

Ruiqi Chen

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EDUCATION

Washington University in St. Louis

2021 - Present

- Ph.D., Neurosciences (in progress); Thesis advisor: [ShiNung Ching](#) & [Todd Braver](#)
- Thesis proposal: *A unifying mechanistic analysis framework for brain dynamics across rest and task states*

Peking University

2017 - 2021

- B.S., Intelligence Science and Technology; Thesis advisor: [Si Wu](#)
- Undergraduate Thesis: *Spatiotemporal information processing with reservoir decision-making networks*

RESEARCH EXPERIENCE

Washington University in St. Louis

Fall 2021 - Present

Graduate Research Assistant; Advisor: [ShiNung Ching](#) & [Todd Braver](#) & [Janine Bijsterbosch](#)

Project: Resting state and task fMRI joint modeling

- Constructed a reliable individualized nonlinear dynamical model for joint analysis of resting & task fMRI
- Revealed nontrivial attractors of mesoscale resting & task state brain dynamics embedded in functional brain networks
- Identified association between task-triggered bifurcations of brain dynamics and working memory performance

Project: Diffeomorphic vector field alignment

- Developed a nonlinear vector field alignment method based on the mathematical definition of topological equivalence
- Implemented an algorithm for infinite-dimensional optimization over all possible aligning transformations
- Demonstrated the efficiency of the method on high-dimensional nonlinear models fit on empirical neural data

Project (collaboration): Improving test-retest reliability estimation with HBM and MVPA

- Trained Hierarchical Bayesian Models (HBM) for parcel-level neural activation during Stroop task

Project (collaboration): Improving brain-behavior association by combining resting state and task fMRI

- Extracted geometric average of resting state and task residual functional connectivity from UK Biobank fMRI data

Project (collaboration): Control input synthesis for high-dimensional nonlinear systems

- Implemented an algorithm for designing control inputs for two-point-boundary-value problems using nonlinear flows

University College London

Summer 2020

Summer Research Assistant (Remote); Advisor: [Sven Bestmann](#); ([Project link](#))

- Simulated planar and spherical cortical traveling waves of different speeds, with static or dynamic sources, in different frequency bands, and under different levels of Signal-to-Noise-Ratio

Tsinghua University

Summer 2019

Summer Research Assistant; Advisor: [Bo Hong](#); ([Project link](#))

- Conducted EEG experiments on subjects during resting state and while listening to story/music
- Performed traditional and functional-connectivity-based microstates clustering and Markov chain analyses

Peking University

2019 - 2020

Undergraduate Research Assistant; Advisor: [Huan Luo](#); ([Project link](#))

- Simulated an auditory sequential working memory cueing task with a Recurrent Neural Network (RNN)
- Designed an auditory working memory EEG experiment with different kinds of mental manipulation during retention period and collected and analyzed data from 16 subjects

GRANTS AND AWARDS

The Cognitive, Computational, and Systems Neuroscience (CCSN) Pathway Traineeship	2023 - 2025
\$30,000/year; McDonnell Center for Systems Neuroscience, Washington University in St. Louis	
The Cognitive, Computational, and Systems Neuroscience (CCSN) Pathway Travel Award	2024
\$1,000; McDonnell Center for Systems Neuroscience, Washington University in St. Louis	
Peking University Undergraduate Research Grant	2019 - 2020
4000 RMB; Peking University	

TEACHING EXPERIENCE

Teaching Assistant, <i>Animal Behavior</i>	Fall 2022
Washington University in St. Louis	

SKILLS

- **Languages:** Chinese (native), Cantonese (native), English (proficient)
- **Experimental:** Psychtoolbox behavioral experiment, EEG recording, EEG & fMRI preprocessing
- **Programming:** MATLAB, Python, R; Linux operation; remote computing (Docker/Slurm); git; basic webpage development (HTML/CSS/Javascript); neural network training (Pytorch); Bayesian modeling fitting (brms)
- **Analytical:** Nonlinear dynamical modeling of empirical data, nonlinear representation alignment, nonlinear dimensionality reduction, limit set analysis and control input synthesis for nonlinear dynamical models, bifurcation and sensitivity analysis, controllability analysis, Hierarchical Bayesian Modeling, MVPA, time-varying connectivity

PEER-REVIEWED PUBLICATIONS

Chen, R., Singh, M., Braver, T. S., & Ching, S. (2025). Dynamical models reveal anatomically reliable attractor landscapes embedded in resting-state brain networks. *Imaging Neuroscience*, 3, imag_a_00442.

Freund, M. C., **Chen, R.**, Chen, G., & Braver, T. S. (2025). Complementary benefits of multivariate and hierarchical models for identifying individual differences in cognitive control. *Imaging Neuroscience*, 3, imag_a_00447.

Easley, T., **Chen, R.**, Hannon, K., Dutt, R., & Bijsterbosch, J. (2023). Population modeling with machine learning can enhance measures of mental health—Open-data replication. *Neuroimage: Reports*, 3(2), 100163.

PREPRINTS

Chen, R., Vedovati, G., Braver, T., & Ching, S. (2024). *DFORM: Diffeomorphic vector field alignment for assessing dynamics across learned models* (No. arXiv:2402.09735). arXiv. <http://arxiv.org/abs/2402.09735>

Tamekue, C., **Chen, R.**, & Ching, S. (2024). *On the control of recurrent neural networks using constant inputs* (No. arXiv:2410.17199). arXiv. <https://doi.org/10.48550/arXiv.2410.17199>

CONFERENCE PRESENTATIONS

Chen, R., Singh, M. F., Braver, T. S., & Ching, S. (2024, October 7). *Towards a unifying mechanistic analysis framework for brain dynamics across resting and task states* [Conference presentation]. Annual Meeting of the Society for Neuroscience 2024, Chicago, IL, United States.

Chen, R., Singh, M. F., Braver, T. S., & Ching, S. (2023, November 13). *Resting state networks embed anatomically reliable nonlinear dynamics* [Conference presentation]. Annual Meeting of the Society for Neuroscience 2023, Washington, DC, United States.

REFERENCES

ShiNung Ching, Ph.D.

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