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: Advanced Mathematics (I), (II): 98, 99, Linear Algebra: 98, Probability and Statistics: 93, Discrete Mathematics: 96
  Computer Science: Data Structure: 97, Machine Learning: 97, Data Mining: 98, Computer Composition Principles and Assembly: 98, Database Principles: 94, Computer Networks: 95, Algorithm Analysis and Design: 92, Computer Architecture: 96, Parallel Computing: 97, Distributed System and Cloud Computing: 95

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.

Visualization and Visual Analysis Research Group at Central South University Oct. 2022 – Dec. 2022
Research Assistant supervised by Prof. Ying Zhao

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

○ 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