Sumit Kumar

PhD Scholar,
Computer Science & Engg,
Indraprastha Institute of Information Technology Delhi

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Summary

My research primarily focuses on the challenges and opportunities in networking for AI/ML systems. More specifically, my future work aims to design scalable, low-latency, multi-tenant network and system architectures for AI training and inference workloads.

Education

- **Indraprastha Institute of Information Technology, Delhi** Delhi, India
  Ph.D. Computer Science and Engineering (CSE) Since Oct 2023
  - Advisor: Dr. Rinku Shah
  - Course work: Programmable Networks, Distributed Systems, Object Oriented Programming: and Design, Graduate Systems and Research Methods.
  - GPA: 8.33 / 10

- **Jawaharlal Nehru University, New Delhi** Delhi, India
  M.Tech Statistical Computing (Data Communication) 2020 - 2022
  - Thesis Title: Minimizing Energy Of Multi-Hop Routing Protocol In Wireless Sensor Network
  - Advisor: Dr. Karan Singh
  - GPA: 8.0 / 9

- **Central University of South Bihar, Gaya** Bihar, India
  M.Sc. in Computer Science 2018 - 2020
  - Thesis Title: IPSec VPN (Implementation of IPSec Tunnel Between Two Sites)
  - GPA: 8.54 / 10

- **Magadh University (Gaya College), Gaya** Bihar, India
  Bachelor in Computer Application 2014 - 2017
  - Score: 65 / 100

Professional Experience

- **Teaching Assistant** New Delhi, India
  Indraprastha Institute of Information Technology Delhi 2024 - 2025
  - Conducted tutorials, assignment demos, quiz preparation, paper checking, and grading:
    * Computer Networks (Monsoon 2024)
    * Systems for AI (Monsoon 2025)

- **Machine Learning Intern** Gurugram, India
  CNH Industrial Mar 2023 - Dec 2022
  - Solve customer-centric problems in the agricultural machinery industry through NLP/generative AI.

Selected Publications

1. **Sumit Kumar**, Arjun, Naman, Ramanjeet, Meet, Praveen, Satananda, Abed, and Rinku ""Simulating LLM training workloads for heterogeneous compute and network infrastructure" ACM SIGCOMM NAIC 2025. , DOI: https://dl.acm.org/doi/10.1145/3748273.3749212.

Skills

- **Programming Languages:** C, C++, Python, Bash shell

- **Libraries/Software Packages**: torch, numpy, pandas, sklearn, matplotlib, PyTorch, scrcpy

- **Software Tools**: Git, Docker, Visual Studio Code, Eclipse, Kubernetes

- **Miscellaneous**: Algorithms, Network, Data Structures, Problem Solving

Current Projects

- **Simulating LLM training workloads for heterogeneous compute and network infrastructure:** This work develops a heterogeneity-aware simulation framework for distributed LLM training that models GPU clusters with diverse compute and network capabilities. The simulator enables accurate training time prediction through support for non-uniform workload partitioning, custom device group configurations, flexible device-to-parallelism mappings (tensor, data, and pipeline parallel), and heterogeneous collective communication primitives. It bridges the gap between idealized homogeneous assumptions in existing tools and realistic, multi-GPU-generation cloud deployments and model-specific heterogeneous deployment.

- **Fast simulation of Scale-Up Fabric and RDMA NIC for Heterogeneous Training:** Leveraging flow-level network simulation, this approach models realistic intra-node and inter-node data paths in heterogeneous LLM training environments. The simulator emulates detailed flow-level behaviours of scale-up interconnects (e.g., NVLink, NVSwitch, UALink) and RDMA-enabled NICs, accurately reflecting congestion, queuing, and bandwidth sharing across multiple GPU generations and network hierarchies. It enables evaluation of end-to-end collective communication performance, distributed job scheduling, and resource contention in mixed hardware clusters, facilitating system optimization for large-scale, heterogeneous deployments.

Awards and Fellowship

- **Letter of Appreciation:** Volunteered and conducted a hands-on session on Linux networking at the ACM Winter School 2023.

- **Master of Technology Fellowship:** Awarded Non-NET Postgraduate Scholarship for a 2-year master's program.

- **NET:** Qualified the National Eligibility Test in Computer Science in 2023.

Academic Service

- Presented a poster on my research work at the Research Innovation and Incubation Showcase Events (RIISE).

- Attended the SIGCOMM 2025 conference and presented short paper at SIGCOMM NAIC workshop in Combira, Portugal.

- Presented a poster at CSE Day 2025 IIITD.

- Attended the ICDCN Conference held at IIT Hyderabad.

- Volunteered and conducted a hands-on session on Linux networking at the ACM Winter School 2023.

Membership and Activities

- Student Member, Association for Computing Machinery (ACM), Member ID: 2264601, since July 2025.

References

- **Rinku Shah**
  Assistant Professor
  Department of Computer Science
  Indraprastha Institute of Information Technology Delhi (IIIT-Delhi)
  Email: rinku@iiitd.ac.in
  Website: `https://faculty.iiitd.ac.in/~rinku/`
  Google Scholar: `https://scholar.google.co.in/citations?user=jNhSvOEAAAAJ`