

Research Interest

Machine Learning, Cognitive Psychology, Abstract Reasoning, Systematic/Compositional Generalization

Education

- **Peking University — School of Electronics Engineering and Computer Science** Beijing, China
B.S. in Intelligence Science and Technology Sept. 2019 - July 2023 (Expected)
 - **Turing Class¹**
 - **Cumulative GPA of 3.818/4.0 (Rank 3/81)**

Selected Publications

- Guangyuan Jiang, Manjie Xu, **Shiji Xin**, Wei Liang, Yujia Peng, Chi Zhang, Yixin Zhu, MEWL: Few-shot multimodal word learning with referential uncertainty: submitted to **ICML 2023**
- **Shiji Xin**, Yifei Wang, Jingtong Su, Yisen Wang, On the Connection between Invariant Learning and Adversarial Training for Out-of-Distribution Generalization: **AAAI 2023 (Oral) Paper**
- **Shiji Xin**, Joy Hsu, Yunzhi Zhang, Jiayuan Mao, Jiajun Wu, Leveraging CLIP for Visual Relationship Understanding: Poster at the UGVR Program at Stanford University

Research Experience

- **Peking University & Beijing Institute for General Artificial Intelligence (CoRe Lab)** Beijing, China
Research Intern - Prof. Yixin Zhu, Dr. Chi Zhang Nov. 2021 - Present
 - **Causal Reasoning:**
 - * Optimized a neuro-symbolic causal discovery approach and implemented an object-centric model.
 - * Designed a structured neural network for causal discovery in Abstract Causal REasoning (ACRE) dataset through modeling the causal prior.
 - **Visual Question Answering:**
 - * Worked on Directed Acyclic Graph (DAG) discovery and modular network.
 - * Designed a DAG-Transformer model for interpretable visual question answering.
 - * Ongoing: Improving the systematic generalization ability of models on the VQA task.
 - **Word Learning:**
 - * Built a dataset for machine word learning.
 - * Evaluated vision-language baselines and compared them to the results of human study.
 - **Intrinsic Reward-guided Causal Learning (Ongoing):**
 - * Surveyed works on learning causal structures through exploration.
- **Stanford Vision and Learning Lab** Stanford, CA
Undergraduate Visiting Researcher (UGVR Program²) - Prof. Jiajun Wu June 2022 - Aug. 2022
 - **Visual Relationship Understanding:**
 - * Designed and developed a framework for visual relationship understanding using CLIP.
 - * Diagnosed CLIP based on the framework by designing multiple experiments and programmed web-based tools to visualize the result.
- **Peking University (ZERO Lab)** Beijing, China
Research Intern - Prof. Yisen Wang June 2021 - Oct. 2021
 - **Domain Generalization and Adversarial Robustness:**
 - * Developed a new adversarial training scheme for domain generalization.
 - * Derived the mathematical connection between Invariant Risk Minimization and DAT objectives.
 - * Analyzed how DAT benefits learning invariant features and verified our hypothesis through experiments on synthetic data and real-world datasets based on DomainBed.

¹An honors program at Peking University founded by Turing Laureate Professor John E. Hopcroft.

²An elite program hosted for less than 18 top Chinese students each year, funding them to do research at Stanford.

Professional Experience

- **Peking University** Beijing, China
Teaching Assistant - [Mathematical Foundations for the Information Age](#), [Prof. Yuqing Kong](#) *Sept. 2021 - Jan. 2022*
 - Collaborated with the professor to design assignments and tests and grade them.
 - Tutored students on mathematical derivation and code debugging and answered their questions.
- **Peking University** Beijing, China
Volunteering Operations Engineer - [Stray Cats Caring Association](#) *Jan. 2021 - April 2022*
 - Collaborated to build and maintain a WeChat Mini Program to organize and identify more than 100 stray cats at Peking University. **The accumulated users reached 500k**, with hundreds of daily users. Media coverage: [Hottest trend on Weibo](#), [Official coverage of Peking University](#).

Selected Projects

- **Boosting Certified ℓ_∞ -dist Robustness with EMA Method and Ensemble Model:** Proved the theoretical difficulty of optimizing the ℓ_∞ -network. Proposed to use EMA and ensemble for better certified robustness of the ℓ_∞ network. [Preprint](#), [Code](#)
- **Analysis on Female-oriented Novels Based on Emotional Arc:** Collaborated with students in the Department of Chinese Language and Literature. Used the technique of emotional arc to analyze the emotional fluctuation in female-oriented novels in the past 20 years to identify the trend. Similar techniques were also used in a previous project on analyzing detective novels using surprise. [Code](#)

Honors and Awards

- **AAAI 2023 Student Scholar (Received)** Dec. 2022
- **Tianchuang Scholarship (Top 10%)** Oct. 2022
- **Third Prize in the 30th "Challenge Cup" Interdisciplinary Student Extracurricular Academic Science and Technology Competition of Peking University (Top 33 among 114 teams)** May 2022
- **John Hopcroft Scholarship (Top 40% of Turing Class)** Oct. 2021
- **Peking University Merit Student (Top 20%)** Oct. 2020
- **Peking University Third-class Scholarship (Top 20%)** Oct. 2020
- **Chinese Chemistry Olympiad Gold Medalist (Top 0.05%)** Dec. 2018

Leadership and Academic Service

- **Chair** for [the first Turing Student Research Forum](#), Peking University, 2022
- Committee member of Turing Class Research Committee since 2020
- Volunteer
 - International Joint Conference on Theoretical Computer Science (IJTCS) 2020, 2021
 - Conference on Web and Internet Economics (WINE) 2020

Skills Summary

- **Languages:** Python, C/C++, R, WebPPL, MATLAB, Stata, Bash, Julia
- **Tools and Frameworks:** PyTorch, TensorFlow, Detectron2, Pyro, Docker, Git, Selenium, L^AT_EX, NVIDIA Modulus
- **Languages:** Chinese (native), English (fluent, TOEFL 109)
- **Representative Courses:** Machine Learning, Cognitive Science, Convex Analysis and Optimization Methods, Randomized Algorithms, Introduction to Stochastic Processes, Intro. to Natural Language Processing, Algorithm Design and Analysis, Data Structure and Algorithm (A)