Rahul Bothra

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Education

Birla Institute of Technology and Science, Pilani 2016 - 2020
B.E. in Computer Science (GPA: 8.09/10.00)

Experience

Research Fellow, Microsoft Research 2020 - Present
Advisors: Dr. Venkat Padmanabhan, Dr. Ranjita Bhagwan
Project: Optimizing resource efficiency for Microsoft Teams

- Designed peak-aware resource provisioning and allocation, and time-aware redundancy planning, which led to estimated cost savings of about 120M$/year and latency improvement of about 50%.
- Started large-scale measurements comparing Azure WAN performance with the Internet, whose insights helped Teams to make informed routing decisions, and Azure Edge to plan future network building.
- Work under submission at SIGMETRICS 2023.

Project: Quantifying network sensitivity of video conferencing applications

- Devised user engagement metrics, which are in addition to user feedback (MOS), useful in understanding user experience for video conferencing applications. These metrics are now being used by Teams to improve their MOS prediction models.
- Quantified the impact of network performance on user engagement, as well as by other non-networking factors. Identified potential applications for improved traffic engineering, congestion control, and server allocation techniques.
- Work under submission at PAM 2023.

Advisors: Dr. Ramachandran Ramjee, Dr. Muthian Sivathanu
Project: Identifying communication bottlenecks in ML training

- Fixed bottlenecks in the application/kernel interface in popular DL communication frameworks (NCCL, gloo) which improved communication performance by upto 60%.
- Identified ephemeral congestion in the ring All Reduce patterns when scaled to large number of nodes, both in Azure and AWS, degrading performance by upto 28%. Solved the issues by a) changing the allReduce topology ordering, and b) removing some nodes from the cluster.

Software Engineer, Azure Migrate 2020
Managers: Priyank Gaharwar, Charumathy Srinivasan

- Designed components to scale-out and orchestrate migration from multiple servers for customers with large in-house datacenters.
- Built in-application debugging for network and authentication related issues, and improved the user interface, both of which improved the SLA from 99% to 99.99% and generated strong positive customer feedback.

Projects

P4-TrafficTool 2020
Advisor: Prof. Ben Leong, NUS Singapore
Improved the parser to support more P4 programs, to generate protocol and packet templates for debugging tools like Scapy, MoonGen, Wireshark, etc. Understood the P4 compiler pipeline, and improved the parsing intervention to be more robust. Source.

Heuristical approach to Clustered Orienteering 2019
Advisor: Prof. Abhishek Mishra, BITS Pilani, Dr. Pramod Tanwar, CSIR CEERI
Clustered Orienteering is an exponentially harder variation of the Travelling Salesman Problem. I designed a GA and Swarm Optimization based heuristic which improved performance by 38% and accuracy by 5% than state of the art.

Reducing image distortion via object aware Seam Carving 2019
Advisor: Dr. Pramod Tanwar, CSIR CEERI
Identified conditions under which important parts of an image can get distorted by Seam Carving and designed an object-aware technique to reduce these distortions. We are working towards a patent filing.

Google Summer of Code - Sugar Labs 2018
Advisor: Walter Bender, MIT Media Lab
Implemented cross version Python support for the Sugar Operating System, dependant UX frameworks, and the networking architecture, motivated by the deprecation of Python 2. Tested the system with different hardwares like OLPC laptops, and Raspberry Pi's, and ensured package consistency across distributions (Debian, Fedora) and Python versions (2.3 to 3.7).

Hyperloop India, SpaceX Global Challenge 2017
Designed and manufactured the halbach array design using Neodymium magnets to levitate our Hyperloop pod. Our design had the most cost efficient Lift to Drag performance in the competition.

Teaching Positions

Teaching Assistant, BITS Pilani 2017 - 2019
Professors: Jagat Sesh., Sundaresan Raman. et. al.
Courses: Logic in Computer Science (CS F211), and Programming (CS F111)

Mentor, Google Open Source Programs 2018 - 2020
Mentored university and high school students in working with open source projects.

Lecturer, CSD course, BITS Pilani 2019
Introduced and led an audit course *Data Science with Python*. Designed course content and evaluative components, and taught over 50 students.

Academic Honors

KYPY Fellowship by Dept. of Science and Techonology, Govt of India
NTSE Scholarship by NCERT Council, Govt of India