

Shaolong Li

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EDUCATION

Central South University (CSU)

Sept. 2020 – Jun. 2024

B.Eng. in Computer Science and Technology

- **Major GPA:** 93.95 / 100 | **Rank:** 1 / 235
- **Overall GPA:** 93.76 / 100 | **Rank:** 2 / 235
- **Selected Scores of Core Courses (Out of 100):**
 - Mathematics:** Calculus (I): 98, Calculus (II): 99, Linear Algebra: 98, Probability and Statistics: 93
 - Computer Science:** Fundamental of Computer Programming (C++): 99, Data Structure: 97, Computer Composition Principles and Assembly: 98, Discrete Mathematics: 96, Database Principles: 94, Computer Networks: 95, Algorithm Analysis and Design: 92, Computer Architecture: 96, Parallel Computing: 97, Distributed System and Cloud Computing: 95, Machine Learning: 97, Data Mining: 98

PUBLICATIONS

(* stands for equal contribution.)

Mixed Sparsity Training: Achieving 4× FLOP Reduction for Transformer Pretraining [PDF]

Pihe Hu*, Shaolong Li*, Xun Wang, and Longbo Huang

Under review for *Transactions on Machine Learning Research (TMLR)*.

Value-Based Deep Multi-Agent Reinforcement Learning with Dynamic Sparse Training [PDF]

Pihe Hu*, Shaolong Li*, Zhuoran Li, Ling Pan, and Longbo Huang

In *Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024.

RESEARCH EXPERIENCE

AIMING Lab at the University of North Carolina at Chapel Hill

Mar. 2024 – Present

Research Assistant supervised by [Prof. Huaxiu Yao](#)

Research on Multimodal Alignment for Multimodal Models

- Introduced a novel multimodal Direct Preference Optimization (DPO) that enables multimodal models to train on interleaved image-text datasets, significantly improving their capability to generate interleaved text-image outputs.
- Incorporated the concept of step reasoning into the alignment of multimodal models, segmented interleaved image-text content by modality into a step-level dataset for training.

Research on Step Reasoning for Large Language Models (LLMs)

- Improved Direct Preference Optimization (DPO) to apply it to step-level preference pair datasets, enhancing LLMs' long-chain mathematical reasoning ability.
- Constructed a step-level training dataset by sampling responses, splitting them into steps, and pairing samples based on the probability of each step leading to the correct answer.
- Leveraged a value function to evaluate context quality, enabling decisions based on the current step's response rather than the entire generated sentence.

Decision Intelligence Lab at Tsinghua University

Jul. 2023 – Feb. 2024

Research Assistant supervised by [Prof. Longbo Huang](#)

Research on Sparse Pretraining for Large Language Models (LLMs)

- Introduced an innovative pretraining method that cuts down about 75% of Floating Point Operations while preserving the LLMs' performance.
- Integrated dynamic sparse training with a varying sparsity pattern to reduce the computational cost of forward and backward propagation.
- Proposed a novel topology evolution scheme, Mixed-Growing, to explore and utilize more parameters, avoiding suboptimal solution spaces.

Research on Sparse Training for Multi-Agent Reinforcement Learning

- Introduced a novel Multi-Agent Sparse Training Framework, reducing Floating Point Operations and model size by up to 20-fold with less than 3% performance loss.
- Capitalized on gradient-based topology evolution combined with a Hybrid TD scheme, enhancing the reliability of TD targets in sparse networks.
- Employed Dual Buffers for stable policy sampling and replaced the max operator with Soft Mellowmax to alleviate DQN overestimation and achieve more accurate value estimation.

Research on Cybercrime Dataset

- Introduced the first open Cyber Asset Graph dataset, which includes real-world cybercrime group data for research.
- Visualized the open Cyber Asset Graph dataset using D3.js and other JavaScript libraries, presenting interactive asset chains and graph nodes.

SKILLS

- **Language:** English, Chinese.
- **Programming:** Python, Pytorch, C, C++, Java, MATLAB, HTML/CSS/Javascript, Shell, TEX, Verilog.
- **Toolsets:** Docker, Git, Linux.

AWARDS AND SCHOLARSHIPS

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|-----------------------------------|-----------|
| ○ Outstanding Graduate, CSU | Mar. 2024 |
| ○ Ruiwei Scholarship | Oct. 2023 |
| ○ Outstanding Student, CSU | Dec. 2022 |
| ○ Yihao Foodstuff Scholarship | Nov. 2022 |
| ○ National Scholarship (Top 0.2%) | Dec. 2021 |
| ○ First Class Scholarship, CSU | Nov. 2021 |