

## Education

### North Carolina State University, Raleigh, North Carolina, USA

Aug 2018 – Present

- Ph.D. in Computer Science (*Graduation Expected May 2023*)
- *Research Areas*: Cloud Computing, Systems, Deep Learning, Networking and Performance Evaluation
- *Courses*: Design and Analysis of Algorithms, Operating System, Performance Evaluation, Advance Internet Protocols

### Lahore University of Management Sciences (LUMS), Pakistan

Aug 2016 – May 2018

- M.Sc. in Electrical Engineering
- *Course*: Topics in Internet Research, Operating System, Probability and Random Processes

### NUCES-FAST, Lahore, Pakistan

Aug 2008 – May 2012

- B.Sc. in Telecommunication Engineering
- *Course*: Programming for Engineers, Data Structures and Algorithms, Feedback and Control Systems, Electronics, Embedded Systems, Linear Algebra and Differential Equations, Multi-variable Calculus

## Experience

### Research Assistant

NCSU

Aug 2018 – Present

**Cloud Gaming**: Dissecting the quality of experience of cloud gaming platforms: Google Stadia, Amazon Luna, Nvidia GeForceNow

- Develop a novel deployable deep-learning based automated tool featuring video processing, image recognition, optical character recognition, and measuring round trip video delay in gaming as server-end, network, and client-end delay with model accuracy  $\geq 99\%$  (*CNN, TensorFlow, Keras, Pandas, FFmpeg, Python3*)
- Implement a lightweight chromium module for video stream logging and off-line analysis, thus identifying factors that degrade bitrate by 6.6-times and frame-rate by 2-times (*Chromium, WebRTC, FFmpeg, usbmon, C++, Python3*)

**AWS Network Measurement**: Analyze the availability and latency of AWS network for elastic compute cloud and serverless

- Build a large-scale longitudinal measurement system for 210 region pairs/ 244 availability zone pairs, collect data comprising 20 billion packets, while identifying several cases of cloud unavailability and latency spikes on AWS network infrastructure (*AWS, Cloud formation, Serverless Lambda, Kubernetes, EC2, EBS, BPF, Python3, C*)
- Use machine learning (long short-term memory) to forecast packet losses in the network with 92% accuracy, thus, enabling preemptive measures for improving application performance (*LSTM, TensorFlow*)

**Spam Political Biases**: Model and evaluate political biases in spam filtering algorithm of Gmail, Outlook, and Yahoo

- Develop tool to collect data and extract over 1.3 million emails from 300 email accounts (*IMAP, Selenium WebDriver, Python3*)
- Apply propensity score matching to estimate the effect of treatment and minimizing the effect of confounding variables in the data

### Research Assistant

LUMS

January 2017 – May 2018

**Scylla**: Develop a software control layer on contiki-OS, interleaving multiple wireless stacks such as 6LoWPAN/Bluetooth 4.2 on a single radio, with priority-scheduling for multiple traffic types, to achieve near stack-native performance while simultaneously offering both wireless stacks (*C, Contiki, Time-Slotted Channel Hopping, TI SensorTag CC2650*)

- Delivered a talk on challenges of wireless heterogeneity in IoT and emerging opportunities at COMSYS, RWTH Aachen, Germany

### Software Engineer

Netsol Technologies

March 2013 – August 2015

- Pursue front-end development and release of a consumer lease solution for an auto-financing client in Australia (*C#, SQL, SVN*)
- Lead on optimizing performance and bug fixing on a live asset financing application

### Project Engineer

Alstom Grid

July 2012 – December 2012

- Lead a team of 5 for deployment and commissioning of telecom infrastructure in 14 power/grid stations and designed primary and backup routing plan for voice and data of 30+ sites of the national grid of Pakistan (*SDH, NEC PABX, AREVA PLC*)

## Publications

- Dissecting Cloud Gaming Performance with DECAF (*Accepted in ACM SIGMETRICS 2022*)
- Interleaving Multiple IoT Stacks on a Single Radio (*ACM CoNEXT 2018*) [\[DOI\]](#)
- Taming Link-layer Heterogeneity in IoT (*ACM SenSys 2017*) [\[DOI\]](#)

(Two submissions under review in *ACM TheWebConference 2022* and *IEEE/ACM Transactions on Networking*)

## Technical Skills

- **Languages**: Python, C++, C, R, SQL,  $\LaTeX$
- **Technologies & Platforms**: AWS, Cloud formation, Serverless Lambda, Kubernetes, Docker, Linux, TensorFlow, Keras, NumPy, Pandas, PIL, Matplotlib, WebRTC, FFmpeg, BPF, ns-3, netem, IMAP, Visual studio, Eclipse, GitHub, SVN

## Projects

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- **Multi-Server Queuing System:** Implement a simulator for M/M/m and M/G/m system and evaluate their performance for First Come First Serve and Shortest Job First service disciplines (*Python3*)
- **Web-Server:** Develop a web-server simulator, with multiple I/O disks, for queuing service disciplines First Come First Serve, Shortest Job First, and Priority Preemptive/Non-Preemptive, and evaluated on 10 million requests (*Python3*)
- **Blockchain in IoT:** Design prototype for access management in IoT using permissioned blockchain with PBFT (python)
- **Ramdisk:** Implement a virtual disk drive using system call interface of filesystem in userspace (*C, FUSE*)
- **User Shell:** Develop a shell command interpreter with parsing, I/O redirection, command execution, and signal handling (*C*)
- **Thread Library:** Implement a user-level threading library supporting create, yield, join, and exit operations (*C*)
- **Smart Energy Metering:** Design and implement a complete smart energy metering system involving data acquisition, concentration, transmission over GSM link to base station, and bill generation (*C, C#, SQL, Zigbee, GSM*)

## Academic Services

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- Mentor two undergrad students on convolutional neural networks and transfer learning (GEARS Summer 2021)
- Mentor two undergrad students on high accuracy video time-stamping (GEARS Summer 2021)
- Reviewer IFIP Networking 2020
- Reviewer journal IEEE Access
- Mentor two undergrad students on web application algorithm analysis (GEARS Summer 2020)
- Mentor two undergrad students on performance evaluation of cloud applications (Spring 2020)

## Honors and Awards

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- NSF Travel Grant for ACM CoNEXT, 2018
- NCSU Student Travel Grant for ACM IMC 2018
- College of Engineering Graduate Merit Award, NCSU, 2018
- Graduate School Scholarship for fully-funded PhD at NCSU
- DAAD Summer Research Exchange Grant, 2017

## Leadership

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- **CoVID-19 Relief:** Initiate and organize ration distribution campaign during pandemic by collecting over \$1000.00 and served 130+ affected families in Pakistan
- **Head Software Competition:** In SOFTEC 2012, manage nationwide software competition with 36 shortlisted teams
- **Vice President:** In NUCES Circuits Society 2011, manage 3 national programming and circuit design competitions