Wiete Fehner

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I am a PhD candidate in Imaging Science at Washington University in St. Louis. I specialize in high-resolution optical imaging techniques for decoding brain activity and mapping human cognition in naturalistic settings, providing a practical alternative to fMRI. My research aims to create neuroimaging technologies that integrate seamlessly into daily life, enabling real-time brain insights through wearable systems. Driven by a vision of accessible neuroimaging, I apply advanced signal processing, statistical modeling, and machine learning to achieve accurate neuro-decoding in real-world environments. With expertise in MATLAB and Python, I design experimental paradigms, develop robust image-processing pipelines, and use data science to address complex neuroimaging challenges.

EXPERIENCE

PhD Research | NeuroPhoto Lab | PI: Dr. Joseph P. Culver *01/2022 – 08/2026*
Biophotonics Research Center, MIR, Washington University in St. Louis

- **Developing Advanced Neuroimaging Techniques**: Pioneering visual semantic encoding and decoding methods using fiber-based and wearable High-Density Diffuse Optical Tomography (HD-DOT) to enable high-resolution semantic human brain mapping as a surrogate for fMRI in naturalistic settings. This work addresses complex signal processing challenges, extending neuroimaging applications into practical, real-world, and clinical contexts.
- **Refining Functional Connectivity Mapping**: Advancing human brain functional connectivity mapping in task-free environments through multivariate analytical techniques within HD-DOT. Improvement of task-free brain mapping approaches is critical for clinical applications.
- **Leading Data Analysis and Method Development**: Designing naturalistic experimental paradigms and directing data collection, novel method development, and validation processes. Optimizing analysis pipelines in MATLAB and Python to incorporate advanced signal processing, artifact correction, and post-processing techniques. Leveraging statistical and machine learning algorithms to improve the interpretation of complex neuroimaging data in real-world contexts.
- **Data Acquisition:** Collection of neuroimaging data with fiber-based and wearable HD-DOT systems. As a level II trained MRI personnel, I collect fMRI data for HD-DOT validation purposes.

Founder & Lead Curriculum Developer, Summer Math Crash Course
Imaging Science Student Council, Washington University in St. Louis *01/2022 – present*

- **Founded and led the annual Summer Math Crash Course to address the diverse mathematical needs of graduate students transitioning from various academic backgrounds or re-entering academia**. Team leader of 14 student curriculum developers and course instructors.
- Lead developer of a 9-week curriculum covering linear algebra, calculus, and signals and systems including programming projects in Google Collab.
- Secured an initial $10k funding, managed the course expansion to a $15k budget, and collaborated closely with faculty to tailor the curriculum, resulting in 120+ student registrations.

Graduate Teaching Assistant | Practicum in Computational Imaging (ESE 5934) *01/2024 – 05/2024*
McKelvey School of Engineering, Washington University in St. Louis

- Mentored engineering graduate students in developing their semester-long computational research projects, focusing on deep learning and machine learning applications in imaging science. Facilitated discussions that guided project formulation and execution. One student published their project at CVPR.

Graduate Research Assistant | Ances Bioimaging Laboratory | PI: Dr. Beau Ances *09/2021 – 01/2022*
Department of Neurology, Washington University in St. Louis

- Conducted comparative analysis of white matter microstructure in Alzheimer's disease versus Down syndrome cohorts using diffusion tensor imaging (DTI) to enhance our understanding of disease mechanisms and inform the development of targeted therapeutic strategies.
- Implemented advanced MRI data preprocessing using FSL, bash scripts, and statistical analysis with R.

Internship | Cognitive Neuroimaging Lab | PI: Dr. Gabriele Gratton & Dr. Monica Fabiani *09/2021 – 01/2022*
Beckman Institute, University of Illinois Urbana-Champaign (virtual because of Covid)

- Training in diffuse optical imaging methodologies such as fNIRS, EROS, pulse-DOT, and the full data analysis pipeline.

Graduate Research Assistant | TBMC Optical Imaging Lab | PI: Dr. Teemu Rinne *10/2019 – 05/2021*
University of Turku, Faculty of Medicine

- Developed a novel auditory paradigm utilizing fNIRS to investigate the functional changes in the auditory cortex induced by cochlear implantation. Collected fNIRS data, processed, and analyzed it in Python. Collected and processed anatomical MRI data to improve the localization of the fNIRS signal.
- Played a pivotal role in establishing the optical imaging lab, which enhanced the university's research infrastructure and experimental capabilities.

Undergraduate Research Assistant | PI: Dr. Blanka Hartmann *10/2017 – 03/2019*
University of Bremen, Department of Education

- Supported educational research through data collection, comprehensive literature review, and administrative task management.

Undergraduate Teaching Assistant | Basics of Neuropsychology *11/2018 – 03/2019*
University of Bremen, Department of Education

- Developed and delivered supplementary lectures on the "Basics of Neuropsychology," focusing on central nervous system fundamentals and neuropsychological disorders such as ASD and ADHD.

EDUCATION

Washington University in St. Louis | St. Louis, MO, USA *08/2021 – 08/2026*
PhD Candidate in Imaging Science

- Thesis title: Advancing High-Density Diffuse Optical Tomography for Visual Semantic Decoding in Naturalistic Settings
- Advisor: Dr. Joseph P. Culver
- Expected graduation date: 08/2026

Washington University in St. Louis | St. Louis, MO, USA *08/2021 – 12/2023*
MS in Electrical Engineering (30 USCS, CGPA: 3.83, graded as A)

University of Turku | Turku, Finland *08/2019 - 05/2021*
MS in Human Neuroscience (120 ECTS, CGPA: 5, graded as 'excellent')

- Thesis title: Functional near-infrared spectroscopy experiment to study functional plasticity in adult auditory cortex after cochlear implant switch-on
- Advisor: Dr. Teemu Rinne

University of Bremen | Bremen, Germany *10/2017 – 07/2019*
Selected Bachelor of Science Courses in Psychology (90 ECTS, CGPA: 1.83, graded as 'good')

- Objective: Acquired foundational skills in research methods, statistics, and psychology to enable a strategic transition to a STEM-focused academic trajectory.

Carl von Ossietzky University of Oldenburg | Oldenburg (Oldb), Germany *10/2014 – 06/2017*
BA in Philosophy and Gender Studies (180 ECTS, CGPA: 1.27, graded as 'excellent')

- Thesis title: Philosophical/psychological analysis of self-determination within the context of prenatal diagnostics. (translated from German)
- Advisor: Dr. phil. Christine Zunke

AWARDS & HONORS

1st Place Poster Award at Imaging Science Pathway Retreat 2024 | St. Louis, USA 04/2024
Imaging Science Outstanding Leadership Award 05/2024
Imaging Science Pathway Fellowship (NIH T32) *01/2023 – 10/2024*
Danforth Scholar | Washington University in St. Louis 09/2021 – *present*
Jane Street Graduate Research Fellowship Workshop, Top Applicant | NYC, USA 04/2024

- Selected as a top applicant and invited to present a poster at this exclusive workshop

McKelvey Engineering Professional Development Award | Washington University in St. Louis 03/2024
Traineeship Award | University of Turku, Finland *05/2020*
Nowetas-Foundation Travel Award | University of Bremen, Germany *01/2019*
Wissenschaftspreis (Science Award) of the OLB-Foundation | Germany *02/2019*

- 2nd Place, with bachelor thesis, €3,500 Prize.

Deutschlandstipendium Scholarship | University of Bremen, Germany *10/2017 - 07/2019*
Hans Böckler Foundation Scholarship | Carl von Ossietzky University of Oldenburg, Germany *04/2016 - 06/2017*

Leadership Experience & Community Service (Selected Activities)

WTFT Representative with WUSTL ENDURE
Washington University in St. Louis *Summer 2024*
- Mentored an undergraduate participant from the WUSTL ENDURE program, supporting underrepresented groups in neuroscience.

Vice President, Association of Graduate Engineering Students (AGES)
Washington University in St. Louis *05/2023 – 05/2024*
- Providing guidance and support to the new executive board to ensure continuity and effective leadership.

President, Association of Graduate Engineering Students (AGES)
Washington University in St. Louis *05/2022 – 05/2023*
- Responsible for leading the executive board, driving strategic initiatives, and collaborating with the engineering school administration to improve student resources and opportunities.
- Organized professional development events with industry representatives and networking events to promote interdisciplinary connections across engineering departments.

Graduate Ambassador, McKelvey School of Engineering *05/2022 – present*
Washington University in St. Louis
- Support prospective and incoming graduate engineering students with their transition to graduate school and represent WashU McKelvey School of Engineering in recruitment and outreach events.

Imaging Science Leadership, McKelvey School of Engineering *12/2021 – present*
Washington University in St. Louis
- Assist faculty in planning and executing the Imaging Science Pathway Retreat. Help organize social and educational events for Imaging Science students to promote collaboration and a positive academic environment.

Community Outreach Coordinator and Teacher *08/2016 – 12/2018*
Rabulo e.V., Oldenburg (Oldb), Germany
- Trained long-term unemployed women, refugees (ages 15-50), and students in intercultural competence and communication. Customized educational content to meet the unique needs and backgrounds of participants.

Skills

Languages: German (native), English (fluent);
Programming Languages: MATLAB, Python (including TensorFlow, PyTorch), R, Shell Scripts;
Statistical Modeling: Advanced proficiency in developing and applying statistical models with various computational tools;
Version Control & Collaboration: Proficient with Git, GitHub; skilled in using LaTeX and Overleaf for scientific documentation;
Research Ethics: Certified in Human Subjects Research and Good Clinical Practice (GCP) by CITI; Level 2 MR Personnel
Project Management: Experienced in managing project lifecycles, ensuring timely delivery and adherence to objectives;
Leadership & Team Management: Proven ability to lead and manage diverse teams in academic and community settings;
Interdisciplinary Collaboration: Skilled in collaborating across various scientific and engineering disciplines;
Communication Skills: Excellent at written and verbal communication, adept at conveying complex information.

Conference Proceedings

1. **Fehner, W.,** Fogarty, M., Bajracharya, A., Markow, Z.E., Wilhelm, W., Trobaugh, J., Huth, A. G., Culver, J. P. (2024). "Towards Semantic Encoding of Visual Content in Movies via High-Density Diffuse Optical Tomography." Poster at Society for fNIRS Conference 2024, Birmingham, GB (10 September 2024).
2. Fogarty, M., **Fehner, W.**, Bajracharya, A., Tang, J., Markow, Z.E., Trobaugh, J., Huth, A. G., Culver, J. P. (2024) Voxel-wise modeling of naturalistic auditory stimuli using very-high-density diffuse optical tomography. Poster at Society for fNIRS Conference 2024, Birmingham, GB (10 September 2024).

3. Bajracharya A, Wilhelm D, Markow Z, Fogarty M, **Fehner W**, Peelle JE, Hershey T, Culver JP. (2024) Functional Brain Mapping of Single-Subjects Using Precision High-Density Diffuse Optical Tomography. Talk at Society for fNIRS Conference 2024, Birmingham, GB (10 September 2024).
4. **Fehner, W.**, Markow, Z., Fogarty, M., Bajracharya, A., Wilhelm, D., Huth, A. G., Culver, J. P. (2024). "Towards Semantic Visual Decoding of Naturalistic Movies with High-Density Diffuse Optical Tomography." Poster presentation at the Organization for Human Brain Mapping (OHBM) 2024, Seoul, South Korea, June 2024.
5. Bajracharya A, Wilhelm D, Markow Z, Fogarty M, **Fehner W**, Peelle JE, Hershey T, Culver JP. Developing Methods for Precision High-Density Diffuse Optical Tomography. Talk at Organization for Human Brain Mapping (OHBM), Seoul, South Korea, 2024.
6. **Fehner, W.**, Markow, Z., Fogarty, M., Bajracharya, A., Wilhelm, D., Huth, A. G., Culver, J. P. (2024). "Towards Semantic Visual Decoding of Naturalistic Movies with High-Density Diffuse Optical Tomography." Invited talk for the MIR Research Symposium 2024, St. Louis, USA, May 2024.
7. **Fehner, W.**, Fogarty, M., Markow, Z., Bajracharya, A., Wilhelm, D., Trobaugh, J. W. , Huth, A. G., Culver, J. P. (2024). "Towards Semantic Visual Encoding of Naturalistic Movies with High-Density Diffuse Optical Tomography." Poster at the Jane Street Graduate Research Fellowship Workshop 2024, New York City, USA, April 2024.
8. **Fehner, W.**, Fogarty, M., Markow, Z., Bajracharya, A., Wilhelm, D., Trobaugh, J. W. , Huth, A. G., Culver, J. P. (2024). "Towards Semantic Visual Encoding of Naturalistic Movies with High-Density Diffuse Optical Tomography." Poster presented at the Imaging Science Pathway Retreat 2024, St. Louis, USA (12 April 2024).
9. **W. Fehner**, M. Fogarty, M.A. Anastasio, J.P. Culver. (2022). “Comparison of Multivariate and Bivariate Functional Connectivity Approaches using High-Density Diffuse Optical Tomography for Human Brain Mapping”. Poster presented at 2023 Neuroscience Retreat, St. Louis, USA (12 October 2023).
10. Bajracharya A, Wilhelm D, Markow Z, Fogarty M, **Fehner W**, Peelle JE, Hershey T, Culver JP. Precision functional mapping of cortical activity using High-Density Diffuse Optical Tomography (HD-DOT). Neuroscience Retreat, Washington University in St.Louis, MO, USA, 2023.
11. Lin, C.-H. P.*, **Fehner, W.***, Orukari, I.*, Frisk, L. K., Agato, A., Verma, M., O’Sullivan, A. J., Svoboda, C., Sumana Chetia, Eggebrecht, A. T., Turgut Durduran, Culver, J. P., &, Trobaugh, J. W. (2023). "Validating fiber-based speckle contrast optical tomography through simulation and human neuroimaging: Imaging CBF using SCOT." Poster presented at the Organization for Human Brain Mapping (OHBM) 2023, Montreal, Canada, July 2023. DOI: 10.13140/RG.2.2.28035.89128.
12. Bajracharya A, Wilhelm D, Markow Z, Fogarty M, **Fehner W**, Peelle JE, Hershey T, Culver JP. Precision functional mapping of cortical activity using High-Density Diffuse Optical Tomography. Organization of Human Brain Mapping, Montreal, Canada, 2023.
13. Aahana Bajracharya, Wilhelm, D., Markow, Z. E., Fogarty, M., **Fehner, W**., Peelle, J. E., Hershey, T., & Culver, J. P. (2023). Precision Functional Mapping of Cortical Activity Using High-Density Diffuse Optical Tomography (HD-DOT). Poster presented at the Biophotonics Congress: Optics in the Life Sciences 2023, Vancouver, Canada (27 April 2023). https://doi.org/10.1364/boda.2023.jtu4b.15
14. Lin, C.-H. P.*, **Fehner, W**.*, Inema Orukari, Lisa Kobayashi Frisk, Agato, A., Verma, M., O’Sullivan, A. J., Svoboda, C., Sumana Chetia, Eggebrecht, A. T., Turgut Durduran, Culver, J. P., & Trobaugh, J. W. (2023). "Fiber-Based Speckle Contrast Optical Tomography for Neuroimaging in Humans: Simulation of High-Density vs. Sparse Arrays and In Vivo Human Measurements." Talk presented at the Biophotonics Congress: Optics in the Life Sciences 2023, Vancouver, Canada (27 April 2023). DOI: https://doi.org/10.1364/brain.2023.bth2b.2.
15. **W. Fehner**, M. Fogarty, M.A. Anastasio, J.P. Culver. (2023). “Multivariate vs Bivariate Functional Connectivity using High-Density Diffuse Optical Tomography for Human Brain Mapping.” Poster presented at 2023 Graduate Research Symposium, St. Louis USA (4 April 2023).
16. **Fehner, W**., Fogarty, M., Anastasio, M. A., & Culver, J. P. (2023). "Evaluation of multivariate approaches to functional connectivity mapping with fNIRS." In Proceedings of SPIE PC12365, Neural Imaging and Sensing 2023, PC123650C (17 March 2023).
17. **W. Fehner**, M. Fogarty, M.A. Anastasio, J.P. Culver. (2023). “Comparison of Multivariate and Bivariate Functional Connectivity Approaches using High-Density Diffuse Optical Tomography for Human Brain Mapping.” Invited talk presented at the Imaging Science Pathway Retreat 2023, St. Louis, USA (30 March 2023).

18. Bajracharya A, Wilhelm D, Markow Z, Fogarty M, **Fehner W**, Peelle JE, Hershey T, Culver JP. Precision High-Density Diffuse Optical Tomography (pHD-DOT) for single-subject functional cortical mapping. Imaging Science Pathway Retreat, Washington University, St.Louis, MO, USA, 2023.
19. **W. Fehner**, M. Fogarty, M.A. Anastasio, J.P. Culver. (2022). "Multivariate vs Bivariate Functional Connectivity with High-Density Diffuse Optical Tomography." Poster presented at 2022 SPECTRA Conference, St. Louis, USA (21 October 2022).
20. **W. Fehner,** M. Fogarty, M.A. Anastasio, J.P. Culver, "Multivariate vs Bivariate Functional Connectivity with High-Density Diffuse Optical Tomography." Poster presented at Society for fNIRS Conference 2022, Boston, USA (11 October 2022).
21. **W. Fehner**, M. Fogarty, M.A. Anastasio, J.P. Culver. (2022). "Multivariate vs Bivariate Functional Connectivity using High-Density Diffuse Optical Tomography". Poster presented at 2022 Neuroscience Retreat, Potosi MO, USA (6 October 2022).
22. **Fehner, W.**, & Defne Aksit. (2021). Are Personality Characteristics of Students Related to the Study Subject? Insights from a Survey Study. "Forsch!" - Studentisches Online-Journal Der Universität Oldenburg, 1, 67–74. https://ojs.uni-oldenburg.de/journals/ojs1/ojs/index.php/forsch/article/view/77
23. **W. Fehner**, T. Rinne, "Functional near-infrared spectroscopy experiment to study functional plasticity in adult auditory cortex after cochlear implant switch-on." Poster presented at the Human Neuroscience Symposium 2021, Turku, Finland (24 April 2021).
24. **Fehner, W.**, & Defne Aksit. (2021). "Are Personality Characteristics of Students Related to the Study Subject? Insights from a Survey Study." Talk presented at World CUR 2019, Oldenburg, Germany (25 May 2019).

* Authors contributed equally