Roza Gunes Bayrak, PhD

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SUMMARY STATEMENT

I am a Senior Research Engineer at Vanderbilt University specializing in neuroimaging and time series analysis. My work draws on a background in computational modeling, signal processing, and machine learning to investigate and improve foundation models for fMRI, EEG, and physiological data. This perspective—rooted in both domain understanding and methodological rigor—guides my efforts to make time series models more robust, interpretable, and generalizable across data regimes. I am interested in research that integrates large-scale modeling with neural and physiological signals to advance brain–computer interface technologies and deepen our understanding of human–machine interaction.

PROFESSIONAL APPOINTMENTS

10/2024 - current	Senior Research Engineer, Vanderbilt University (secondary) Research Assistant Professor, Vanderbilt University
08/2023 - 09/2024	Research Assistant Professor, Vanderbilt University

EDUCATION

2018 - 2023	Ph.D., Computer Science Vanderbilt University, Nashville, Tennessee, USA Dissertation: "Computational Methods to Advance Individual Precision in Brain Mapping"
2013 - 2016	M.S., Electrical Engineering Tufts University, Medford, Massachusetts, USA
2010	B.S., Electrical and Communication Çankaya University, Ankara, Turkey

GRANT WRITING

RO1 NIH/NIMH | FMRI Physiological Signatures of Aging and Alzheimer's Disease
Role: Research Assistant
Funded in 2021

U24 NIH | NeuroTS: Integration and Dissemination of Advanced Time-Series Machine Learning Tools for Human Functional Neuroimaging
Role: Principal Investigator
Not funded (resubmission pending)

RO1 NIH/NIMH | Tools for integrative analysis of neuroimaging and physiological data
Role: Co-Investigator
Not funded (resubmission pending)

PUBLICATIONS

1. Yamin Li, Shiyu Wang, Chang Li, Ange Lou, Haatef Pourmotabbed, Sarah Goodale, Dario J Englot, Daniel Moyer, **Roza G Bayrak**, Catie Chang. “Mind the State: Towards Unified, Context-Aware EEG-to-fMRI Synthesis.”, ICML 2025 (under review).
2. Qinwen Ge, **Roza G Bayrak**, Anwar Said, Catie Chang, Xenofon Koutsoukos, Tyler Derr. "Defining and Benchmarking a Data-Centric Design Space for Brain Graph Construction.", arXiv preprint arXiv:2508.12533 (in revision).
3. Shiyu Wang, Yamin Li, Ziyuan Xu, Haatef Pourmotabbed, Chang Li, **Roza G Bayrak**, Catie Chang. "A VQ-VAE framework for modeling physiological information in fMRI.", Workshop on Foundation Models for the Brain and Body, NeurIPS 2025.
4. **Roza G Bayrak**, Colin B Hansen, Jorge A Salas, Nafis Ahmed, Ilwoo Lyu, Mara Mather, Yuankai Huo, Catie Chang. "DeepPhysioRecon: Tracing peripheral physiology in low frequency fMRI dynamics.", Imaging Neuroscience (2025).
5. Rebecca G Clements, Kristina M Zvolanek, Neha A Reddy, Kimberly J Hemmerling, **Roza G Bayrak**, Catie Chang, Molly G Bright. "Quantitative mapping of cerebrovascular reactivity amplitude and delay with breath-hold BOLD fMRI when end-tidal CO2 quality is low.", Imaging Neuroscience (2025).
6. Kimberly Rogge-Obando, Terra Lee, Caroline G Martin, Kamalpreet Kaur, Yamin Li, Jeffrey M Harding, Shiyu Wang, Richard Song, Ruoqi Yang, Rithwik Guntaka, Sarah E Goodale, **Roza G Bayrak**, Lucina Q Uddin, Martin Walter, Jeremy Hogeveen, Catie Chang. "Global effects in fMRI reveal brain markers of state and trait anxiety.", medRxiv 2025.07. 15.25331571
7. Haatef Pourmotabbed, Caroline G Martin, Sarah E Goodale, Derek J Doss, Shiyu Wang, **Roza G Bayrak**, Hakmook Kang, Victoria L Morgan, Dario J Englot, Catie Chang. "Multimodal state-dependent connectivity analysis of arousal and autonomic centers in the brainstem and basal forebrain.", Imaging Neuroscience (2025).
8. Chang Li, Yamin Li, Haatef Pourmotabbed, Shengchao Zhang, Jorge A Salas, **Roza G Bayrak**, Catie Chang. “CBrain: Cross-Modal Learning for Brain Vigilance Detection in Resting-State fMRI.”, MICCAI 2025.
9. Yamin Li, Ange Lou, Ziyuan Xu, Shengchao Zhang, Shiyu Wang, Dario J Englot, Soheil Kolouri, Daniel Moyer, **Roza G Bayrak,** Catie Chang. “NeuroBOLT: Resting-state EEG-to-fMRI Synthesis with Multi-dimensional Feature Mapping.”, NeurIPS 2024.
10. Shiyu Wang, Ziyuan Xu, Yamin Li, Mara Mather, **Roza G Bayrak,** Catie Chang. “Reconstructing physiological signals from fMRI across the adult lifespan.”, SPIE 2024.
11. Anwar Said, **Roza G Bayrak**, Tyler Derr, Mudassir Shabbir, Daniel Moyer, Catie Chang, and Xenofon Koutsoukos. “NeuroGraph: Benchmarks for Graph Machine Learning in Brain Connectomics.”, NeurIPS 2023.
12. **Roza G Bayrak,** Ilwoo Lyu, Catie Chang. “Learning subject-specific functional parcellations from cortical surface measures.”, MICCAI International Workshop on Predictive Intelligence in Medicine (PRIME), 2022

13. **Roza G Bayrak*,** Francois Rheault*, Xuan Wang, Kurt G Schilling, Jasmine M Greer, Colin B Hansen, Cailey Kerley, Karthik Ramadass, Lucas W Remedios, Justin A Blaber, Owen Williams, Lori L Beason-Held, Susan M Resnick, Baxter P Rogers, Bennett A Landman. "TractEM: Evaluation of Protocols for Deterministic Tractography White Matter Atlas.", Magnetic Resonance Imaging (2021).
14. Jorge A Salas, **Roza G Bayrak**, Yuankai Huo, Catie Chang. "Reconstruction of respiratory variation signals from fMRI data.", Neuroimage (2021).
15. Kurt Schilling, …, **Roza G Bayrak**, et al. "Tractography dissection variability: what happens when 42 groups dissect 14 white matter bundles on the same dataset?" Neuroimage (2021).
16. **Roza G Bayrak,** Colin B Hansen, Jorge A Salas, Nafis Ahmed, Ilwoo Lyu, Yuankai Huo, Catie Chang. "From brain to body: Learning low-frequency respiration and cardiac signals from fMRI dynamics.", MICCAI, 2021.
17. **Roza G Bayrak,** Jorge A Salas, Yuankai Huo, Catie Chang. "A Deep Pattern Recognition Approach for Inferring Respiratory Volume Fluctuations from fMRI Data.", NIH Award, MICCAI, 2020.
18. **Roza G Bayrak,** Nhung Hoang, Colin B Hansen, Catie Chang, Matthew Berger. "PRAGMA: Interactively Constructing Functional Brain Parcellations.", Best Paper Honorable Mention, IEEE VIS, 2020.
19. Vishwesh Nath, Kurt G Schilling, Samuel Remedios, **Roza G Bayrak**, Yurui Gao, Justin A Blaber, Yuankai Huo, Bennett A. Landman, and A. W. Anderson. "Learning 3D White Matter Microstructure from 2D Histology." In 2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI), 2019.
20. Colin B Hansen, Vishwesh Nath, Allison E Hainline, Kurt G Schilling, Prasanna Parvathaneni, **Roza G Bayrak**, Justin A Blaber, Owen Williams, Susan Resnick, Lori Beason-Held, Okan Irfanoglu, Carlo Pierpaoli, Adam W Anderson, Baxter P Rogers, Bennett A. Landman, "Consideration of Cerebrospinal Fluid Intensity Variation in Diffusion Weighted MRI." SPIE Medical Imaging, 2019.
21. Vishwesh Nath, Samuel Remedios, Prasanna Parvathaneni, Colin B Hansen, **Roza G Bayrak**, Camilo Bermudez, Justin A Blaber, Karthik Ramadass, Kurt G Schilling, Vaibhav A. Janve, Yurui Gao, Yuankai Huo, Ilwoo Lyu, Owen Williams, Susan Resnick, Lori Beason-Held, Baxter P Rogers, Iwona Stepniewska, Adam W Anderson, Bennett A Landman, "Harmonizing 1.5T/3T Diffusion Weighted MRI through Development of Deep Learning Stabilized Microarchitecture Estimators." SPIE Medical Imaging, 2019.
22. Colin B Hansen, Vishwesh Nath, Allison E Hainline, Kurt G Schilling, Prasanna Parvathaneni, **Roza G Bayrak**, Justin A Blaber, Okan Irfanoglu, Carlo Pierpaoli, Adam W. Anderson, Baxter P Rogers, Bennett A. Landman. "Characterization and Correlation of Signal Drift in Diffusion Weighted MRI." Magnetic Resonance Imaging (2018).

BOOK CHAPTER

23. Xu, Ting, **Roza G Bayrak**, Alexandra Fischbach, Eric W Bridgeford, Joshua Vogelstein, Stephanie Noble, and Sheeba Anteraper. "Current Limitations in Functional Connectivity Assessment: Suggestions for Analysis Improvements." In Functional Connectivity of the Human Brain, edited by Maria Assunta Rocca and Massimo Filippi, Chapter 13. 1st ed. San Diego: Academic Press, 2025.

ABSTRACTS

24. Rithwik Guntaka, Shansita Sharma, Richard Song, Shiyu Wang, Kimberly Rogge-Obando, Sarah Goodale, Haatef Pourmotabbed, Jeffrey Harding, Alex Douma, Catie Chang, **Roza G Bayrak**. "A Collaborative Framework for Standardizing Physiological Data Quality Assessment in Neuroimaging", OHBM 2025.
25. Chang Li, Yamin Li, Haatef Pourmotabbed, Shengchao Zhang, Jorge A Salas, **Roza G Bayrak**, Catie Chang. "Vigilance-State Classification in fMRI Data with Contrastive Learning", OHBM 2025.
26. Stefano Moia, ..., **Roza G Bayrak**, ..., Janine D Bijsterbosch. "Proceedings of the OHBM Brainhack 2022" Aperture Neuro (2024).
27. **Roza G Bayrak**, Nafis Ahmed, Mara Mather, Catie Chang. "Physiological Signatures Across the Brain", OHBM 2024.
28. **Roza G Bayrak**, Richard Song, Rachel Yang, Catie Chang. "Thumbs up or down: Simple quality assessment tool for physiological signals", OHBM 2024.
29. **Roza G Bayrak**, Catie Chang, and the physiopy community. "Physiopy: a Python suite for handling physiological data recorded in MRI settings", OHBM 2024.
30. **Roza G Bayrak**, Nafis Ahmed, Mara Mather, Catie Chang. "Physiological Signatures Across the Brain", RSBC 2023.
31. **Roza G Bayrak**, Catie Chang, Stefano Moia, and the physiopy community. "Physiopy: a Python suite for handling physiological data recorded in MRI settings", OHBM 2023.
32. **Roza G Bayrak**, Colin B Hansen, Nafis Ahmed, Jorge A Salas, Mara Mather, Ilwoo Lyu, Yuankai Huo, Catie Chang. "Tracing peripheral physiology in low frequency fMRI dynamics", OHBM 2023.
33. **Roza G Bayrak**, Ilwoo Lyu, Catie Chang. "Learning subject-specific functional parcellations from structural MRI.", OHBM 2022.
34. **Roza G Bayrak**, Colin B Hansen, Nafis Ahmed, Jorge A Salas, Ben Gold, Yuankai Huo, Catie Chang. "From brain to body: Learning Respiration and Heart Rate Fluctuations from fMRI data.", Merit Abstract Award, OHBM 2021.
35. Nafis Ahmed, **Roza G Bayrak**, Mara Mather, Catie Chang. "Relating BOLD low-frequency physiological patterns to behavioral and cognitive traits." OHBM 2021
36. **Roza G Bayrak**, Kurt G Schilling, Jasmine M. Greer, Colin B Hansen, Justin A Blaber, Christa M Greer, Susan M Resnick, Owen A. Williams, Lori L. Beason-Held, Baxter P Rogers, Landman A Bennett. "TractEM: A fast protocol for Whole Brain Tractography." ISMRM 2018

TALKS & PRESENTATIONS

INVITED TALKS

Seminar, Building Community-Driven Software Ecosystems for Temporal Dynamics in Neuroimaging: From Physiological Signal Processing to Large-Scale Time Series Models

February 2025 | Vanderbilt University Institute of Imaging Science, Vanderbilt University Medical Center, Nashville USA

Seminar, Mining Brain Function from Structure and Peripheral Physiological Data

March 21, 2024 | Research Seminars, Vanderbilt Institute for Surgery and Engineering, Nashville USA

Talk, Tracing Peripheral Physiology in the Functional MRI Dynamics
March 7, 2023 | Women in Data Science Conference, Vanderbilt Data Science Institute, Nashville, Tennessee, USA

Seminar, Signal in the noise: Physiological components of fMRI data
August 5, 2021 | Research in Progress Seminars, Vanderbilt Institute for Surgery and Engineering, Nashville USA

CONFERENCE PRESENTATIONS

Poster, A Collaborative Framework for Standardizing Physiological Data Quality Assessment in Neuroimaging
June, 2025 | Organization for Human Brain Mapping (OHBM) Conference, Brisbane, Australia

Oral, Physiopy: a Python suite for handling physiological data recorded in MRI settings
June, 2024 | Organization for Human Brain Mapping (OHBM) Conference, Seoul, Korea

Poster, Thumbs up or down: Simple quality assessment tool for physiological signals
June, 2024 | Organization for Human Brain Mapping (OHBM) Conference, Seoul, Korea

Poster, Physiological Signatures Across the Brain
June, 2024 | Organization for Human Brain Mapping (OHBM) Conference, Seoul, Korea

Poster, NeuroGraph: Benchmarks for Graph Machine Learning in Brain Connectomics
December 14, 2023 | Conference on Neural Information Processing Systems (NeurIPS), New Orlans, USA

Poster, Physiological Signatures Across the Brain
September 22, 2023 | Resting State Brain Connectivity Conference, Dallas, USA

Oral, Physiopy: a Python suite for handling physiological data recorded in MRI settings
June 24, 2023 | Organization for Human Brain Mapping (OHBM) Conference, Montreal, Canada

Poster, Tracing Peripheral Physiology in the Functional MRI Dynamics
June 22, 2023 | Organization for Human Brain Mapping (OHBM) Conference, Montreal, Canada

Oral, Learning Subject-Specific Functional Parcellations from Cortical Surface Measures
September 23, 2022 | Predictive Intelligence in Medicine (PRIME) Workshop, Medical Image Computing and Computer Assisted Intervention (MICCAI), Singapore

Poster, Learning Subject-Specific Functional Parcellations from Cortical Surface Measures
June 24, 2022 | Organization for Human Brain Mapping (OHBM) Conference, Glasgow, Scotland

Poster, From Brain to Body: Learning low-frequency respiration and cardiac signals from fMRI dynamics
September 21, 2021 | Medical Image Computing and Computer Assisted Intervention (MICCAI), Strasburg, France

Oral, From Brain to Body: Learning low-frequency respiration and cardiac signals from fMRI dynamics
June 24, 2021 | Organization for Human Brain Mapping, Seoul, Korea

Oral, Relating BOLD low-frequency physiological patterns to behavioral and cognitive traits
June 24, 2021 | Organization for Human Brain Mapping, Seoul, Korea

Best Paper Honorable Mention - Oral, PRAGMA: Interactively Constructing Functional Brain Parcellations
October 27, 2020 | IEEE Visualization (VIS) Conference, Salt Lake City, Utah, USA

Poster, A deep pattern recognition approach for inferring respiratory volume fluctuations from fMRI data
September 2020 | Medical Image Computing and Computer Assisted Intervention (MICCAI), Lima, Peru

PANELS

Panelist, AI Revolutions
June 23, 2022 | Vanderbilt Data Science Institute, Nashville, Tennessee, USA

Panel Co-chair, Open Science Room: Open Publishing
June 23, 2022 | Organization for Human Brain Mapping, Glasgow, Scotland

Panel Co-chair, Open Science Room: Social Bias in Machine Learning
June 21, 2022 | Organization for Human Brain Mapping, Glasgow, Scotland

Student Panelist, VISE Symposium: Data, AI, and Discovery
December 15, 2021 | Vanderbilt Institute for Surgery and Engineering (VISE), Nashville, Tennessee, USA

LEADERSHIP & SERVICE

CONFERENCE ORGANIZATION

2025 – Co-Chair, International Workshop on Medical Computer Vision (MCV), CVPR (full day)
2025 – General Chair, BrainHack Vanderbilt (3 days)
2024 – Founder/Chair, BrainHack Vanderbilt (2 days)
2022 – Chair, Open Science Room, Open Science Special Interest Group, OHBM (5 days)

PHYSIOPY COMMUNITY | OPEN-SOURCE CONTRIBUTOR

2022 – Current

Contributing to the development of tools to operate physiological files in MRI setups specifically *phys2denoise* and *peakdet* libraries; the vast knowledge documentations for *the Community Practices;* BIDS extension proposal for physiological signals.

VANDERBILT INSTITUTE FOR SURGERY AND ENGINEERING (VISE)

2021 – 2022 | President, Women of VISE

PEER REVIEW

2020 – Current

Journals: Neuroimage, Frontiers in Neuroscience, Human Brain Mapping
Open Review Conferences: NeurIPS, MICCAI, ICLR, ICML, MiDL
Workshops: Women in MICCAI, Med-NeurIPS

MEMBERSHIPS

MICCAI, SIGKDD, IEEE, IEEE WIE, OHBM OSSIG

TEACHING EXPERIENCE

Guest Lecturer

EECE 8396 - Analysis of Functional Magnetic Resonance Imaging
Spring 2022, Spring 2023
CS 4262/5262: Foundations of Machine Learning
Fall 2020, Fall 2021

Teaching Assistant

CS 4262/5262 – Foundations of Machine Learning
Fall 2020 | Vanderbilt University, Nashville TN

CS 8395 – Deep Learning in Medical Image Computing
Spring 2020 | Vanderbilt University, Nashville TN

CS 1101 - Programming and Problem-Solving
Spring 2019 | Vanderbilt University, Nashville TN

RESEARCH MENTORSHIP

2025 – Current	Juan Gomez Lagandara, *Master's Student*
2025 – Current	Chang Li, *PhD Student*
2025 – Current	Yamin Li, *PhD Student*
2023 – 2024	Shansita Sharma, *Undergraduate Researcher*
2023 – 2024	Shiyu Wang, *PhD Student*
2023 – 2024	Ziyuan Xu, *Undergraduate Researcher*
2022 – 2023	Rithwik Guntaka, *Research Assistant*
2020 – 2021	Rithwik Guntaka, *Undergraduate Researcher*
2020 – 2021	Karuna Gujar, *Master's Student*
2019 – 2020	Nafis Ahmed, *Undergraduate Researcher*

HONORS & FELLOWSHIPS

2021	Merit Abstract Award, OHBM Annual Meeting, Seoul, KOREA
2020	NIH Award, MICCAI Annual Meeting, Lima, PERU
2020	Best Short Paper Honorable Mention, IEEE VIS, Salt Lake City, Utah, USA
2018 - 2019	Graduate Fellowship, Ministry of National Education, TURKEY
2013 - 2016	Graduate Fellowship, Ministry of National Education, TURKEY
2012 - 2013	Second Language Fellowship, Ministry of National Education, TURKEY
2006 - 2010	Undergraduate Fellowship, Ministry of National Education, TURKEY
2005 - 2010	Undergraduate Fellowship, Cankaya University, TURKEY