CHIRAG R RAO

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Education

Massachusetts Institute of Technology   **Cambridge MA**
Ph.D. Communications and Networking   *2022-Present*
Laboratory for Information and Decision Systems (LIDS)

Massachusetts Institute of Technology   **Cambridge MA**
S.M. Aeronautics and Astronautics   *2020-2022*
Thesis: Age of information for broadcast and collection in spatially distributed wireless networks
Advisor: Prof. Eytan Modiano

Johns Hopkins University   **Baltimore MD**
M.S. Computer Science   *2015-2018*

Cornell University   **Ithaca NY**
B.S. Electrical and Computer Engineering   *2009-2013*

Industry and Research Experience

Massachusetts Institute of Technology   **Cambridge MA**
PhD Student   *2022–present*
Currently investigating problems in networks and communication using probability, optimization, and learning

- Solved an integer linear programming problem to optimize latency in Low Earth Orbit satellite network topologies
- Conducted rigorous simulation and mathematical modeling of a vehicular routing problem to minimize information staleness
- Established upper and lower bounds on information freshness in wireless network broadcast/collection (published in INFOCOM 2023)

DEVCOM Army Research Laboratory   **Adelphi MD**
Computer Engineer   *2013–present*
Focused on experimental research in wireless communication

- Collaborated with engineers to implement a distributed beamforming system with software-defined radios
- Integrated software-defined radios with ground robots to publish channel state information to the Robot Operating System
- Conducted experimentation with ground robots to characterize communication at the low-VHF Radio Frequency band (published in IEEE Transactions on Antennas and Propagation)
- Demonstrated utility of low-VHF band by implementing a digital video streaming platform to wirelessly transmit/receive data (published in IEEE VTC 2019)
- Simulated Loosely-Synchronous code re-use to scale wireless networks implementing QS-CDMA (published in IEEE PIMRC 2018)

Graduate Level Coursework

o **Probability/Statistics**: Fundamentals of Probability, Inference and Information, Algorithms for Inference
o **Optimization/ML**: Machine Learning, Optimization Methods, Reinforcement Learning
o **Networking**: Data Communication Networks, Statistical Communication and Localization Theory

Select Publications

Refereed Journal Publications..

Z. Zhao, G. Verma, **C. R. Rao**, A. Swami, and S. Segarra, "Link scheduling using graph neural networks," *IEEE Transactions on Wireless Communications*, vol. 22, no. 6, pp. 3997–4012, 2023.

F. T. Dagefu, G. Verma, **C. R. Rao**, L. Y. Paul, J. R. Fink, B. M. Sadler, and K. Sarabandi, "Short-range low-vhf channel characterization in cluttered environments," *IEEE Transactions on Antennas and Propagation*, vol. 63, no. 6, pp. 2719–2727, 2015.

Refereed Conference Publications...

C. R. Rao and E. Modiano, "Age of broadcast and collection in spatially distributed wireless networks," in *IEEE INFOCOM 2023-IEEE Conference on Computer Communications*, pp. 1–10, IEEE, 2023.

A. Kumar, G. Verma, **C. R. Rao**, A. Swami, and S. Segarra, "Adaptive contention window design using deep q-learning," in *ICASSP 2021-2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 4950–4954, IEEE, 2021.

J. Choi, **C. R. Rao**, and F. T. Dagefu, "Real-Time Digital Video Streaming at Low-VHF for Compact Autonomous Agents in Complex Scenes," pp. 1–5, Institute of Electrical and Electronics Engineers (IEEE), 2019.

C. R. Rao, F. Dagefu, P. Spasojević, and G. Verma, "Node recruitment in Loosely-Synchronized scalable networks with sporadic transmission (poster)," in *2019 22nd International Conference on Information Fusion (FUSION) (FUSION 2019)*, (Ottawa, Canada), 2019.

F. T. Dagefu, J. N. Twigg, **C. R. Rao**, and B. M. Sadler, "Directional communication enabled by mobile parasitic elements," in *2019 International Conference on Military Communications and Information Systems (ICMCIS)*, pp. 1–7, 2019.

C. R. Rao, F. T. Dagefu, G. Verma, P. Spasojević, and B. M. Sadler, "Scalable sporadic medium access for complex propagation environments," in *2018 IEEE 29th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)*, pp. 1–7, IEEE, 2018.

Technical Reports..

L. Sadler, **C. R. Rao**, J. Rogers, and H. Nguyen, "Rostojausbridge manual," Tech. Rep. ADA559379, U.S. Army Research Laboratory, 2012.

Technical skills

Optimization: CVX, Gurobi	**Data Management**: SQL, Hadoop, Spark
Analysis & Simulation: Matlab, Jupyter	**Python**: PyTorch, Scikit-learn
Tools: Bash, Docker, Git, Linux	**Languages**: C++, Matlab, Java, LaTeX, Julia
Robotics: Robot Operating System, Rviz	**Software-Defined Radio**: GNU Radio, UHD

Teaching Experience

Top Score Education   **Washington DC**
Professional Tutor   *2018–present*

- Taught advanced STEM topics including calculus and physics as well as the SAT and ACT exams
- Managed client relationships with students and parents, providing guidance and weekly progress reports

Massachusetts Institute of Technology   **Cambridge MA**
Teaching Assistant   *2023*
16.36 Communication Systems and Networks

- Conducted weekly office hours, covering fundamental topics in communication system design and networking including modulation, source and channel coding, and packet routing
- Developed and graded weekly problem sets
- Rated 7/7 by students in the subject evaluation report

Cornell University   **Ithaca NY**
Academic Excellence Workshop Facilitator   *2011–2012*
A College of Engineering initiative to provide students with optional supplementary math courses

- Instructed undergraduate engineers in linear algebra, differential equations, and multivariate calculus
- Organized class activities that encouraged students to learn the class material collaboratively

Awards & Leadership

- Received the Science, Mathematics, and Research for Transformation (SMART) full-tuition merit scholarship awarded by the US Department of Defense, 2021
- Received the Best Paper Award of the 2019 ICMCIS Conference
- President of Cornell University Eta Kappa Nu (HKN) Electrical Engineering Honor Society
- Member of Cornell University Tau Beta Pi Engineering Honor Society

Activities & Community Service

Community Tax Aid, Inc.   **Washington DC**
Tax Reviewer   *2014–2019*
Volunteered to prepare taxes and consult for low-income households in the Washington DC metropolitan area

- Managed and advised volunteer tax preparers to ensure quality preparation of over 400 returns
- Prepared tax returns for over 60 households per year as an IRS Certified Advanced Tax Preparer
- Counseled clients in English and Spanish on tax-related topics and personal finance

South Asian Performing Arts Network   **Washington DC**
Resident Dancer & Actor   *2018–2021*
Performed South Asian dance and theater pieces in venues across the Washington DC metropolitan area

Languages

Native Proficiency: English, Kannada   **Limited Working Proficiency**: Spanish, Hindi

Other

- **Invited Reviewer**: IEEE Internet of Things Journal
- **Committee Member**: LIDS Socials Committee (Present), IDSS Student Council (Present), LIDS Student Conference Committee (2021-2022)