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Ish Kumar Jain

Education

2018 - 2023 **Doctor of Philosophy (PhD)**, *University of California San Diego*, CA.
Major: Electrical Engineering, ***GPA: 4.0***
- PhD Candidate and Research Assistant with Prof. Dinesh Bharadia.
- **Teaching:** Communication Systems Lab (Spring-2020) | Modern Wireless Communication (Winter-2021).
- **Selected Courses:** Digital Communication, Communication Circuit Design, Algebraic Coding, Wavelets & Filter Design, Array Processing, AI & Pattern Analysis.

2016 - 2018 **Master of Science (MS)**, *New York University, Tandon School of Engineering*, NY.
Major: Electrical Engineering, ***GPA: 3.96***
- Myron M. Rosenthal Commencement Award for the best MS Academic Achievement in ECE.
- **Teaching:** Machine Learning (Spring-2018 and Fall-2017) | TCP-IP Lab (Spring-2017).
- **Selected Courses:** Advanced Machine Learning, Massive-MIMO, Networks & Mobile Systems, Internet Architecture and Protocols, Probability and Stochastic Processes.

2012 - 2016 **Bachelors of Technology (B.Tech.)**, *Indian Institute of Technology (IIT Kanpur)*, Kanpur, India.
Major: Electrical Engineering, ***GPA: 9.5 (out of 10)***
- Motorola Gold Medalist: Commencement award for the best all-round performance in Electrical Engineering.
- **Selected Courses:** Wireless Communications, Convex Optimization, Image Processing, Robotics, Data Structures.

Technical Skills

Programming	Python, C, C++
Software	Matlab (CVX), GitHub, Shell scripting, Altium
Systems	5G NR testbed, Wilocity wil6210 60GHz testbed, USRP, WARP, Quantenna

Research

Mar 2022– Ongoing **Multi-user Millimeter-Wave Massive MIMO testbed research**, *with Prof. Dinesh Bharadia*.
- Developing a multi-user beam management scheme for mmWave Massive MIMO links leveraging channel sparsity to get interference-free, high-throughput, and reliable links for all users.

Mar 2022– Ongoing **High Mobility Communication with Doppler estimation and prediction**, *with Prof. Dinesh Bharadia*.
- Working towards low latency Open-RAN architecture to efficiently support high-mobility communication by taking insights from delay-Doppler channel representation.

Aug 2021– Mar 2022 **Flexible and resource-efficient multi-user mmWave networks**, *with Prof. Dinesh Bharadia*.
- Identified a vulnerability in today's mmWave system that they cannot perform frequency multiplexing to support many simultaneous users because the phased array can only illuminate one user direction at a time and bound to stream all frequency bands to that direction.
- Designed and tested a new mmWave front-end phased array architecture that that can split the frequency bands into multiple directions simultaneously, enabling frequency multiplexing and scaling mmWave connectivity to tenfold more users with high throughput.

Sep 2018– Aug 2020 **[Sigcomm'21] Reliable mmWave Links using Multi-beamforming**, *with Prof. Dinesh Bharadia*.
- Developed a 5G NR testbed using USRP X310/X410 and 28GHz phased arrays [mmNets'21 paper].
- Established a wideband (400 MHz) OFDM link and individually characterized each component of the testbed.
- Designed a multi-beam system and beam refinement procedures that exploit multipath components to establish a stable and reliable mmWave connection without any training overhead.
- Our system is 5G NR compliant, uses COTS phased arrays, and achieves 100% reliability in a dynamic environment with mobile users and random blockages.

Jul 2018– Aug 2021 **Wireless Virtual Reality**, *with Prof. Dinesh Bharadia, Prof. Pamela Cosman*.
- Developed a viewport-aware Truncated Square Pyramid (TSP) scheme for 3D to 2D transformation of 360^o videos.
- Analysed trade-off between video quality and bandwidth and developed algorithms to tune a truncation parameter for optimal performance.

Jan–June 2018 **[MS Thesis] Millimeter Wave Blockage Analysis**, *with Prof. Shivendra Panwar*.

- Analyzed the impact of blockage by static buildings, mobile blockers, and self-blockage by the user on mmWave link reliability in an outdoor mmWave environment with macro-diversity (connectivity with multiple base stations).
- Our results indicate that the minimum density of BS required to satisfy the QoS for URLLC applications is mainly driven by reliability and latency constraints, rather than coverage or capacity requirements.

Internship Experience

June–Sep 2022 **VMware**, *Palo Alto, CA, USA*.

Topic: VMWare RAN Intelligent Controller (RIC), *Mentor: Dr. Rakesh Misra*

- I will design intelligent near-real-time applications to improve wireless connectivity in Open-RAN framework.

June–Aug 2017 **Nokia Bell Labs**, *Murray Hill, NJ, USA*.

Topic: Millimeter Wave Beam Training Algorithm Design, *Mentor: Dr. Özge Kaya*

- Developed an adaptive beam training algorithm for mobile multi-user scenario in outdoor mmWave cellular networks.
- Achieved an average of over 60% reduction in beam-steering delay over a sequential search baseline.

Selected Publications

Tier1 Conf. 2022 **IK Jain**, et al "Flexible and resource efficient multi-user mmWave system", *Under submission to a Tier-1 networking conference 2022*.

Mobicom S3 2021 **IK Jain**, R Subbaraman, D Bharadia "Demo and dataset for mmWave multi-beam tracking using mMobile 28 GHz testbed", *Mobicom S3 Workshop 2021*.

Sigcomm 2021 **IK Jain**, R Subbaraman, D Bharadia "Two beams are better than one: Towards Reliable and High Throughput mmWave Links", *SIGCOMM 2021*.

Mobicom mmNets 2020 **IK Jain**, R Subbaraman, TH Sadarahalli, X Shao, H Lin, D Bharadia, "mMobile: Building a mmWave Testbed to Evaluate and Address Mobility Effects", *4th ACM Workshop on Millimeter-Wave Networks and Sensing Systems (Mobicom Workshop - mmNets)*, 2020.

NSDI 2020 R Ayyalasomayajula, A Arun, C Wu, S Rajagopalan, S Ganesaraman, A Seetharaman, **IK Jain**, D Bharadia, "LocAP: Autonomous Millimeter Accurate Mapping of WiFi Infrastructure", *NSDI*, 2020.

JSAC 2018 **IK Jain**, R Kumar, S Panwar, "The Impact of Mobile Blockers on Millimeter Wave Cellular Systems", *IEEE JSAC special issue on URLLC*, 2018.

Volunteer

2021–2022 **Scholar in Residence**, *The Marconi Society*.

Served as a student scholar for facilitating the Marconi Society meetings with the chair Vint Cerf and other prominent scientists, engineers, and policymakers.

2020–2021 **Coordinator, Jacobs Undergraduate Mentorship Program**, *UC San Diego*.

Bridging the communication gap between undergraduates and graduate students at Jacobs School of Engineering.

2019–2021 **Vice President, ECE graduate student council**, *UC San Diego*.

Responsible for providing communication between ECE students and the Council and organizing weekly events such as seminars and coffee hours.

Awards/Honors and Services

- Commencement award for the best graduate student service in ECE, UC San Diego, May 2021.
- Technical Program Committee (TPC), S3 Workshop, Mobicom 2021.
- Organizer, ACM Sigcomm Trivia 2021.
- Reviewer of IEEE Trans. Vehicular Technology (TVT) 2019-20, NCC 2021, Globecom 2021, WCNC 2022, IEEE Access 2021-22, SPAWC 2022.
- Artifact Evaluation Committee, ACM CoNEXT 2019.
- Awarded student travel grant for MobiCom, New Delhi 2018.
- Samuel Morse MS Fellowship (full financial support during MS at NYU) 2016–2018.
- Secured All India Rank 390 (amongst 0.5 million students) in IIT–Joint Entrance Exam 2012.