Sapna Chaudhary

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Summary

PhD Scholar with expertise and a strong interest in measuring, designing, and optimizing video streaming applications to ensure efficient performance over both limited and high-speed networks.

Education

- **Indraprastha Institute of Information Technology Delhi** — New Delhi, India
  Ph.D (Computer Science & Engg.) — *Aug 2020 - Present*
  - Advisor: Dr. Mukulika Maity(IIIT Delhi) and Dr. Sandip Chakraborty (IIT Kharagpur)
  - Research Topic: Design and Development of a Sustainable Video Streaming Framework over Limited Bandwidth and High-Speed Networks
  - Current CGPA: 8.8/10
- **Guru Gobind Singh Indraprastha University, USICT** — Delhi, India
  Masters of Technology (Computer Science Engineering) — *2018 - 2020*
  - Advisor: Dr. Rahul Johari
  - Project: Optimized Routing in Wireless Network using Machine Learning
  - Silver Medalist
  - Percentage: 9.0
- **Inderprastha Engineering College (IPEC)** — Uttar Pradesh, India
  Bachelors of Technology, Computer Science Engineering — *2012 - 2016*
  - Percentage: 73%

Certificates/Scorecards

- **TMA PhD School** — 26 - 27 June 2023
  Certificate Link : Google Drive Link — *TMA Conference, Naples, Italy*
- **GATE** — 2019
  Score : 444

Projects

- **Optimized Adaptive Protocol Selection Mechanism for Video Streaming Application**
  Research Project

  With the advent of QUIC (HTTP/3), a recent transport layer protocol, significant improvements in performance under challenging network conditions have been observed compared to TCP. However, in high-bandwidth networks, the legacy TCP (HTTP/2) protocol often outperforms QUIC (HTTP/3). Recognizing this, prior research has introduced adaptive transport protocol selection mechanisms, primarily designed for web services, relying on supervised machine learning models. Unfortunately, such mechanisms are largely absent for applications like video streaming and often fail to adapt to changing network conditions. Moreover, switching transport protocols during video streaming can adversely impact the Quality of Experience (QoE) due to the loss of congestion control state. This work focuses on proposing an adaptive framework (Intel-Switch) for seamless protocol switching for services like video streaming. It includes a protocol selection mechanism for evolving network conditions, an optimized ABR algorithm on the face of protocol switching to minimize the impact on video QoE, and an eBPF-based mechanism to transfer the congestion state at the server side. Together, these innovations aim to enhance video streaming performance in dynamic environments.

- **Design and Development of Sustainable Video Streaming Framework over limited Networks:**
  Research Project

  Not all parts of a developing country like India enjoy a good Internet bandwidth. Popular video streaming applications require a minimum bandwidth to operate. This work aims to measure the performance of popular video streaming applications under poor network bandwidth using the recent application protocol HTTP/3. HTTP/3 uses QUIC as the underlying transport protocol. This work aims to identify issues/challenges with the QUIC protocol and the browser that enables it over a poor bandwidth network. Further, the work aims to propose network and application-level solutions that can provide the best possible QoE over a low and very low network bandwidth.

  Paper Link : `https://ieeexplore.ieee.org/document/10453353`

- **A Dataset for Analyzing Streaming Media Performance over HTTP/3 Browsers**
  Research Project

  HTTP/3 is a new application layer protocol supported by most browsers. It uses QUIC as an underlying transport protocol. QUIC provides multiple benefits, like faster connection establishment, reduced latency, and improved connection migration. Hence, popular browsers like Chrome/Chromium, Microsoft Edge, Apple Safari, and Mozilla Firefox have started supporting it. This work presents an HTTP/3-supported browser dataset collection tool named H3B. It collects the application and network-level logs during YouTube streaming. We consider YouTube to be one of the most popular video streaming applications that support QUIC. Using this tool, we collected a dataset of over 5936 YouTube sessions covering 5464 hours of streaming over 5 different geographical locations and 5 different bandwidth patterns. We believe our tool and the dataset could be used in multiple applications, such as a better configuration of application/transport protocols based on the network conditions, intelligent integration of network and application, predicting YouTube's QoE, etc.

  Paper Link : `bit.ly/3VhQQ4k`

- **ORuML: Optimized Routing in wireless network using Machine Learning**
  M.Tech Thesis

  Routing is a process of selecting a path in a network for delivering a packet from the source node to the destination node. Successful delivery of a message is a challenge in delay tolerant networks, and therefore, this thesis proposes an algorithm for a wireless network called ORuML, which uses a machine learning algorithm, namely KNN(K-Nearest Neighbour), SVM(Support Vector Machine), and MLR (Multinomial Logistic Regression), to predict the network type of the source and destination nodes. The proposed algorithm determines whether the source and destination nodes are co-located and also determines the best neighboring hop for efficient routing.

  Paper Link : `https://onlinelibrary.wiley.com/doi/full/10.1002/dac.4394`

- **Smart Helmet**
  M.Tech Thesis

  Routing is a process of selecting a path in a network for delivering a packet from the source node to the destination node. Successful delivery of a message is a challenge in delay tolerant networks, and therefore, this thesis proposes an algorithm for a wireless network called ORuML, which uses a machine learning algorithm, namely KNN(K-Nearest Neighbour), SVM(Support Vector Machine), and MLR (Multinomial Logistic Regression), to predict the network type of the source and destination nodes. The proposed algorithm determines whether the source and destination nodes are co-located and also determines the best neighboring hop for efficient routing.

  Paper Link : `https://onlinelibrary.wiley.com/doi/full/10.1002/dac.4394`

Professional Experience

- **Department of Computer Science & Engg.** New Delhi, India
  Indraprastha Institute of Information Technology Delhi *Jan 2021 to December 2023*
  - *Teaching Assistant (Aug 2020 to Dec 2020)*
    Working as a Teaching Assistant for the course Computer Networks. The work involves grading answer sheets and providing tutorials and remedial lessons to students.

– *Teaching Assistant (Jan 2021 to May 2021)*
Working as a Teaching Assistant for the course Wireless Networks. The work involves grading answer sheets and providing tutorials and remedial lessons to students.

- **LastMileS Workshop** Bangalore, India
  COMSNETS 2022 *2022*
  Volunteer
  Worked as Workshop Volunteer during the LastMileS Workshop at the COMSNETS 2022 conference held in Bangalore. The work involved helping the Co-Chairs in smooth conduct of the workshop and coordinating the talks and paper presentations.

- **Department of Computer Science and Engineering** Delhi, India
  USICT, GGSIPU *2018-2020*
  Chairperson
  Worked as Chairperson of USICT ACM Student Chapter. The work involved organizing various technical events in the university, which involved organizing talks, competitions, and activities related to tech.

Publications

1. **Sapna Chaudhary**, Naval Kumar Shukla, Prince Sachdeva, Sandip Chakraborty, and Mukulika Maity. "Managing Connections by QUIC-TCP Racing: A First Look of Streaming Media Performance Over Popular HTTP/3 Browsers." IEEE Transactions on Network and Service Management (2024). **Published**
2. **Sapna Chaudhary**, Mukulika Maity, Sandip Chakraborty, and Naval Kumar Shukla. "A Dataset for Analyzing Streaming Media Performance over HTTP/3 Browsers." Advances in Neural Information Processing Systems 36 (2024). **Published**
3. **Sapna Chaudhary**, Sandip Chakraborty and Mukulika Maity. "A Measurement Study of TCP and QUIC Through the Lens of YouTube Video Streaming", Graduate Forum Paper in Proceedings of International Conference on COMmunication Systems & NETworkS (COMSNETS'22) held in Bangalore, India. **Accepted**
4. **Sapna Chaudhary**, Rahul Johari, *"ORuML: Optimized Routing in Wireless Network using Machine Learning"* published in International Journal of Communication Systems 2020,Wiley (SCI). **Published**
5. Shubhi Bansal, Rahul Johari, **Sapna Chaudhary**, Prachi Garg, Riya Bhatia, Kalpana Gupta *"e-PRAN: Enhanced prophet routing algorithm in delay tolerant networks"* published in Journal of Information and Optimization Sciences, 2020. **Published**
6. Johari, Rahul, Nitesh Kumar Gaurav, **Sapna Chaudhary**, and Apala Pramanik. *"START: Smart Stick based on TLC Algorithm in IoT Network for Visually Challenged Persons."* published in 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), IEEE. **Published**

Skills

- **Programming Languages:** Python, C++
- **Libraries/Software Packages**: numpy, pandas, sklearn, matplotlib
- **Other Softwares/Tools**: Linux, Git, FFmpeg, ns3 (Familiar)

Awards & Medals

- Received Fellowship from Core Research Grant (CRG), DST/SERB during PhD.
- Microsoft student travel grant to attend and present our paper at the NeurIPS 2023 conference held physically in New Orleans, USA.

- SIGCOMM student travel grant to attend TMA PhD School and TMA Conference 2023 held physically in Naples, Italy.
- Full travel grant to attend COMSNETS 2023 physically held in Bangalore, India.
- Received travel grant at IMC 2022.
- Received travel grant at Mobisys 2021, and actively participated in the conference.
- Received travel grant at MMSys 2021, and actively participated in the conference.
- Awarded with AICTE GATE scholarship of Rs. 12400 every month from 2018-2020.
- GATE qualified in year 2019, 2018 and 2017.
- Silver Medal, M.Tech in Guru Gobind Singh Indraprastha University (2020).

Academic Service

- Member of Technical Program Committee of COMSNETS 2025
- Member of Review Committee of NeurIPS 2024
- Member of Review Committee of ICMI 2024
- Chairperson of USICT GGSIPU ACM Student Chapter from 2018-2020.

References

- Dr. Mukulika Maity
  Associate Professor, Department of Computer Science & Engineering
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  Email: `mukulika@iiitd.ac.in`
- Dr. Sandip Chakraborty
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  Email: `sandipchkraborty@gmail.com`
- Dr. Rahul Johari
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