Shaolong Li

shaolongli16@gmail.com https://shaolongli616.github.io/

EDUCATION

Central South University (CSU) Sept. 2020 – Jun. 2024

B.Eng. in Computer Science and Technology

- **GPA:** 93.95 / 100 (Major) | 93.76 / 100 (Overall)
- **Rank:** 1 / 235 (Major) | 2 / 235 (Overall)
- **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 enhancing their ability 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, and then trained the models on the dataset using multimodal DPO.

Research on Step Reasoning for Large Language Models

- Improved Direct Preference Optimization to apply it to step-level preference pair datasets, aiming to enhance the long-chain mathematical reasoning ability of LLMs.
- Constructed the training dataset by sampling responses, splitting them into steps, and pairing positive and negative samples based on the probability of each step leading to the correct final answer.
- Leveraged a value head to enable the model to evaluate the quality of the contextual situation, allowing the model to make decisions based on the quality of the action at the current step rather than the entire sentence generated so far.

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

- Introduced an innovative pretraining method that cuts down about 75% of Floating Point Operations while preserving the LLMs' performance.
- Integrated dynamic sparse training and hybrid sparse attention with a sparsity variation pattern to minimize the computational cost of network forward and backward propagation.
- Proposed a novel topology evolution scheme, Mixed-Growing, which allows for a discrepancy between the number of pruned and grown links.

Research on Sparse Training for Multi-Agent Reinforcement Learning

- Introduced an innovative Multi-Agent Sparse Training Framework that translates Floating Point Operations into up to 20-fold reduction for both training and inference, accompanied by a commensurate level of model compression, all achieved with less than 3% performance degradation.
- Capitalized on gradient-based topology evolution combined with a novel Hybrid TD scheme to enhance the reliability of TD targets in sparse networks.
- Employed the Dual Buffers in data sampling to improve policy stability. Used the Soft Mellowmax operator as a substitute for the max operator to alleviate overestimation from DQN 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 an open Cyber Asset Graph(CAG) dataset that comprises numerous CAGs of real-world cybercrime groups, which is the first open dataset for research in the field of cybercrime.
- Employed D3.js to visualize an open cyber asset graph dataset, programmed interactive functionalities using JavaScript, including the visibility of 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