

# Shaoyang Cui(Joey)

Department of Psychological and Cognitive Sciences

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👤 Self-page

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👤 GitHub Profile

## EDUCATION

### • Bachelor of Engineering in Artificial Intelligence

Sep 2021 - Jul 2025

*Yuanpei College, Peking University*

Overall Grade: 86/100 | GPA: 3.52/4.0

Member of the **Tong Class**, an honorary pilot program specializing in AI at Peking University.

## RESEARCH INTERESTS

My research centers on understanding and explaining the essence of intelligence, with the long-term aspiration of creating Artificial General Intelligence (AGI). I approach this problem from two complementary perspectives:

- **Top-down:** Investigating intelligence from a macroscopic perspective, with a focus on intention, consciousness, and world models. My aim is to leverage existing AI technologies to analyze, explain, and replicate intelligent phenomena.
- **Bottom-up:** Drawing on computational neuroscience, I seek to mimic the computational logic of biological intelligence through detailed models. This involves studying brain-inspired architectures, analyzing brain regions, and simulating (or even training) biophysically detailed neuron models. My goal is to discover new research directions in intelligence science and develop approaches more fundamentally aligned with AGI.

## RESEARCH EXPERIENCE

### – Research Intern, Computational Neuroscience Team (PI: Dr. Kai Du)

Jul 2023 – Jul 2025

*Institute for Artificial Intelligence, Peking University*

- \* Conducted computational neuroscience research on **biophysically detailed neuron models**, focusing on the robustness and computational properties of layer 5 pyramidal cells (L5PC).
- \* Implemented simulations in the NEURON environment to examine how dendritic morphology and active ion channel dynamics influence information integration and noise tolerance.
- \* Explored candidate synaptic learning rules for biophysical neural networks, analyzing how spiking neurons adapt to task-specific constraints.

### – Research Assistant, Brain-Inspired Algorithmic Modeling Lab

Jul 2025 – Present

*Department of Psychological and Cognitive Sciences, Tsinghua University*

- \* Work on brain-inspired AI algorithms bridging **neuroscience and machine learning**, focusing on how dynamical features of neural representations relate to learning performance.
- \* Develop and evaluate **manifold-analysis agents** to automatically characterize representational geometry in neural networks.
- \* Assist in data analysis and model design for projects on neural representation and decision-making within the Tsinghua PSC group.

## PUBLICATION

### – Task Ability Decomposition and Difficulty Quantification of Visual Tasks for AGI Evaluation

Mar 2024 - Jul 2025

Cui, S. Y., He, X. Y., Han, J. H., Zhang, Z. L., & Peng, Y. J.

- \* Accepted (in press) at **Science China Technological Sciences (JCR Q1)**. Full title available upon request.
- \* First to explore the structure of task-ability space and its link to task difficulty.
- \* Proposed TADDL-V: a framework for quantifying difficulty of visual tasks to support AGI evaluation.
- \* Released AGI-V70: a curated benchmark set for testing diverse visual abilities. See GitHub.

## PROJECTS

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### FAB: Factory of Abstract-style Benchmark

Nov 2024 – May 2025

*Independent Project*

- Developed the first fully automated, low-cost benchmark generation framework for abstract-style evaluation across multiple academic fields.
- Enabled scalable benchmarking of large language models using structured abstraction errors, covering semantic, structural, and factual variants.

- Open-source benchmark available on GitHub: FAB Benchmark Repository.

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|---|---|---------------------------|
| * | <b>TradeCraft: Multi-Agent Benchmark for Theory-of-Mind and Cooperative Reasoning</b>   | <i>Jan 2024 - Present</i> |
|   | <i>Collaborative Research Project, supervised by Dr.Junqi Wang and Dr.Lifeng Fan</i>  |                           |
| · | Designed and developed <b>TradeCraft</b> , a large-scale multi-agent benchmark and simulation environment for evaluating Theory-of-Mind, cooperation, and competition among LLM-based agents. |                           |
| · | Built multi-agent task pipelines integrating role assignment, planning, and social reasoning modules, enabling systematic evaluation of social orientation and cooperative behaviors.         |                           |
| · | Manuscript <b>under review at ICLR 2026</b> .   |                           |

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|---|--|----------------------------|
| * | <b>Possible Models of Self-Awareness in Conscious Turing Machines</b>  | <i>Sep 2022 - Dec 2022</i> |
|   | <i>Course Project, supervised by Prof. Lenore Blum(CMU) and Prof.Manuel Blum(CMU)</i>  |                            |
| · | Based on the previous works of Conscious Turing machine(CTM), discussed the consciousness and self-consciousness of a CTM, gave a clear definition.  |                            |
| · | Concerning some illusion and disorder phenomena, create a possible model and workflow(the 'MIT' model) to understand how those phenomena works in CTM, and thus grasp a glimpse of the generation of consciousness in CTM. |                            |
| · | <b>Invited to present at the IJTCS2023 workshop.</b>   |                            |

## ON-CAMPUS

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|---|---|----------------------------|
| * | <b>Champion, 2nd AI Cup Badminton Tournament, Institute for AI, Peking University</b> | <i>Jun 2025</i>            |
| * | <b>Team Manager and Coach: Women's Football Team,Yuanpei College</b>                  | <i>Oct 2022 - Jun 2024</i> |
| * | <b>Member of the Tennis Team,Yuanpei College</b>                                      | <i>Oct 2022 - Jul 2025</i> |

## AWARDS & ACHIEVEMENTS

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|---|---|---------------------------|
| * | <b>IJCAI 2022–2023 Special Track: Chinese Standard Mahjong AI Competition</b>   | <i>Jun 2022 –Jun 2023</i> |
|   | <i>Peking University, under the supervision of Prof. Wenxin Li</i>  |                           |
| · | Achieved <b>10th place</b> in <b>IJCAI 2022</b> and <b>7th place</b> in <b>IJCAI 2023</b> , invited to present at the <b>IJCAI 2023 Special Track</b> . |                           |
| · | Competition details available at official game page.  |                           |

## PERSONAL QUALITIES

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**IELTS:** 7.5

**Technical Skills:** Proficient in PyTorch, NEURON as well as development tools like Git and GitHub.