

XIAOXUAN LEI

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EDUCATION

- McGill University & Mila, Quebec AI Institute Canada** 2021 – Present
PhD in Computational Neuroscience & Artificial Intelligence (neural-AI) (Expected 2026)
Advisor: Pouya Bashivan, Pierre Bellec
- Radboud University Nijmegen & Donders Institute Netherlands** 2018 – 2020
Cognitive Neuroscience and Artificial Intelligence (Cum Laude)
Advisor: Paul Tiesinga, Marcel van Gerven
- University of Chinese Academy of Sciences, China** 2014 – 2018
Bachelor in Mathematics with Minor in Computer Science
Exchange at Australia National University with Full Scholarship (2017)
Thesis Advisor: Jinhu Lv

RESEARCH INTERESTS

Intersection of **Artificial Intelligence** and **Neuroscience**. Specialize in developing **neural network models**, including fine-tuning **large multimodal models (LMMs)** for cognitive modeling. Interested in **scaling laws**, **mechanistic interpretation** and **geometrical data analysis** for intelligent systems with applications in **neuroscience/BCI**, and **AI alignment and safety**.

PROFESSIONAL EXPERIENCE

- Neural-AI Intern, Cold Spring Harbor Laboratory, NY** Summer 2023
Development of novel R2 estimator that accommodates limited data and trial-to-trial variability
Advisor: Benjamin Cowley, Dean Pospisil
- Team Member at CNeuroMod, Montreal** 2022 – 2023
Human physiological/fMRI data collection and analysis, behavioral task design.

PAPERS

1. **Xiaoxuan Lei**, Takuya Ito, Pouya Bashivan. *Geometry of naturalistic object representations in recurrent neural network models of working memory*. *Conference on Neural Information Processing Systems (NeurIPS), 2024.*
2. **Xiaoxuan Lei**, Lucas Gomez, Mark Bai, Pouya Bashivan. *iWISDM: Assessing instruction following in multimodal models at scale*. *3rd Conference on Lifelong Learning Agents (CoLLAs), 2024.*
3. Liu, X., Wang, Y., Huang, Z., Xu, B., Zeng, Y., Chen, X., Wang, Z., Yang, E., **Lei, X.**, Huang, Y., and Liu, X. *The Application of ChatGPT in Responding to Questions Related to the Boston Bowel Preparation Scale*. *arXiv preprint, 2024.*
4. **Xiaoxuan Lei**. *Neural Network Models of Reversal Learning in Nonhuman Primates*. *2020.*

SELECTED POSTERS & INVITED TALKS

1. (Poster) *Geometry of naturalistic object representations in models of working memory*. Xiaoxuan Lei, Takuya Ito, Pouya Bashivan. *Cognitive Computational Neuroscience (CCN), 2024.*
2. **Oral Presentation** *Geometry of naturalistic object representations in models of working memory*. Xiaoxuan Lei, Takuya Ito, Pouya Bashivan. *NEXTEN Conference: Envisaging Theoretical and Computational Neuroscience for the Next 10 Years, St. Louis, US, 2024.*

3. **Best Poster** *Towards Naturalistic Recurrent Models of Visual Working Memory*. Xiaoxuan Lei, Mark Bai, Pouya Bashivan. *Montreal AI & Neuroscience (MAIN), 2022.*
4. (Poster) *MulTFS: A Temporal Compositional Environment for Studying Working Memory*. Xiaoxuan Lei, Mark Bai, Pouya Bashivan. *Graduate Research Day, McGill University, 2022.*
5. (Poster) *A Recurrent Reinforcement Learning Model Solves a Reversal-Learning Task with Uncued Switches Using Division of Labor*. Xiaoxuan Lei, Thilo Womelsdorf, Paul H. Tiesinga. *Society for Neuroscience (SfN), 2022, San Diego, CA.*

SELECTED PROJECTS

EmoNeuro

A machine learning-powered EEG-based brain-computer interface (BCI) designed for real-time emotional regulation.

iWISDM Automatic Task Generator

A scalable dataset framework for evaluating **instruction-following capabilities** in large-scale vision-language models (LVLMs).

Attitude Control of Micro-Satellite

Patent: Double-refraction sun sensor and measurement method of carrier three-axis attitudes of double-refraction sun sensor (CN 106643743B). Developed a novel **double-refraction sun sensor** for precise satellite attitude control.

HONORS AND AWARDS

CAMBAM Fellowship, McGill University	2024
Graduate Mobility Award, McGill University, Canada	2022, 2023
Doctoral Excellence Scholarship, Union Neuroscience et Artificial Intelligence - Québec, Canada	2021
Graduate Excellence Fellowship, McGill University, Canada	2021
Dr. Richard I. Birks Fellowship, McGill University, Canada	2021
Exchange Scholarship, University of Chinese Academy of Sciences (Top 20/300+)	2017
Mathematical/Interdisciplinary Contest in Modeling, Honorable Mention	2017
China Public Welfare Project Contest, Bronze Award (Team Leader)	2016
University Merit Scholarship for Academic Excellence	2015, 2016
Undergraduate Research Funding, Chinese Academy of Sciences (Team Leader)	2015, 2016
Asia and Pacific Mathematical Contest in Modeling, Third Prize	2016

SERVICE

Ad Hoc Reviewer

ICML GRaM Workshop (2024), NeurIPS (2024), Cognitive Computational Neuroscience (CCN, 2024), Montreal Artificial Intelligence Symposium (MAIS, 2022).

Teaching Assistant

2019 – Present

Courses: Fundamentals of Machine Learning, Probability and Statistics for Engineers, Numerical Computation, Artificial Intelligence, Frequentist Statistics, Probability Theory, Statistical Machine Learning.

Scientific Outreach

Beyond Words: A Glimpse into Comparing LLMs on Idiom Translation. Noga Mudrik, Eva Yezerets, Amir Hosein Daraie, Xiaoxuan Lei. Read more.

Other Activities

ServiceNow Industry Internship Supervision (Nikhil Pottanigari on Multimodal vector search) 2024

TRAIL (Trustworthy & Responsible AI Learning) Certificate, Mila - Quebec AI Institute	2024
Organizer, Mila Neural-AI Reading Group	2023
Organizing Committee, UNIQUE Student Symposium (USS)	2021
Senior Editor, The Proceedings of Cognitive Neuroscience	2019 – 2020
President, Student Council, School of Mathematical Sciences, UCAS	2017
Intern, <i>Scientific American</i> (China)	2016

SKILLS

Programming Languages: Python, MATLAB, Bash

Deep Learning: PyTorch, TensorFlow, Keras; Large-scale neural network models

Medical Imaging: NiBabel, FSL, FreeSurfer, OpenCV, scikit-image

Neuroscience: fMRI/EEG/eye-tracking experiments, primate electrophysiology data analysis, human/LLM behavioral analysis

Computational Tools: Git, LaTeX, Conda, Pip, Blender

Languages: Mandarin Chinese (Native), English (Advanced), French & Dutch (Beginner)