

Jingxuan Fan (She/Her/hers)

Boston, MA · jfan@g.harvard.edu · +1(909)344-4142
[linkedin.com/in/jingxuan-fan/](https://www.linkedin.com/in/jingxuan-fan/) · github.com/jingxuanf0214

EDUCATION

Harvard University

Ph.D. Candidate, Program in Neuroscience

Dissertation: Reinforcement Learning with Dense Intrinsic Rewards for Complex Environment Navigation

M.S. in Applied Math

March 2024

Relevant Coursework: Reinforcement Learning, Neural Computation, Advanced Topics in Data Science, Physical

Mathematics, TinyML and Efficient Deep Learning, Mathematical & Engineering Principles for Training Foundation Models

Massachusetts Institute of Technology

Cambridge, MA

B.S. in Brain and Cognitive Science

May 2020

Honors & Awards: Hans Lukas Teuber Award for Outstanding Academics, Walle J.H. Nauta Award for Outstanding Research

SKILL & INTERESTS

Programming skills: Python (PyTorch, Tensorflow, scikit-learn, Pandas, SciPy/NumPy), Matlab, SQL, Linux, Git

Modeling skills: LLM post-training, reinforcement learning, representation learning, multimodal foundation model, diffusion

SELECTED RESEARCH EXPERIENCE

Harvard University

Cambridge, MA

PhD Researcher, Dept. of Neurobiology

Expected Jan. 2026

- **Developed a visual-olfactory virtual reality environment** to study reward-guided spatial reasoning and cognition; **Designed and trained an RNN-PPO agent with internal curiosity module (RND)** to simulate behavioral policies for reward-guided navigation and foraging tasks; **Conducted state space analysis** to extract low-dimensional neural dynamics representations and investigated their role in composing observable parameters in behavioral policies (journal manuscript in prep)
- **Led efforts in NBLAST-based neuron matching of *Drosophila* central brain** across large scale connectome datasets; **Performed graph embedding and hierarchical clustering** to multi-level sensory-motor pathways
- **Developed a Mixture of Expert (MoE) framework** to combine diverse modalities and sources of genetic variants prediction evidence (functional evidence, protein language model prediction, population genetic evidence, clinical notes) to achieve SOTA performance on genetic variants cancer risk prediction

Master's Researcher, Dept. of Applied Mathematics

March 2024

- **Trained PPO agents with state-dependent dense intrinsic rewards** for complex maze navigation tasks; characterized how dense rewards shape exploration behavioral policy and latent representations
- **Developed a framework to generate large-scale synthetic rule pool and perform data-aware rule selection** for scoring preference data in the safety domain; Demonstrated **improved results on reward model benchmarks** using preference data scoring with the rule adaptor; Submission to ICML
- **Developed test prompts and trained SAE to dissect transformer circuits** for spatial relations generation in SOTA text-to-image diffusion models e.g. PixArt, SD3.5; applied feature steering to improve 2/3D spatial scores on T2ICompBench
- **Developed an automated method** to generate a large-scale, domain-specific dataset of graduate-level applied mathematics problems; **Benchmarked** leading closed- and open-source LLMs on this dataset and **performed in-depth error analysis**; Developed a framework to improve this domain specific ability through **tool usage and finetuning**; (NeurIPS MATH-AI 2024, ICLR 2025)

Massachusetts Institute of Technology

Cambridge, MA

Undergraduate Researcher, Picower Institute

Sept.2017-May 2020

- Conducted smFISH, IHC, q-PCR and behavioral assays to study the neural circuit for danger signal detection and avoidance during social behaviors and co-authored a paper published in *Nature*

Undergraduate Researcher, McGovern Institute

Sept.2018-May 2020

- Designed single-nanometer iron oxide nanoparticles as dopamine-responsive MRI sensors, developed brain-wide delivery methods to assess its distribution and functionality; Co-authored two papers published in *JACS* and *PNAS*

PROFESSIONAL EXPERIENCE

Meta, Research Intern

May 2024-Aug. 2024

- Developed a novel image-based feature representation tailored to high density sEMG and used customized CV models for gesture decoding and input feature attributions
- Introduced manifold capacity as a theoretical metric for representation quality evaluation and multimodal SSL loss
- Implemented generative models to extract disentangled factors in sEMG for generalization and data augmentation

Axoft, Software Intern

Sept. 2023-Dec. 2023

- Developed and maintained in-house software pipelines for fluorescence imaging processing and spike sorting
- Applied statistical and machine learning models for neural decoding from population spiking and LFP data

PUBLICATIONS

Fan, J., Martinson, S., Wang, E.Y., Hausknecht, K. (2024). HARDMath: A Benchmark Dataset for Challenging Problems in Applied Mathematics (<https://arxiv.org/pdf/2410.09988>). **NeurIPS 2024 MATH-AI workshop, ICLR 2025**

Kwon, J.-T., Ryu, C., Lee, H., Sheffield, A., Fan, J., Cho, D. H., Bigler, S., Sullivan, H. A., Choe, H. K., Wickersham, I. R., Heiman, M., & Choi, G. B. (2021). An amygdala circuit that suppresses social engagement. **Nature**, 593(7857), 114–118.

Wei, H., Wiśniowska, A., Fan, J., Harvey, P., Li, Y., Wu, V., Hansen, E. C., Zhang, J., Kaul, M. G., Frey, A. M., Adam, G., Frenkel, A. I., Bawendi, M. G., & Jasanoff, A. (2021). Single-nanometer iron oxide nanoparticles as tissue-permeable MRI contrast agents. **Proceedings of the National Academy of Sciences**, 118(42).

Hsieh V., Okada S., Wei H., García-Álvarez I., Barandov A., Alvarado SR., Ohlendorf R., Fan J., Ortega A., Jasanoff A. (2019). Neurotransmitter-responsive nanosensors for T2-weighted magnetic resonance imaging. **Journal of the American Chemical Society**, 141 (40), 15751-15754