-week winter school

PEER REVIEW

CONFERENCES

- Machine Learning for Health (ML4H) workshop at NeurIPS/conference (2019, 2021)
- Neural Information Processing Systems (NeurIPS) (2020, 2021)
- Conference on Health, Inference, and Learning (CHIL) (2020, 2021, 2023)

JOURNALS

- Radiology: Artificial Intelligence
- Medical Image Analysis
- British Journal of Radiology (BJR)
- Journal of Digital Imaging (JDI)
- Nature Communications Medicine
- Computer Methods and Programs in Biomedicine
- Neurocomputing

SCIENCE COMMUNICATION

Interview with Onc Live about my work on modeling spatial interactions in non-small cell lung cancer video and article

Invited contribution to Springer Nature Reserach Communities, discussing our paper titled " Improving the repeatability of deep learning models with Monte Carlo dropout." blog post