Kartik Patel

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Interests

Wireless networks: MmWave networks, Cellular and adhoc networks, System design and Prototyping
Learning: Bandits, Online learning, Reinforcement learning, Deep learning

Education

Ph.D., Electrical and Computer Engineering — **The University of Texas at Austin**
Advisors: Robert W. Heath Jr., Sanjay Shakkottai — *August 2017 - May 2024*

M.S., Electrical and Computer Engineering — **The University of Texas at Austin**
GPA: 4.00/4.00 — *August 2017 - May 2020*

B. Tech., Electronics and Communication Engineering — **Indian Institute of Technology Roorkee**
GPA: 9.25/10, Class Rank: 2^{nd} — *July 2013 - May 2017*

Publications

- **K. Patel***, J. Zhang*, I. Kiminos, L. Kampianakis, M. Eggleston, and J. Du, "MAC layer design of multi-static wide area backscatter networks," *Submitted to IEEE Journal of Radio Frequency Identification*
- **K. Patel**, N. J. Myers, and R. W. Heath Jr., "Circulant shift-based beamforming for secure communication with low-resolution phased arrays," *IEEE Transactions on Wireless Communications*, vol. 22, no. 4, pp. 2295–2310, 2023
- I. Tariq, **K. Patel**, T. Novlan, S. Akoum, M. Majmundar, G. de Veciana, and S. Shakkottai, "Bandit learning-based online user clustering and selection for cellular networks," in *In Proc. of IEEE 20th International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks (WiOpt)*, September 2022
- **K. Patel**, N. J. Myers, and R. W. Heath Jr., "Physical layer defense against eavesdropping attacks on low-resolution phased arrays," in *2022 IEEE International Conference on Communications (ICC)*, 2022, pp. 492–497
- Y. Zhang, **K. Patel**, S. Shakkottai, and R. W. Heath Jr., "Side-information-aided noncoherent beam alignment design for millimeter wave systems," in *20th ACM International Symposium on Mobile Ad Hoc Networking and Computing (Mobihoc)*, 2019, pp. 341–350 **(Best Paper Finalist)**
- **K. Patel**, D. Patel, M. López-Benítez, and S. Chaudhary, "Distribution-free spectrum sensing for full duplex cognitive radio," in *2018 IEEE 88th Vehicular Technology Conference (VTC-Fall)*, 2018, pp. 1–5

Industry Experience

Communication Systems Intern, Nokia Bell Labs, New Jersey
Design of a Large-scale Bi-static Backscatter Network and Prototyping — *June-August 2022*

Research Intern, Qualcomm Wireless R&D, San Diego
On MmWave Beam Tracking Algorithm — *June-August 2020*

Research Intern, Cisco Innovation Lab, San Jose
Device Identification based on RF Fingerprints from Raw IQ Signals — *May-August 2019*

Student Developer, GNU Radio, Google Summer of Code 2017
Design of Web-based Display for GNU Radio — *May-August 2017*

Project Assistant, Indian Institute of Science, Bengaluru
Energy Harvesting Wireless Sensor Network design with Bluetooth Low Energy protocol — *May-July 2016*

Selected Projects

Predicting the Performance Impact of Configuration Changes in LTE and 5G Cellular Networks
Collaborators: C. Ge, S. Shakkottai, and A. Mahimkar, Y. Shaqalle from AT&T, New Jersey

- Developed a two-stage framework to predict the performance impact of configuration changes in the cellular networks purely from the dataset.
- Conducted the first real-world empirical causal study of a cellular network without requiring any assumptions on the underlying latents.

Physical Layer Security with Low-resolution MmWave Phased Arrays [Project Page]
Collaborators: N. J. Myers, R. W. Heath Jr.

- Proposed a physical layer defense using the circulant shifting of a beamformer on low-resolution phased arrays.
- Validated proposed defense using a fully configurable 60 GHz mmWave testbed.
- Designed an attack *AirSpy* on a V2I system using an aerial eavesdropper.

User Clustering and Selection in Cellular Network
Collaborators: I. Tariq, S. Shakkottai, and T. Novlan, S. Akoum, M. Majumndar from AT&T Labs

- Proposed a Bandit learning-based theoretically-provable approach to user clustering based on the similarity in channel distribution and the associated rate regions.
- Designed a heuristic-based approach to an online user selection to optimize the network throughput.

Side-information-aided Noncoherent Beam Alignment Design and Prototyping [Project Page]
Collaborators: Yi Zhang, S. Shakkottai, R. W. Heath Jr.

- Designed a side-information-aided channel estimation algorithm using non-coherent measurements.
- Prototyped a fully configurable 60 GHz mmWave testbed with custom phased arrays, USRP, and MATLAB.

Energy Harvesting Wireless Sensor Network design with Bluetooth Low Energy protocol
Supervisors: Neelesh Mehta, Associate Professor, Indian Institute of Science *May - July 2016*

- Worked on designing a sensor network for a specific scenario using a Bluetooth Low Energy (BLE) protocol.
- Developed a BLE protocol module on NS3 [Documentation].

Web-based display for GNURadio - `gr-bokehgui`
GNU Radio, Google Summer of Code 2017 *May - August 2017*

- Implemented the functionality that allows remote web-based interaction with flowgraphs using Bokeh.
- Integrated with GNU Radio companion for convenient use.

Research Talks

- On "Physical Layer Security with Low-resolution MmWave Phased Arrays" in Sabarmati Young Researchers Seminar at IIT Gandhinagar, Gujarat, Sept. 2023.
- On "Bandit learning-based online user clustering and selection for cellular network" (poster) in IEEE ComSoc Summer School on 6G Communication and Wireless Technologies at Northeastern University, Boston, June 2023.
- On "Bandit learning-based online user clustering and selection for cellular network" (poster) in the 2nd 6G@UT Forum at the University of Texas at Austin, May 2022, with Isfar Tariq.
- On "Side-Information-Aided Noncoherent Beam Alignment Design for Millimeter Wave Systems" (poster) in the Texas Wireless Summit 2019 at the University of Texas at Austin, November 2019, with Yi Zhang.

Teaching Experience

- *Probability and Stochastic Processes I* by Prof. Gustavo de Veciana at UT Austin, Fall 2018, Eval. 4.6/5
- *Digital Logic Design* by Dr. Brijesh Kumar at IIT Roorkee, Spring 2017.

Awards

- Selected for IEEE ComSoc Summer School 2023 at Northeastern University, Boston with a full scholarship.
- Finalist for the best paper award in ACM MobiHoc 2019.
- Student travel grant for attending ACM MobiHoc 2019.
- Department Rank 2 among 76 students in ECE Department, IIT Roorkee.
- Won *IIT Roorkee Heritage Excellence Award* for two consecutive years.
- Ranked in the top 1% students of the country in JEE-Advance 2013.

Computer skills

Programming Languages: C, C++, Python, Java **Softwares**: MATLAB, GNU Radio, NS3, CMake

Relevant Courses

Communication and Networks: Space-Time Communication, Wireless Communications Laboratory, Analysis and Design of Communication Network, Wireless Networks, Coding Theory, Advance Digital Communications

Machine Learning and Probability: Online Learning, Reinforcement Learning, Large Scale Optimization, Advanced Probability: Inference and Networks, Special Topics on Unsupervised Learning, Probability and Stochastic Processes

Service

Reviewer: IEEE Open Journal of Communications Society; IEEE Wireless Communications Letters; IEEE ICC, Globecom 2023; IEEE PIMRC, Globecom 2022; IEEE VTC-Spring 2020

Committees: Departmental UG-Curriculum Revision Committee, Dept. of Elec. and Commun. Engineering, IIT Roorkee, 2020; Department Student Committee, Dept. of Elec. and Commun. Engineering, IIT Roorkee, 2015-17.

Volunteer: IEEE WCNC 2022, Austin; 6G@UT 2021, 2022; Texas Wireless Summit 2017-19; IEEE SPCOM 2016, Bengaluru

Extra Curriculars

Student Chair

IEEE Student Chapter, IIT Roorkee *2014-2017*

- Coordinated Special Interest Groups, workshops, guest lectures and internship programs for undergraduate students.
- Initiated a Sixth Sense Lecture Series to explain fundamental concepts like information theory, transforms and linear algebra in intuitive manner.

Chief Technical Lead, Information Management Group

Institute Computer Center, IIT Roorkee *2014-2017*

- Responsible for maintaining the full stack of institute's intranet and internet services and datacenters.
- Initiated fundamental changes in server workflows based on network traffic to optimize the use of servers and reduce the communication between servers and databases.