

Igor Kadota

Columbia University, Department of Electrical Engineering, office: CEPSR 801
Email: igor.kadota@columbia.edu Web: www.igorkadota.com

Research Interests

Theory: network modelling and optimization, scheduling algorithms with performance guarantees, multi-armed bandits, Lyapunov optimization, renewal theory, stochastic coupling, machine learning, and regret analysis.

Systems: design and implementation of ultra-low latency wireless networks, 5G networks, Internet-of-Things (IoT), Smart-Cities, full-duplex wireless, millimeter-wave systems, spectrum sharing, and Software Defined Radios (SDR).

Education

- 2016–2020 **Massachusetts Institute of Technology (MIT), USA**
Ph.D. in Communication Networks from MIT LIDS (affiliated with MIT IDSS)
Thesis: Age of Information in Wireless Networks - Theory and Implementation
Advisor: Prof. Eytan Modiano
Committee: Prof. Mohammad Alizadeh, Prof. Mor Harchol-Balter, Prof. Yin Sun, and Prof. Moe Win
- 2014–2016 **Massachusetts Institute of Technology, USA**
S.M. in Communication Networks from MIT LIDS
Thesis: Transmission Scheduling of Periodic Real-Time Traffic in Wireless Networks
Advisor: Prof. Eytan Modiano
- 2011–2013 **Technological Institute of Aeronautics (ITA), Brazil**
S.M. in Telecommunications
Thesis: Kalman Filtering - Estimate of the Numbers of Active Queues in an 802.11e EDCA WLAN
Advisor: Prof. Alessandro Anzaloni
- 2005–2010 **Technological Institute of Aeronautics, Brazil**
B.Sc. in Electrical Engineering

Work Experience in Industry

- 2013–2014 **R&D Network Engineer**, Mectron - Defense and Technology, Brazil
- Optimized network layer and data link layer algorithms for a Mobile Ad-hoc NETWORK (MANET) using cross-layer techniques. Collaborated with the Radio Frequency (RF) and the Application teams.

Research Experience

- 2020–Present **Postdoctoral Research Scientist**, Columbia University, USA
Department of Electrical Engineering (and affiliated with the Data Science Institute)
- **Develops network control algorithms** for emerging wireless technologies (in particular *mmWave*, *full-duplex*, and *spectrum sharing*) using theory-based and data-driven approaches;
 - **Implements these algorithms** in the NSF PAWR COSMOS *city-scale wireless testbed* in order to evaluate their performance in supporting ML-based applications such as *Smart-Cities* and *IoT* which are sensitive to latency, throughput, and information freshness.
- 2014–2020 **Graduate Research Assistant**, MIT LIDS, USA
- **Developed network control algorithms** with provable performance guarantees (in terms of latency, throughput, and/or information freshness) for wireless networks that carry time-sensitive information using tools such as reinforcement learning, multi-armed bandits, Lyapunov optimization, renewal theory, and stochastic coupling. Papers based on this research received the Best Paper Award at IEEE INFOCOM 2018 and the Best Paper Award Finalist at ACM MobiHoc 2019;
 - **Built a SDR wireless testbed from the ground up.** The testbed was composed of 11 state-of-the-art SDRs, 25 Raspberry Pis, and 3 powerful GPU workstations. Selected and purchased the equipment, assembled the testbed, and implemented my novel network control algorithms.

Awards

- 2020 **MIT School of Engineering (SoE) Graduate Student Extraordinary Teaching and Mentoring Award** given annually by the MIT SoE to a single graduate student in "recognition of demonstrated extraordinary teaching and mentoring efforts as a teaching or research assistant".
- 2019–2020 **Thomas G. Stockham Jr. Fellowship** awarded annually by the MIT SoE to a single graduate student in "recognition of outstanding academic record, exceptional background, and promising future."
- 2019 **Best Paper Award Finalist at ACM MobiHoc 2019** among 156 paper submissions.
- 2018 **Best Paper Award Winner at IEEE INFOCOM 2018** among 1,606 paper submissions. This work was featured at MIT News, ACM TechNews, Science Daily, Campus Technology, etc.
- 2018 **MIT AeroAstro Graduate Teaching Assistantship Award** given annually by the MIT Department of Aeronautics and Astronautics to a single graduate student "who has demonstrated conspicuous dedication and skill in helping fulfill a subject's educational objectives."
- 2017 & 2020 Two **Best Presentation Awards** at the MIT LIDS Student Conference in 2017 and in 2020.
- 2011–2013 **CAPES Fellowship** from the Brazilian federal agency throughout the SM in ITA.
- 2010 **Best Senior Thesis** of the Department of Electrical Engineering of ITA in 2010. This senior thesis was developed in collaboration with researchers from *University of Rome - La Sapienza* and led to the journal publication in [J8].

Mentoring and Teaching

- 2017–Present **Directly supervised the work of 10+ MEng and undergraduate students** both at MIT and Columbia University. Two of these students have graduated from MIT and are now pursuing a PhD degree: Lilly Clark (USC) and Lisa Zahray (Georgia Tech).
- 2016–2019 **Gave multiple lectures** for graduate and undergraduate students as part of the MIT courses: 16.363 Communication Systems & Networks and 6.263 Data-Communication Networks.
- Spring 2017 **Created a Teaching Radio Laboratory** (from the ground up) for the MIT course Communication Systems & Networks to complement the theoretical lectures with hands-on experiments. Selected and purchased 16 teaching SDRs, and designed 5 customized experiments that closely follow the lectures.
- Spring 2019 **Teaching Assistant (TA) for the Radio Lab**, Communication Systems & Networks, MIT
- Spring 2018
 - Conducted the laboratory, developed laboratory scripts, and graded assignments;
- Spring 2017
 - Student evaluation of the TA was (on average) 6.9 out of 7.0;
 - Received the **MIT TA award of 2018** for creating and conducting the Radio Lab;
 - Received the **MIT SoE Teaching and Mentoring award of 2020**.
- Summer 2017 Completed the **Kaufman Teaching Certificate Program** offered by the Teaching and Learning Lab at MIT. Some of the topics were: Designing a Course and Constructing a Syllabus, Interactive Teaching & Active Learning, and Teaching Inclusively.
- Spring 2016 **Teaching Assistant**, Communication Systems & Networks, MIT
 - Held weekly office hours, offered exam review sessions, and assisted in the design of problem sets and exams. Student evaluation of the TA was 6.9 out of 7.0.
- 2011–2012 **Math Teacher**, Brazilian local government
 - Prepared and delivered weekly classes for a talented class of underprivileged middle school students.

Conference Publications

Citations: Total number of citations is 892, the most cited publication has 240 citations, and the average number of citations per publication is 46.9 (source: Google Scholar on 11/24/2021).

- [C1] **I. Kadota**, M. S. Rahman, and E. Modiano, "WiFresh: Age-of-Information from Theory to Implementation," to appear in Proc. of IEEE ICCCN, 2021. [Invited paper]
- [C2] E. Atay, **I. Kadota**, and E. Modiano, "Aging Wireless Bandits: Regret Analysis and Order-Optimal Learning Algorithm," to appear in Proc. of WiOpt, 2021.

- [C3] **I. Kadota** and E. Modiano, “Age of Information in Random Access Networks with Stochastic Arrivals,” to appear in Proc. of IEEE INFOCOM, 2021. **[Acceptance rate 19.9% (252/1,266)]**
- [C4] D. Stojadinovic, P. Netalkar, C. Bastidas, **I. Kadota**, G. Zussman, I. Seskar, and D. Raychaudhuri, “A Spectrum Consumption Model-based Framework for DSA Experimentation on the COSMOS Testbed,” to appear in Proc. of ACM MobiCom WiNTECH Workshop, 2021.
- [C5] A. Nagulu, S. Garikapati, M. Essawy, **I. Kadota**, T. Chen, A. Natarajan, G. Zussman, and H. Krishnaswamy, “Full-Duplex Receiver with Wideband Multi-Domain FIR Cancellation Based on Stacked-Capacitor, N-path Switched-Capacitor Delay Lines Achieving $>+54$ dB SIC Across 80MHz BW and $>+15$ dBm TX Power Handling,” to appear in Proc. of IEEE ISSCC, 2021.
- [C6] **I. Kadota**, M. S. Rahman and E. Modiano, “Poster: Age of Information in Wireless Networks: from Theory to Implementation”, in Proc. of ACM MobiCom, Sept. 2020, pp. 1–3.
- [C7] **I. Kadota** and E. Modiano, “Minimizing the Age of Information in Wireless Networks with Stochastic Arrivals,” in Proc. of ACM MobiHoc, July 2019, pp. 221–230. **[Best Paper Award Finalist] [Acceptance rate 23.7% (37/156)]**
- [C8] R. Talak, **I. Kadota**, S. Karaman and E. Modiano, “Scheduling Policies for Age Minimization in Wireless Networks with Unknown Channel State,” in Proc. of IEEE ISIT, June 2018, pp. 2564–2568.
- [C9] **I. Kadota**, A. Sinha, E. Modiano, “Optimizing Age of Information in Wireless Networks with Throughput Constraints,” in Proc. of IEEE INFOCOM, April 2018, pp. 1844–1852. **[Best Paper Award Winner] [Acceptance rate 19.2% (308/1,606)]**
- [C10] **I. Kadota**, E. Uysal-Biyikoglu, R. Singh and E. Modiano, “Minimizing Age of Information in Broadcast Wireless Networks,” in Proc. of IEEE Allerton, Sept. 2016, pp. 844–851.
- [C11] K. Kim, C. Li, **I. Kadota** and E. Modiano, “Optimal Scheduling of Real-Time Traffic in Wireless Networks with Delayed Feedback,” in Proc. of IEEE Allerton, Sept. 2015, pp. 1143–1149.

Journal, Theses, and Book

- [J1] T. Chen, S. Garikapati, A. Nagulu, A. Gaonkar, M. Kohli, **I. Kadota**, H. Krishnaswamy, and G. Zussman. “A Survey and Quantitative Evaluation of Integrated Circuit-based Antenna Interfaces and Self-Interference Cancellers for Full-Duplex,” to appear in IEEE Open Journal of the Communications Society, Special issue on Full-Duplex Transceivers for Future Networks: Theory and Techniques, 2021.
- [J2] **I. Kadota** and E. Modiano, “Minimizing the Age of Information in Wireless Networks with Stochastic Arrivals,” IEEE Transactions on Mobile Computing, vol. 20, no. 3, pp. 1173–1185, Mar. 2021.
- [J3] **I. Kadota**, “Age of Information in Wireless Networks: Theory and Implementation,” PhD thesis, Dept. of Aeronautics and Astronautics, MIT, Sept. 2020.
- [J4] **I. Kadota**, A. Sinha and E. Modiano, “Scheduling Algorithms for Optimizing Age of Information in Wireless Networks with Throughput Constraints,” IEEE/ACM Transactions on Networking, vol. 27, no. 4, pp. 1359–1372, Aug. 2019.
- [J5] Y. Sun, **I. Kadota**, R. Talak and E. Modiano, *Age of Information: A New Metric for Information Freshness*. Morgan & Claypool, 2019. **[Book]**
- [J6] **I. Kadota**, A. Sinha, E. Uysal-Biyikoglu, R. Singh and E. Modiano, “Scheduling Policies for Minimizing Age of Information in Broadcast Wireless Networks,” IEEE/ACM Transactions on Networking, vol. 26, no. 6, pp. 2637–2650, Dec. 2018.
- [J7] **I. Kadota**, “Transmission Scheduling of Periodic Real-Time Traffic in Wireless Networks,” SM thesis, Dept. of Aeronautics and Astronautics, MIT, Sept. 2016.
- [J8] **I. Kadota**, A. Baiocchi and A. Anzaloni, “Kalman Filtering: Estimate of the Numbers of Active Queues in an 802.11e EDCA WLAN,” Elsevier Computer Communications, vol. 39, pp. 54–64, Feb. 2014.

Under Review

- [R1] **I. Kadota**, D. Jacoby, H. Messer, G. Zussman, and J. Ostrometzky, "Switching in the Rain: Predictive Wireless x-haul Network Reconfiguration," Submitted to IEEE Transactions on Wireless Communications, 2021.
- [R2] P. Netalkar, A. Zahabee, C. Bastidas, D. Stojadinovic, **I. Kadota**, G. Zussman, I. Seskar, D. Raychaudhuri, "Large-Scale Dynamic Spectrum Access with Spectrum Consumption Models," Submitted to Proc. of IEEE ICC, 2021.

Talks

- 2021 Aging Wireless Bandits: Regret Analysis and Order-Optimal Learning Algorithm
 - Talk at WiOpt
- 2021 Age of Information in Random Access Networks with Stochastic Arrivals
 - Talk at IEEE INFOCOM
- 2021 Wireless Networks for Emerging Time-Sensitive Applications: Theory and Systems
 - Invited talk at Yale, hosted by Prof. Steve Morse
- 2019–2021 WiFresh: Age-of-Information from Theory to Implementation
 - Talk at IEEE ICCCN, 2021
 - Invited talk at MIT LIDS Student Conference, 2020 **[Best Presentation Award]**
 - Invited talk at UPenn, hosted by Prof. Shirin Bidokhti, 2020
 - Invited talk at Harvard ISS Seminar, hosted by Prof. Flavio du Pin Calmon, 2019
 - Invited talk at WPI ECE Graduate Seminar, hosted by Prof. D. Richard Brown, 2019
 - Invited talk at MIT, hosted by the Society for Applied and Industrial Mathematics, 2019
- 2016 & 2020 Index Policies: Gittins and Whittle Indices
 - Invited talk at CMU SQUALL Seminar, hosted by Prof. Mor Harchol-Balter, 2020
 - Tutorial at MIT CNRG group meeting, hosted by Prof. Eytan Modiano, 2016
- 2020 Age-of-Information in Wireless Networks: Theory and Implementation
 - MIT PhD doctoral thesis defense
- 2019 Minimizing the Age of Information in Wireless Networks with Stochastic Arrivals
 - Talk at ACM MobiHoc
- 2017 & 2018 Optimizing Age of Information in Wireless Networks with Throughput Constraints
 - Talk at IEEE INFOCOM, 2018
 - Invited talk at CMU SQUALL Seminar, hosted by Prof. Mor Harchol-Balter, 2017
- 2017 Minimizing Age of Information in Broadcast Wireless Networks
 - Talk at MIT LIDS Student Conference **[Best Presentation Award]**
- 2017 Lyapunov Optimization applied to the Age of Information minimization problem
 - Invited Talk at MIT LIDS Tea Talk
- 2015 Optimal Scheduling of Real-Time Traffic in Wireless Networks with Delayed Feedback
 - Talk at IEEE Allerton

Service

- 2019–2021 Technical Program Committee (TPC) Member:
 - WiOpt
 - IEEE INFOCOM Workshop on AoI
 - IEEE Globecom Workshop on experimental wireless platforms and testbeds
 - IEEE VTC

- 2016–2021 Reviewed 100+ papers and articles for 15+ journals, magazines, and conferences in the field, including:
- IEEE/ACM Transactions on Networking
 - IEEE Transactions on Information Theory
 - IEEE Transactions on Mobile Computing
 - IEEE Transactions on Communications
 - IEEE Transactions on Wireless Communications
 - IEEE Internet of Things Journal
 - Journal of Communications and Networks
 - IEEE Journal on Selected Areas in Communications
 - IEEE Network Magazine
 - IEEE Wireless Communications Letters
 - IEEE Communications Letters
 - IEEE Networking Letters
 - IEEE INFOCOM Workshop
 - IEEE ISIT
 - IEEE Vehicular Technology Conference
 - IFIP Performance
 - ACM SIGMETRICS
 - IEEE ICC: Communication Theory Symposium
- 2014–2020 Served in multiple committees, one or two per term, during the PhD at MIT:
- Co-Chair of the MIT Westgate Executive Committee, 2019-2020
 - Co-Chair of the MIT LIDS Social Committee, twice, 2014-2015 & 2018-2019
 - Member of the MIT LIDS Mentoring Committee, twice, 2017-2019
 - Co-Chair of the MIT LIDS Student Conference, 2017-2018
 - Host of MIT Ashdown's monthly roundtable discussions, twice, 2015-2017