Jingxuan Fan (She/Her/hers)

Boston, MA·jfan@g.harvard.edu·+1(909)344-4142

linkedin.com/in/jingxuan-fan/ · github.com/jingxuanf0214

EDUCATION

Harvard University — **Cambridge, MA**
Ph.D. Candidate, Program in Neuroscience — Expected Nov. 2025
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: generative models, reinforcement learning, representation learning, time series analysis, LLM benchmarking

SELECTED RESEARCH EXPERIENCE

Harvard University — ***Cambridge, MA***
PhD Researcher, Dept. of Neurobiology — *Expected Nov. 2025*
- **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)
- **Performed analysis on a novel *Drosophila* connectome dataset,** bridging existing brain and VNC datasets**; 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

Master's Researcher, Dept. of Applied Mathematics — *March 2024*
- **Trained PPO agents with state-dependent dense intrinsic rewards** for complex maze navigation tasks; characterized diverse exploration behaviors on the behavioral policy level as well as interpretable latent representations as compared to sparse rewards
- **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 rule selector
- **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 **model distillation**; Accepted by **NeurIPS MATH-AI/**under review at **ICLR**

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

UpHonest Capital, Scout — *May 2023-present*
- Sourced deals in the field of AI-based provider tools for mental health and presented to the fund managers

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

Merck Research Laboratories, Research Intern — *June 2018-Aug. 2018*
- Performed cell culture, immunoprecipitation and high throughput fluorescence imaging and quantification to characterize TDP-43 protein interaction networks and pathology in Amyotrophic Lateral Sclerosis (ALS) model

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**

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