JIYI WANG

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EDUCATION

Peking University **Beijing, China**
Bachelor of Science, Chemistry *Sept 2020 - July 2024*
Thesis: AI-assisted development of non-classical allosteric inhibitors of beta-lactamase. *supervised by Dr. Zhe Ji*
Overall GPA: 3.70/4.0, Major GPA: 3.75/4.0

PUBLICATIONS

Jiyi Wang, Likai Tang, Huimiao Chen, Marcelo G Mattar, Sen Song. Brain-Like Replay Naturally Emerges in Reinforcement Learning Agents, *Submitted to arXiv, 2024.*

Jiyi Wang, Jingyang Ke, Anqi Wu. Learning Task-Agnostic Skill Bases to Uncover Motor Primitives in Animal Behavior. *under review of NeurIPS*

Jingyang Ke, Feiyang Wu, **Jiyi Wang**, Jeffrey Markowitz, Anqi Wu. Inverse Reinforcement Learning with Switching Rewards and History Dependency for Characterizing Animal Behaviors. *International Conference on Machine Learning, 2025*

RESEARCH EXPERIENCE

Research Assistant, Georgia Institute of Technology **Atlanta, GA**
Inverse Reinforcement Learning to Identify Skill Sets, supervised by Dr. Anqi Wu *Aug 2024 - Jun 2025*

- Developed an inverse reinforcement learning algorithm with **linear decomposition** of the environment to find out the skill sets that act as the basis functions of animal behaviors. Used the trajectory data to recover the reward function and identify skill sets.
- Helped to use EM to solve a multi-reward MDP and revealed the **multiple intentions** laying behind the behavior data.

Research Assistant, Tsinghua University & New York University **Beijing, China & New York, NY**
Reinforcement Learning to Model Replay, supervised by Dr. Sen Song & Dr. Marcelo Mattar *May 2023 - Present*

- Proposed a **modular** reinforcement learning neural network; Implemented it using **JAX**; reproduced replay through training.
- Reproduced **biological experiments** related to replay; verified the **replay's functions** of planning, memory update and cognitive map update; Analyzed **neural manifold** to give an intuitive understanding in the process.

Research Assistant, Peking University **Beijing, China**
Dimension Reduction of Gamma Oscillation Dynamics, supervised by Dr. Louis Tao *Jan 2023 - May 2023*

- Used dimension reduction techniques to analyze the latent variables that control the neuronal dynamics in gamma oscillation.
- Merged the state-of-the-art sequence analysis model TimesNet into the VAE backbone; compressed high dimensional neuronal signals to **low-dimension** vectors and analyzed properties of signals in the latent space, each with different characteristics.

Research Assistant, Peking University **Beijing, China**
Hierarchical Hopfield Network For Memory Recall and Retrieval, supervised by Dr. Si Wu *Sept 2022 - Feb 2023*

- Used Hopfield model to explain the phenomena of **memory recall** and **memory retrieval** of seen items in a task.
- Used a **hierarchical Hopfield** model by retrieving the items level by level through the regulation of inhibitory neurons. Alleviated the problems of dropping accuracy in the recall task with overlapped item patterns.

AWARDS

- First Prize in Province Chemistry Olympiad (1/3000), Chinese Chemical Society *2019*
- Silver Medal in National Chemistry Olympiad (30%), Chinese Chemical Society *2019*
- National Scholarship (on profound academic performance, 2/165), Peking University *2021*

- Samsung Scholarship (on academic performance, 20/160), Peking University *2022*
- Shisun Ding Scholarship (on academic performance, 20%), Peking University *2024*

COURSEWORK AND SKILLS

Programming Background Github page: https://github.com/G1NO3/Geert_code

- Introduction to Computation(90) Learning Data Science with Python(95) Reinforcement Learning(83)
  Computer Vision and Deep Learning(92) Graph Neural Network(84) Multi-agent Reinforcement Learning(86)
- **Deep Learning Platforms:** PyTorch, JAX **Languages:** Python, MATLAB, C++, C, Julia.
- **Experience:** Familiar with machine-learning models in language, vision, and learning applications. 20k lines of code experience.
- **Projects** [Click to see the report of each project]
  General: poem classification, stock trading, music classification, image feature analysis and time series analysis.
  CV: Visual straightening in AI and brain. Used straightening loss in latent space to improve the extrapolation prediction performance and match the result neural experiments.
  GNN: community detection, Molecular classification. Investigate the self-supervised contrastive molecular learning graph neural network. Used an imbalanced masking probability to improve the pre-training performance.
  RL: Honor of Kings (MOBA, both Single- and Multi-agent), Used single-agent reinforcement learning (PPO) to train an agent to play a competitive MOBA game. Used multi-agent reinforcement learning (COMA&Q-MIX) to train several agents to play a cooperative MOBA game.
  Supply chain management, Used VDN to play a multi-agent beer game and alleviated the instability problem.
  Mahjong Competition. Investigated the performance differences between PPO and supervised learning in playing Chinese Mahjong. Used reward shaping to improve the PPO in this game.

Math Background

- Calculus(89), Linear Algebra, Stochastic Processes(85) Probability Theory and Mathematical Statistics
  Markov Chain Monte Carlo, Variational Inference Expectation Maximization, Generative Models(93)
- **Projects:** Application of VAE-based clustering algorithms on neuronal data analysis. Removed the label prior in pi-VAE and replaced it with a posterior that needs to be inferred. Developed a new model to do unsupervised clustering. Applied it to the place cells data to prove the interpretability.

Neuroscience and Psychology Courses

- Functional Anatomy of Central Nervous System(93) Systematic and Computational Neuroscience(85)
  Experimental Psychology(89) Neuropsychology(100)
- **Projects:** V1-Saliency map model. Used V1-Saliency model to reproduce some famous conceptual experiments in psychology. Decision-making model based on neuronal connections. Used a biophysical model to reproduce a decision-making experiment.

Summer School

- Neuromatch (NeuroAI) *July 2024*, **online** CNeuro *July 2024*, **Beijing**
  Swarma Pattern (NeuroAI) *Feb 2023*, **Beijing** Swarma Pattern (Neurodynamics) *Mar 2023*, **Beijing**
- **Projects:** Biologically realistic mechanism for credit assignment problems (weight perturbation, feedback alignment, predictive coding, etc.). Investigated the differences between these algorithms and back propagation.

TEACHING EXPERIENCE

Teaching Assistant, Peking University Beijing, China
Chemistry Today *Sept 2022 - June 2023*

- Assisted with sending the notifications, organizing discussions and correcting and grading final papers.
- Organized a seminar to help first-year students get familiar with the process and key points of literature search and retrieval.
- Graded students' midterm papers, providing feedback based on the accuracy, and professionalism of their literature summaries.

RESEARCH INTERESTS

NeuroAI, normative model, reinforcement learning, hippocampus, replay, learning, memory