

# JIN FANG

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## EDUCATION

### University of Science and Technology of China (USTC)

Anhui, China

Ph.D. in Computer Science

2020.9-2026.6 (expected)

- Research focus on MISys, Collective Communication, and In-network Computing
- Advisors: Prof. Hongli Xu and Prof. Gongming Zhao

### Hunan University (HNU)

Hunan, China

B.S. in Computer Science

2016.9-2020.6

- Excellent Graduation Thesis of Hunan University

## PUBLICATIONS

1. S. Zheng, W. Bao, Q. Hou, X. Zheng, **J. Fang**, etc, *Triton-distributed: Programming Overlapping Kernels on Distributed AI Systems with the Triton Compiler*, (**Arxiv**)
2. S. Zheng, **J. Fang**, X. Zheng, Q. Hou, W. Bao, N. Zheng, Z. Jiang, D. Wang, J. Ye, H. Lin, L. Chang, X. Liu, *TileLink: Generating Efficient Compute-Communication Overlapping Kernels using Tile-Centric Primitives*, (**MLSys'25**)
3. **J. Fang**, G. Zhao, H. Xu, L. Luo, Z. Yao, A. Xie, *Non-Idle Machine-Aware Worker Placement for Efficient Distributed Training in GPU Clusters*, IEEE International Conference on Network Protocols (**ICNP'24**)
4. **J. Fang**, G. Zhao, H. Xu, Z. Yu, B. Shen, L. Xie, *Accelerating Distributed Training with Collaborative In-network Aggregation*, IEEE/ACM Transactions on Networking (**ToN'24**)
5. **J. Fang**, G. Zhao, H. Xu, Z. Yu, B. Shen, L. Xie, *GOAT: Gradient Scheduling with Collaborative In-Network Aggregation for Distributed Training*, IEEE/ACM International Symposium on Quality of Service (**IWQoS'23**)
6. **J. Fang**, G. Zhao, H. Xu, C. Wu, Z. Yu, *GRID: Gradient Routing with In-network Aggregation for Distributed Training*, IEEE/ACM Transactions on Networking (**ToN'23**)
7. **J. Fang**, G. Zhao, H. Xu, H. Tu, H. Wang, *Reveal: Robustness-Aware VNF Placement and Request Scheduling in Edge Clouds*, Computer Networks (**ComNet'23**)
8. J. Liu, Y. Zhai, G. Zhao, H. Xu, **J. Fang**, Z. Zeng, Y. Zhu, *InArt: In-Network Aggregation with Route Selection for Accelerating Distributed Training*, International World Wide Web Conference (**WWW'24**)

## EXPERIENCE

### Communication Collective Library for Sequence Parallelism LLM Job

Bytedance

Seed-Foundation-mlsys, Beijing, China

Main Developer

2024.11-present

- Implement AllGather and AlltoAll operations based on RDMA verbs programming
- Design collective communication algorithms for cross-pcie and cross-node scenarios
- Optimize bandwidth utilization under resource-constraint machine architectures
- Reduce No. of NICs per machine from 8 to 2 (by 75%), while achieve the same bandwidth utilization
- Evaluate performance of different machine architecture and analyze communication bottleneck for different SP setup (SP-Ulysses and SP-Ring)

### Communication-Computation Fused GPU Kernel Generation

Bytedance

Seed-Foundation-mlsys, Beijing, China

Research Intern

2024.6-2024.12

- Implement collective communication operations (e.g., AllGather) based on Triton and NVSHMEM
- Design and implement communication-computation fused operations (e.g., AllGather+GEMM), exploring overlaps between GEMM and collective communications

- Achieve near-optimized bandwidth utilization on A100\*8 NVlink machines
- Implement TP-fused and SP-fused kernels for both dense and MoE LLMs (Integrated into 6 popular LLMs)
- Implement and optimize cross-node communication computation fusion kernels
- Achieve end-to-end speed up by  $3\times$  and  $1.5\times$  compared with Pytorch and vLLM

**Optimizing Worker Placement for Distributed Training in OCS Network**      Huawei 2012 Lab, Hefei, China

*Research Intern*      2023.12-2024.5

- Investigate existing large model task deployment and resource scheduling works
- Investigate existing gradient compression optimization for sparse model training
- Model physical and logical communication patterns of different collective communication algorithms, analyze the impact of communication topology on task training time
- Design a task placement algorithm to optimize the cross-rack traffic in the optical circuit switch network

**Simulating network faults with programmable dataplane**      Suzhou, China

*Main Developer*      2022.12-2023.9

- Build a user-friendly, multi-backend fault injection system in programmable dataplane
- Design a parser generation algorithm to handle flow dependency and load the table entries
- Formulate the fault injection point selection problem
- Implement several network faults with P4 in TNA and PSA architectures

**Accelerating distributed training with programmable switches**      Zhijiang Lab, Hangzhou, China

*Research Intern*      2022.6-2022.9

- Improve the in-network aggregation throughput by mitigating the influence of asynchronous arrived packets
- Design a knapsack-based randomized rounding algorithm for gradient scheduling
- Implement a distributed training prototype with Pytorch
- Implement the in-network aggregation logic in Tofino with P4
- Reduce the communication overhead of distributed training tasks by 81.2%

**Developing and testing Alcor, a cloud native SDN platform**      Futurewei, Remotely

*Developer*      2021.6-2021.9

- Write an automatic building script for large scale deployment with bash
- Write an end-to-end test of the virtualization control plane (ACA) with C++
- Develop grpc thread for pulsar subscribe information (PR #274) with C++

**Implement a LSTM model based on high-level synthesis**      Hunan, China

*Main Developer*      2019.6-2020.1

- Train a LSTM model based on Keras to predict the steam pressure in nuclear power plant reactor
- Implement the trained LSTM model with C++ and deploy it into a Pynq-Z2 board
- Reduce the inference time by 90x compared with software implementation
- *Win the award of Excellent Graduation Thesis of Hunan University*

## AWARDS

- |  |            |
|--|------------|
| • Guorui scholarship                               | 2023       |
| • Excellent price (25%) in Intel P4 China Hackthon | 2022       |
| • Doctoral first-class academic scholarship        | 2022, 2023 |
| • Master's first-class study scholarship           | 2020, 2021 |

## SKILLS

- Programming Language: C/C++, Python, P4, C#, Swift
- Developing Framework: Pytorch, p4c, eBPF, Mininet