

Muyang Lyu (吕沐洋)

PH.D. CANDIDATE · PEKING UNIVERSITY

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Education

Peking University

Ph.D. Candidate, Integrative Life Sciences (Physics)
Academy for Advanced Interdisciplinary Studies

• Advisor: Prof. Si Wu

- **Cognitively-Inspired AI:** World Models, Latent Action Models, Skill Learning
- **Computational Neuroscience:** Hippocampal–Entorhinal Circuit, High Frequency Oscillation in Epilepsy, Perceptual Learning

Beijing, China
2023–2028 (expected)

Beijing Normal University

B.S., Computer Science and Technology
School of Artificial Intelligence

• GPA: 3.8/4.0

Beijing, China
2019–2023

Research Interests

I approach AI from a cognitively-inspired perspective, focusing on **world models**, **latent action models**, and **skill learning**. I aim to develop embodied agents that learn generalizable abstract structures from unannotated sensory inputs, without relying on language supervision. This line of work seeks to enable efficient learning, robust generalization, and flexible decision-making for **intelligent robotics**, while also informing the abstract reasoning capabilities of LLMs.

Publications

Tianqiu Zhang*, **Muyang Lyu***, Xiao Liu, Si Wu. **Structure Abstraction and Generalization in a Hippocampal–Entorhinal Inspired World Model.** *ICML 2026.*

Tianqiu Zhang*, **Muyang Lyu***, Yufan Zhang, Fang Fang, Si Wu. **DiLA: Disentangled Latent Action World Models.** *ICML 2026.*

Xiao Liu, **Muyang Lyu**, Cong Yu, Si Wu. **To Learn or Not to Learn, That is the Question — A Feature-Task Dual Learning Model of Perceptual Learning.** *NeurIPS 2024.*

Chaoming Wang, **Muyang Lyu**, Tianqiu Zhang, Sichao He, Si Wu. **A Differentiable Approach to Multi-scale Brain Modeling.** *ICML Workshop 2024.*

*Indicates equal contribution.

Research Experience

Structure Abstraction and Generalization in a Hippocampal–Entorhinal Inspired World Model

Co-lead Researcher; Co-first Author, *ICML 2026* | Advisor: Prof. Si Wu

Peking University
Jul. 2024–May 2026

- Proposed a brain-inspired world model for hierarchical structure–content disentanglement, using an HPC-like state module for content-preserving sensory processing and an MEC-like transition module for path integration.
- Trained on unlabeled human–object interaction videos, the model learned reusable abstract latent actions and achieved state-of-the-art performance on prediction and structure-reuse tasks.
- Co-led the algorithmic conceptualization, theoretical formulation, and quantitative/qualitative analyses of learned structures.

DiLA: Disentangled Latent Action World Models

Co-lead Researcher; Co-first Author, *ICML 2026* | Advisor: Prof. Si Wu

Peking University
Oct. 2025–May 2026

- Developed a dual-branch latent action world model that separates dynamics-related actions from static sequence content, resolving the trade-off between abstract action learning and prediction fidelity.
- Learned continuous, semantically structured latent actions that transfer across embodiments and support MPC-based robotic simulation experiments.
- Co-led the algorithmic design, theoretical framework, and empirical analyses of learned action structures.

Temporal Abstract Skill and Hierarchical Policy Learning from Unlabeled Video Data

Co-lead Researcher; *ICLR 2027 in preparation* | Advisor: Prof. Si Wu

Peking University
Jan. 2026–Present

- Developing methods to learn reusable temporal skill representations and hierarchical policies from unlabeled video data.
- Designing the core algorithmic framework and empirical validation pipeline for skill discovery, temporal dynamics modeling, and cross-embodiment transfer.
- Expected first co-author.

Additional Cognitive AI Research

Neural Mechanisms of High Frequency Oscillations in Epilepsy

Co-lead Researcher, Computational Modeling; Advisor: Prof. Si Wu

Built biologically plausible computational models of epileptic seizures and interictal states in collaboration with clinical neurosurgeons; proposed and validated a mechanism for HFO emergence. Manuscript in preparation, expected co-first author.

Peking University
Jun. 2024–Present

Computational Modeling of Perceptual Learning Mechanisms

Core Contributor; Advisor: Prof. Si Wu

Built two-stage neural network models for feature learning and task decision learning, reproducing specificity and transfer effects in perceptual learning. Second author, **NeurIPS 2024**.

Peking University
Sep. 2022–Dec. 2024

Model Fitting Module for BrainPy

Core Contributor; Advisor: Prof. Si Wu

Built model-fitting modules for BrainPy, a brain dynamics programming framework, to fit neurodynamic model parameters to experimental data. Second author, **ICML Workshop 2024**.

Peking University
Dec. 2023–Jul. 2024

Large-Scale Whole-Brain Simulation of Zebrafish

Core Contributor; Advisor: Prof. Si Wu

Integrated neural activity and connectome data to support large-scale whole-brain simulation, linking microstructural brain dynamics with behaviorally observed cognitive functions.

Peking University
Sep. 2023–Jun. 2024

Earlier Cognitive AI and Neuroengineering Research

Undergraduate Researcher / Project Lead; Advisor: Profs. Zonglei Zhen, Xia Wu, and Bailu Si

Worked on cognitive and brain-inspired AI projects spanning multi-brain-region neural networks for Raven's Progressive Matrices, spatial-cognition-based path planning with grid-cell firing simulations, and hybrid brain-computer interface systems based on conceptual and motor imagery.

Beijing Normal University
Apr. 2020–Sep. 2022

Skills

- **Programming / ML:** Python, PyTorch, BrainPy
- **Research Areas:** World models, latent action learning, skill learning, embodied AI, computational neuroscience
- **Tools:** Weights & Biases, Hugging Face, Git, Linux/Bash, tmux, AI-assisted development with Claude/Codex
- **Languages:** Mandarin (native), English (CET-6: 589), Japanese (JLPT N2)

Teaching Experience

- **Teaching Assistant**, *Applications of AI in Psychological Research*, Peking University: Instructed 7 hours of core lectures on complex AI methodologies (Feb.–Jul. 2025).
- **Instructor**, *International Summer Forum for Top Psychology Students*: Led a 2-hour programming workshop with real-time technical troubleshooting (Aug. 2025).
- **Instructor**, *4th Neural Computational Modeling Camp*: Delivered a 3-hour lecture on simplified neuron models and dynamics analysis (Jul. 2025).

Academic Activities

- **Oral Presenter**, *Soochow University–Peking University Joint Symposium on Cognitive Science and Brain–Computer Interfaces*: Talk on “DiLA: Disentangled Latent Action World Models” (Apr. 2026).
- **Poster Presenter**, *Center for Quantitative Biology (CQB) Annual Meeting, Peking University*: “To Learn or Not to Learn, That is the Question — A Feature-Task Dual Learning Model of Perceptual Learning” (Jan. 2025).
- **Selected Participant**, *Cold Spring Harbor Asia (CSHA) Summer School on Computational and Cognitive Neuroscience*, Suzhou (Jun.–Jul. 2024).

Awards

2021	Meritorious Winner , Mathematical Contest in Modeling (MCM)
2020	First Prize (Beijing) , Contemporary Undergraduate Mathematical Contest in Modeling (CUMCM)
2020–2022	Jingshi Scholarship (Top 10%–20%) , Beijing Normal University
2020–2023	Cyrus Tang Foundation Scholarship , Cyrus Tang Foundation