Ish Kumar Jain

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Research Statement

My research takes a multi-faceted approach to optimize wireless networks. I focus on enhancing throughput and addressing crucial factors such as reliability, low latency, security, and ease of deployment in real world scenarios.

Education

2018 - 2023 **University of California San Diego**, *CA*.
PhD, Electrical and Computer Engineering, *GPA: 4.0*
Advisor: Prof. Dinesh Bharadia

2016 - 2018 **New York University, Tandon School of Engineering**, *NY*.
MS, Electrical and Computer Engineering, *GPA: 3.96*
Advisor: Prof. Shiv Panwar

2012 - 2016 **Indian Institute of Technology (IIT Kanpur)**, *India*.
Bachelors of Technology (B.Tech.), Electrical Engineering, *GPA: 9.5 (out of 10)*

Professional Experience

June–Sep 2022 **VMware**, *Palo Alto, CA, USA*.
Mentor: Dr. Rakesh Misra
- Designed and patented a near-real-time application (xApps) with VMware RIC in Open-RAN framework.

June–Aug 2017 **Nokia Bell Labs**, *Murray Hill, NJ, USA*.
Mentor: Dr. Özge Kaya
- Developed an RL-based beam training algorithm for mmWave links, demonstrating 60% efficiency improvement over a baseline on real-world data.

Awards and Honors

- Best Poster Runner-up, Hotmobile 2023.
- Qualcomm Innovation Fellowship winner 2022-23.
- Winner of 3-minute research talk competition at ACM Mobisys'20, Mobicom'21, Mobicom'22.
- Commencement award for the best graduate student service in ECE, UC San Diego, May 2021.
- Commencement award for the best MS Academic Achievement in ECE, New York University, May 2019.
- Commencement award (Motorola Gold Medalist) for the best all-round performance in Electrical Engineering and Computer Science, IIT Kanpur, May 2016.
- Travel grant for MobiCom, New Delhi 2018, Hotmobile CA 2023, Infocom NY 2023.
- 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.

Publications

IEEE Infocom 2023 mmFlexible: Flexible Directional Frequency Multiplexing for Multi-user mmWave Networks
IK Jain, RR Vennam, R Subbaraman, D Bharadia – Media coverage

IEEE S&P 2023 mmSpoof: Resilient Spoofing of Automotive Millimeter-wave Radars using Reflect Array
IEEE Security and Privacy 2023.
RR Vennam, **IK Jain**, K Bansal, J Orozco, P Shukla, A Ranganathan, D Bharadia

IEEE WPMC 2022 — Delivering 360-degree video with Viewport-adaptive Truncation
International Symposium on Wireless Personal Multimedia Communications (WPMC) 2022.
T Qiu, **IK Jain**, R Wu, P Cosman, D Bharadia

HotCarbon 2022 — Multiple smaller base stations are greener than a single powerful one: Densification of Wireless Cellular Networks, *ACM HotCarbon Workshop 2022*
A Gupta, **IK Jain**, D Bharadia

Sigcomm 2021 — [mmReliable] Two beams are better than one: Towards Reliable and High Throughput mmWave Links
IK Jain, R Subbaraman, D Bharadia – Media coverage

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

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

MDPI Journal 2019 — Extreme Multiclass Classification Criteria, *MDPI Computation Journal*, 2019.
A Choromanska, **IK Jain**

IEEE JSAC 2018 — The Impact of Mobile Blockers on Millimeter Wave Cellular Systems
IEEE Journal on selected areas in communications (JSAC), 2018
IK Jain, R Kumar, S Panwar

IEEE ITC 2018 — Driven by Capacity or Blockage? A Millimeter-wave Blockage Analysis
IEEE International Teletraffic Congress (ITC) 2018
IK Jain, R Kumar, S Panwar – Invited paper

Posters/ Demos

Hotmobile poster 2023 — [Poster] Delay Phased Arrays: Towards programmable beam-bandwidth for 5G networks
IK Jain, RR Vennam, D Bharadia – Best Poster Runner-up

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

MobiCom 2018 — [Poster] Facilitating Low Latency and Reliable VR over Heterogeneous Wireless Networks
A Ravichandran, **I K Jain**, R Hegazy, T Wei, D Bharadia

Patents

US Patent (provisional) — **IK Jain**, et al., inventors. A platform for xApp development with RAN intelligent controller. *Patent pending, contact VMware*

US Patent (provisional) — D Bharadia, **IK Jain**, R Subbaraman, T Sadarahalli, inventors. Enabling Reliable Mmwave Link Using Multi-Beam Pro-Active Tracking. *Patent pending, contact UC San Diego (innovation@ucsd.edu)*

US Patent (granted) — D Bharadia, R Ayyalasomayajula, A Arun, C Wu, S Rajagopalan, S Ganesaraman, A Seetharaman, **IK Jain**, inventors. Enable Indoor Navigation with Context assisted Localization.

Research Experience

Aug 2022–Ongoing — **Sustainable Multi-user Millimeter-Wave systems**, *with Prof. Dinesh Bharadia.*

- Developing a multi-user beam management and sensing scheme to ensure link reliability, avoid interference and guarantee high per-user throughput with power-efficient mmWave systems.

Aug 2021– Aug 2022 **Securing mmWave automotive radars**, *with Prof. Dinesh Bharadia & Prof. Aanjhan Ranganathan*.
- Developed a spoofing attack mechanism targeting automotive radar systems, capable of causing sensor malfunction.
- Designed and built a spoofing device using a mmWave reflect-array and commercially available components.

Aug 2021– Aug 2022 **[Infocom'23] Flexible and low latency multi-user mmWave**, *with Prof. Dinesh Bharadia*.
- Discovered a vulnerability in current mmWave systems, which limits their ability to perform frequency multiplexing for multiple users due to the directional beam only being able to illuminate one user direction at a time.
- Designed a new power-efficient front-end architecture that can split the frequency bands into multiple concurrent directions, enabling flexible frequency multiplexing, low latency, and higher spectrum utilization.

Aug 2018– Aug 2021 **[Sigcomm'21] Reliable mmWave Links using Multi-beamforming**, *with Prof. Dinesh Bharadia*.
- Developed beam management scheme that ensures multiple diverse paths are available to mmWave devices to maintain 100% reliable packet transfer even under random and unpredictable link blockage events.
- Prototyped a 5G standard-compliant mmWave network using USRP X310/X410 and off-the-shelf phased arrays and demonstrated the effectiveness of our scheme.

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 occlusions by mobile blockers 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.

Teaching and Mentoring Experience

Teaching Assistant.

WI 2021,23 ECE 257B- Modern Wireless Communication (Graduate) – best TA 10/10 rating.

Spring 2020 ECE 157B- Communication and Sensing Systems (Undergraduate) – helped design a new class.

Spring 2018 EEGY 9123- Introduction to Machine Learning (Graduate).

Fall 2017 EEUY 4563- Introduction to Machine Learning (Undergraduate) – helped design a new class.

Spring 2017 ELGY 6373- Internet Architecture and Protocols Lab (Graduate).

Mentorship, I mentored two PhD students and 10+ BS/MS students at UC San Diego. I particularly help historically underrepresented and underprivileged students.

Leadership

2021–2022 **The Marconi Society**, *Scholar in Residence*.
Served as a student scholar for facilitating the Marconi Society meetings with the chair Vint Cerf and other prominent scientists, engineers, and policymakers.

2021–2022 **Escribamos Ciencia K12 team**, *UC San Diego*.
Developed interesting science modules and videos for K12 students on topics such as electricity, internet, nuclear power, etc., under guidance of Prof. Olivia Graeve.

2020–2022 **Coordinator, Jacobs Undergraduate Mentorship Program**, *UC San Diego*.
Mentored underprivileged students through lab tours, industry talks, panel discussions, technical workshops, etc., and bridged the communication gap between undergraduates and graduate students.

2020–2021 **O.W.L Reading group**, *Inter-continental collaboration*.
Founded in Fall 2020 as a small group of Ph.D. students interested in research talks and discussion on recent conference papers and has grown over 100+ members in a year.

2019–2021 **Vice President, ECE graduate student council**, *UC San Diego*.
Responsible for providing communication between ECE students and the ECE department and organizing weekly events such as seminars and coffee hours.

Services

2023 **Co-chair**.
ACM Mobicom S3 Workshop 2023

2021 **Technical Program Committee (TPC)**.
ACM Mobicom S3 Workshop 2021
IEEE WCNC 2022

2019–2023 **Technical Reviews**.
IEEE Trans. Vehicular Technology (TVT) 2019-20
National Conference on Communications (India) 2021
IEEE Globecom 2021
IEEE WCNC 2022, 23
IEEE Access 2021-23
IEEE SPAWC 2022
IEEE Comm Letter 2022
IEEE JSAC 2023

2021 **Lead organizer and moderator**.
Sigcomm'21 Social Trivia

2019 **Artifact Evaluation Committee**.
ACM CoNEXT 2019