

VIJAY G. SUBRAMANIAN

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EDUCATION

Ph.D. Electrical Engineering, University of Illinois at Urbana-Champaign – October 1999.

Dissertation: Broadband Fading Channels: Signal Burstiness and Capacity.

Master of Science (Engineering) (M.Sc.(Eng)), Electrical Communication Engineering, Indian Institute of Science (IISc), Bangalore, India – October 1995.

Bachelor of Technology (B.Tech.), Electronics and Communication, Indian Institute of Technology (IIT), Madras, India – July 1993.

AREAS OF EXPERTISE

Social networks & network science, Economics & game theory, Cloud Computing, Optimization, Statistics & mathematics, Networks, Wireless systems, Algorithms, Learning, Stochastic control

PROFESSIONAL EXPERIENCE

ACADEMIC EMPLOYMENT

- **Associate Professor**, Electrical Engineering & Computer Science Dept, University of Michigan, Ann Arbor, MI, USA. *Sept 2014–present.*
- **Research Assistant Professor**, Electrical Engineering & Computer Science Dept, Northwestern University, Evanston, IL, USA. *Nov 2011–Aug 2014.*
- **Senior Research Associate**, Electrical Engr. & Computer Science Dept, Northwestern University, Evanston, IL, USA. *Nov 2010–Oct 2011.*
- **Research Fellow**, Hamilton Institute, National University of Ireland, Maynooth, Co. Kildare, Ireland. *May 2006–Nov 2010.*

INDUSTRIAL EMPLOYMENT

- **Distinguished Member of Technical Staff**, Performance Analysis and Availability Department, Networks Business, Motorola Inc., Arlington Heights, IL, USA. *Oct 2004–May 2006.*
- **Senior Staff Engineer**, Mathematics of Communication Networks, Global Telecommunications Solutions Sector, Motorola Inc., Arlington Heights, IL, USA. *Jan 2001–Sept 2004.*
- **Lead Engineer**, Mathematics of Communication Networks, Global Telecommunications Solutions Sector, Motorola Inc., Arlington Heights, IL, USA. *Nov 1999–Dec 2000.*

CONSULTANCY

- **Visiting Professor**, Nokia Solutions Networks, Arlington Heights, IL. *July–Dec 2014.*
- **Visiting Professor**, NJRC, QFT, Qualcomm, Bedminister, NJ. *July–Dec 2013.*
- **Visiting Professor**, NJRC, QFT, Qualcomm, Bedminister, NJ. *July–Dec 2012.*

HONORARY POSITIONS

- **Adjunct Associate Research Professor**, Coordinated Sciences Laboratory, University of Illinois at Urbana-Champaign, Urbana, IL, USA. *Aug 2022–Aug 2024*.
- **Adjunct Assistant Professor**, Electrical Engr. & Computer Science Dept, Northwestern University, Evanston, IL, USA. *Sep 2014–Aug 2018*.
- **Visiting Researcher**, Laboratory for Information & Decision Sciences (LIDS), Massachusetts Institute of Technology, Cambridge, MA, USA. *Aug–Nov 2010*.

RESEARCH GRANTS

ACTIVE:

- NSF CPS: Medium: Collaborative Research: Empowering prosumers in electricity markets through market design and learning (Co-PIs S. Shakkottai, L. Xie & S. Bose), USD 300,000.00 (Total USD 1,200,000.00), Sept. 2020-present.
- NSF CIF: AF: Small: A Perturbed Markov Chains Approach to Studying Centrality, Mixing and Reinforcement Learning, USD 350,555.00, July 2020-present.
- NSF CNS Core: Medium: Collaborative Research: Learning to Cache and Caching to Learn in High Performance Caching Systems (Co-PIs S. Shakkottai, D. Kalathil & M. Alizadeh), USD 175,000.00 (Total USD 700,000.00), Oct. 2020-present.
- DARPA: Digitally Assisted CMOS Relaxation Oscillator based Quantum-inspired computing (DACROQ) (Lead PI M. Flynn & Co-PI Z. Zhang), Awarded to date USD 83,666.00 (Total to date USD 653,805.00), Jan. 2023-present.
- NSF CPS: Medium: Collaborative Research: CPS Medium: Developing Data-driven Robustness and Safety from Single Agent Settings to Stochastic Dynamic Teams: Theory and Applications, (Co-PIs L. Ying, Y. Yin, D. Mukherjee & S.T. Maguluri), USD 160,000.00 (Total USD 480,000.00), June 2023-present.
- ONR: MURI: New Game Theory for New Agents: Foundations and Learning Algorithms for Decision-Making Mixed-Agents, (Co-PIs D. Bergemann, A. Blum, R. Jain, E. Mossel, M. Tambe, O. Tamuz & E. Tardos), USD 2,238,000.00 (Total USD 7,500,000.00), Processing Award, May 2024-Apr. 2029.

COMPLETED:

- NSF CNS Core: Medium: Collaborative Research: Learning to Cache and Caching to Learn in High Performance Caching Systems (Co-PIs S. Shakkottai, D. Kalathil & M. Alizadeh), USD 175,000.00 (Total USD 700,000.00), Oct 2020-Sept 2023.
- NSF SES EARS-Market Structures for Efficient Spectrum Sharing (Co-PIs R. Berry, M. Honig & R. Vohra), USD 35,372.25 (Total USD 141,489.00), Aug 2012-July 2013.
- NSF IIS III: Inferring first movers in large-scale socio-technical networks (Co-PI R. Berry), USD 250,000.00 (Total USD 500,000.00), Aug 2012-Aug 2017.
- NSF EARS: Collaborative Research: Creating an Ecosystem for Enhanced Spectrum Utilization Through Dynamic Market Mechanisms, (Co-PIs S. Shakkottai & T. Nguyen), USD 239,198.00; Sept 2014-Aug 2018.
- NSF EARS: Spectrum Sharing in the Shadow of Uncertainty: Risk, Incentives and Investment, (Co-PIs R. Berry, M. Honig & R. Vohra), USD 300,000.00 (Total USD 1,200,000.00), Sept 2013-Aug 2018.
- Mcity Tailored Project LGE: Efficient scheduling and resource allocation over heterogeneous interfaces for cooperative connected vehicles, USD 83,000.00; July 2018-June 2019.

- NSF ECCS: A control-theoretic framework for analysis and design of networked systems with strategic agents via structured strategies, (Co-PI A. Anastasopoulos), USD 200,000.00 (Total USD 400,000.00); Sept 2016-Aug 2020.
- MIDAS Sponsorship Funds, General Dynamics, USD 50,000.00; May 2020-Dec 2020.
- DiDi ChuXing Right-Time, Right-Place: A Reinforcement LEarning Approach for Idle-Car Repositioning (Co-PIs L. Ying & M. Liu), USD 33,333.00 (Total USD 100,000.00), Aug 2020-July 2021.
- M-CUBED Phase 3 Fast Misinformation Detection and Intervention in Online Social Networks (Co-PIs L. Ying & Y. Orhun), USD 20,000.00 (Total USD 60,000.00), May 2020-Dec 2021.

CONFERENCE ORGANIZATION GRANTS

- NSF: The 6th Midwest Workshop on Control and Game Theory, USD 12,000.00, April 2017.
- Univ. of Michigan sources: The 6th Midwest Workshop on Control and Game Theory, USD 42,000.00, April 2017.

TRAVEL GRANTS

- Science Foundation of Ireland Short-Term Travel Fellowship 2009 - Euros 11,090.43 for a 3 month research visit to LIDS, MIT in 2010.

PUBLICATIONS

BOOK CHAPTERS:

1. J. Huang, V. G. Subramanian, R. Berry and R. Agrawal, "Scheduling and resource allocation in OFDMA wireless systems," Book Chapter in *Orthogonal Frequency Division Multiple Access, Auerbach Publications*, CRC Press, April 2010.

ARTICLES IN REFEREED JOURNALS:

1. Khan N, Moharrami M, Subramanian VG. "Rarest-First with Probabilistic-Mode-Suppression (RFw-PMS)." *IEEE Transactions on Information Theory*. 2024 Feb 13.
2. Cohen A, Subramanian V, Zhang Y. "Learning-based optimal admission control in a single-server queuing system." *Stochastic Systems*. 2024 Jan 5.
3. Kao H, Subramanian V. "Localization and approximations for distributed non-convex optimization." *Journal of Optimization Theory and Applications*. 2023 Nov 10:1-38.
4. Moharrami M, Subramanian V, Liu M, Sundaresan R. "The Erlang weighted tree, a new branching process." *Random Structures & Algorithms*. 2023 Oct.
5. D. Tang, H. Tavafoghi, V. G. Subramanian, A. Nayyar and D. Teneketzis, "Dynamic Games among Teams with Delayed Intra-Team Information Sharing," *Dynamic Games And Applications, Special Volume on Multi-agent Dynamic Decision Making and Learning*, 13, 353–411 (2023).
6. Helou, R. E., Lee, K., Wu, D., Xie, L., Shakkottai, S., and Subramanian, V., "OpenGridGym: An Open-Source AI-Friendly Toolkit for Distribution Market Simulation," *IEEE Transactions on Smart Grid*, Oct 2022.
7. D. Vial and V. G. Subramanian, "Local non-Bayesian social learning with stubborn agents," *accepted to IEEE Transactions on Control of Network Systems, Special Issue on Dynamics and Behaviors in Social Networks*, Jan 2022.
8. D. Vial and V. Subramanian, "Empirical Policy Evaluation with Supergraphs," *IEEE Journal on Selected Areas in Information Theory* "Sequential, active, and reinforcement learning," 2 (2), 641-651, 2021.

9. C. Chen, R. Berry, M. Honig and V. Subramanian, "Pricing, Bandwidth Allocation and Service Competition in Heterogeneous Wireless Networks," *IEEE/ACM Trans. on Networking*, accepted, May 2020.
10. C. Chen, R. Berry, M. Honig and V. Subramanian, "Bandwidth optimization in HetNets with unlicensed access," *IEEE Journal on Special Areas in Communication (JSAC)*, Special Issue on Smart Data Pricing, Aug 2020.
11. R. Berry, M. Honig, T. Nguyen, V. Subramanian and R. Vohra, "The Value of Sharing Intermittent Spectrum," *Management Science*, May 2020.
12. D. Vial and V. Subramanian, "On the role of clustering in Personalized PageRank estimation," *ACM Trans. Model. Perform. Eval. Comput. Syst. (ACM TOMPECS)*, Dec 2019.
13. B. Xia, S. Shakkottai and V. Subramanian, "Small-Scale Markets for a Bilateral Energy Sharing Economy," *IEEE Transactions on Control of Network Systems (TCNS)*, Special Issue on Analysis, Control and Optimization of Energy System Networks, October 2019.
14. D. Vial and V. Subramanian, "A structural result for Personalized PageRank and its algorithmic consequences," *Proceedings of ACM on Measurement and Analysis of Computing Systems (ACM POMACS) 2019*, June 2019. (Also *ACM Sigmetrics 2019*)
15. D. Tang and V. G. Subramanian, "Random Walk Based Sampling for Load Balancing in Multi-Server Systems," *Proceedings of ACM on Measurement and Analysis of Computing Systems (ACM POMACS) 2019*, Feb 2019. (Also *ACM Sigmetrics 2019*)
16. Tang D., Subramanian V., "Eigenvalues of LRU via a linear algebraic approach," *Operations Research Letters*, 46, 2, 193–198, 2018-03-01.
17. Jian Li, Bainan Xia, Xinbo Geng, Hao Ming, Srinivas Shakkottai, Vijay Subramanian, and Le Xie, 2018, "Mean Field Games in Nudge Systems for Societal Networks," *ACM Trans. Model. Perform. Eval. Comput. Syst. (ACM TOMPECS)* 3, 4, Article 15 (August 2018)
18. Li J., Shakkottai S., Lui J., Subramanian V., "Accurate Learning or Fast Mixing? Dynamic Adaptability of Caching Algorithms," *IEEE Journal on Selected Areas in Communications*, 36, 6, 1314–1330, 2018-06-01.
19. Nair J., Subramanian V., Wierman A., "Provisioning of ad-supported cloud services: The role of competition," *Performance Evaluation*, 120, 36–48, 2018-04-01.
20. C. Chen, R. A. Berry, M. L. Honig and V. G. Subramanian, "Competitive resource allocation in HetNets: The impact of small-cell spectrum constraints and investment costs," *IEEE Transactions on Cognitive Communications and Networking*. 09/2017; 3(3), 478–490.
21. T. N. Le, V. G. Subramanian and R. A. Berry, "Information Cascades with Noise," *IEEE Transactions on Signal and Information Processing over Networks (Special Issue on Distributed Information Processing in Social Networks)*. 06/2017; 3(2): 239–251.
22. J. Li, R. Bhattacharya, S. Paul, S. Shakkottai and V. Subramanian, "Incentivizing Sharing in Realtime D2D Streaming Networks: A Mean Field Game Perspective," *IEEE/ACM Transactions on Networking*. 02/2017; 25(1): 3–17.
23. T. Nguyen, V. Subramanian and R. Berry, "Delay in Trade Networks," *Operations Research (Special Issue on Information and Decisions in Social and Economic Networks)*. 04/2016; 64(3): 646–661.
24. M. Moharrami, V. Subramanian, M. Liu and M. Lelarge, "Impact of Community Structure on Cascades," *EC'16: Proceedings of the 2016 ACM Conference on Economics and Computation*. 07/2016: 635–636. (Also see corresponding conference entry.)
25. V. R. Raja, V. Ramaswamy, S. Shakkottai and V. Subramanian, "Mean Field Equilibria of Pricing Games in Internet Marketplaces," *SIGMETRICS'16: Proceedings of the 2016 ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Science*. 06/2016; 44(1): 387–388. (Also see corresponding poster entry.)
26. J. Li, B. Xia, X. Geng, H. Ming, S. Shakkottai, V. Subramanian and L. Xie, "Energy Coupon: A Mean Field Game Perspective on Demand Response in Smart Grids," *ACM SIGMETRICS 2015*: 455–456. (Also see corresponding poster entry.)

27. J. Nair, V. G. Subramanian, and A. Wierman, "On competitive provisioning of cloud services," SIGMETRICS Performance Evaluation Review, 42(2):30–32, Oct 2014. (Also see corresponding conference entry.)
28. V. G. Subramanian and D. J. Leith, "On the rate-region of CSMA/CA WLANs," *IEEE Trans. Info. Theory*, 3932–3938, June 2013.
29. X. Chen, V. G. Subramanian and D. J. Leith, "PHY modulation/rate control for fountain codes in 802.11 WLANs," Elsevier Journal on Physical Communication, October 2012.
30. R. Berry, M. Honig, T. Nguyen, V. Subramanian, H. Zhou and R. Vohra, "Newsvendor model of capacity sharing," ACM SIGMETRICS Performance Evaluation Review 40(2):26–29, Sept 2012. (Also see corresponding conference entry.)
31. D. J. Leith, Q. Cao and V. G. Subramanian, "Max-min fairness in 802.11 mesh networks," *IEEE/ACM Trans. on Networking*, 20(3), 756–769 June 2012.
32. V. G. Subramanian, S. Kittipiyakul and T. Javidi, "Many-sources large deviations of Max-Weight scheduling," *IEEE Trans. on Info. Theory*, 57(4), 2151–2168, April 2011.
33. V. G. Subramanian, "LDP for Max-Weight scheduling over convex compact rate-regions," *Mathematics of Operations Research*, 35(4), 881–910, Nov 2010.
34. V. G. Subramanian, R. A. Berry and R. Agrawal, "Joint scheduling and resource allocation in DL of CDMA systems," *IEEE Transactions on Information Theory*, 56(5), 2416–2432, 2010.
35. D. J. Leith, V. G. Subramanian and K. R. Duffy, "Log convexity of rate region in 802.11e WLANs," *IEEE Comm. Letters*, 14(1), 57–59, 2010.
36. V. Badarla, V. G. Subramanian and D. J. Leith, "Low-delay dynamic routing using fountain codes," *IEEE Comm. Letters*, 13(7), 552–554, 2009.
37. V. G. Subramanian, K. R. Duffy and D. J. Leith, "Existence and uniqueness of fair rate allocations in lossy wireless networks," *IEEE Transactions on Wireless Communications*, 8(7), 3401–3406, 2009.
38. J. Huang, V. G. Subramanian, R. Agrawal and R. Berry, "Joint scheduling and resource allocation in uplink OFDM systems for broadband wireless access networks," *IEEE JSAC Special Issue on Broadband Access Networks*, 27(2), 226–234, 2009.
39. J. Huang, V. G. Subramanian, R. Agrawal and R. Berry, "Downlink scheduling and resource allocation for OFDM systems," *IEEE Transactions on Wireless Communications*, 8(1), 288–296, 2009.
40. K. R. Duffy and V. G. Subramanian, "On the impact of correlation between collaterally consanguineous cells on lymphocyte population dynamics," *Journal of Mathematical Biology*, 59(2), 255–285, 2009.
41. V. G. Subramanian, K. R. Duffy, M. L. Turner and P. D. Hodgkin, "Determining the expected variability of immune responses using the Cyton model," *Journal of Mathematical Biology*, 56(6), 861–892, June 2008.
42. B. Hajek and V. G. Subramanian, "Capacity and reliability function for small signal constraints," *IEEE Transactions on Information Theory*, 48(4), 828–839, April 2002.
43. V. G. Subramanian and B. Hajek, "Broadband fading channels: Signal burstiness and capacity," *IEEE Transactions on Information Theory*, 48(4), 809–827, April 2002.
44. V. Subramanian and R. Srikant, "Statistical multiplexing with priorities: Tail probabilities of queue-lengths and waiting times," *Queueing Systems: Theory and Applications*, 34(1-4), pp. 215–236, 2000.

REFEREED CONFERENCE PAPERS:

1. Khan N, Dinesha U, Arunachalam S, Narasimha D, Subramanian V, Shakkottai S. "A Multi-Agent View of Wireless Video Streaming with Delayed Client-Feedback." In IEEE INFOCOM 2024 May. IEEE.
2. Adler S, Subramanian V. "Bayesian learning of optimal policies in Markov decision processes with countably infinite state-space." Advances in Neural Information Processing Systems. 2024 Feb 13;36.

3. Zhang, Y., Cohen, A. and Subramanian, V.G., 2022, September, "Learning-based Optimal Admission Control in a Single Server Queuing System," in 2022 58th Annual Allerton Conference on Communication, Control, and Computing (Allerton). IEEE.
4. H. Kao, Chen-Yu Wei and V. G. Subramanian, "Decentralized Cooperative Reinforcement Learning with Hierarchical Information Structure," in Algorithmic Learning Theory (ALT) 2022, March 2022.
5. H. Kao and V. G. Subramanian, "Common Information based Approximate State Representations in Multi-Agent Reinforcement Learning," in AISTATS 2022, March 2022.
6. M. Muthuswamy, R. Berry, M. Honig, T. Nguyen, V. Subramanian and R. Vohra, "Spectrum Pooling with Competitive Service Providers," in 2021 IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN) (pp. 169–176), Dec 2021.
7. D. Tang, H. Tavafoghi, V. G. Subramanian, A. Nayyar and D. Tenketzis, "Private Information Compression in Dynamic Games among Teams," in 2021 IEEE Conference on Decision and Control (CDC), pp. 177–184, Dec 2021.
8. S.-T. Su, V. Subramanian and G. Schoenebeck, "Bayesian Persuasion in Sequential Trials," in The 17th Conference on Web and Internet Economics (WINE), 2021, pp. 22–40, Dec 2021.
9. S.-T. Su, V. Subramanian and D. Kempe, "On the benefits of being constrained when receiving signals," in The 17th Conference on Web and Internet Economics (WINE), 2021, pp. 167–185, Dec 2021.
10. Khan N., Moharrami M. and Subramanian V., Stable and Efficient Piece-Selection in Multiple Swarm BitTorrent-like Peer-to-Peer Networks, IEEE INFOCOM 2020, Toronto, Canada, July 2020.
11. D. Tang and V. G. Subramanian, "Derandomized Asymmetrical Balanced Allocation," Allerton Conference 2019.
12. H. Kao and V. G. Subramanian, "Convergence Rate Analysis for Distributed Optimization with Localization," Allerton Conference 2019.
13. D. Vial and V. Subramanian, "A structural result for Personalized PageRank and its algorithmic consequences," in *Proc. ACM SIGMETRICS'19*.
14. D. Tang and V. G. Subramanian, "Random Walk Based Sampling for Load Balancing in Multi-Server Systems," in *Proc. ACM Sigmetrics 2019*.
15. S.-T. Su, V. Subramanian and G. Schoenebeck, "Social Learning with Questions," in *Proc. NetEcon'19*.
16. D. Vial and V. Subramanian, "Local non-Bayesian social learning with stubborn agents," in *Proc. ACM EC'19*.
17. Xia B., Shakkottai S., Subramanian V., "Small-Scale Markets for Bilateral Resource Trading in the Sharing Economy," in *Proc. IEEE Infocom'18*.
18. Le T., Subramanian V., Berry R., "Bayesian Learning with Random Arrivals," in *Proc. IEEE ISIT'18*.
19. D. Tang and V. G. Subramanian, "Balanced Allocation on Graphs with Random Walk Based Sampling," in *Proc. 56th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, Monticello, IL, USA, 2018, pp. 765-766.
20. C. Chen, R. Berry, M. Honig and V. Subramanian, "The Impact of Small-Cell Bandwidth Requirements on Strategic Operators," in *Proc. IEEE International Symposium on Dynamic Spectrum Access Networks (DySpAN) 2017*, Baltimore, MD, United States of America, 03/2017.
21. T. Le, V. Subramanian and R. Berry, "Quantifying the Utility of Imperfect Reviews in Stopping Information Cascades," in *Proc. IEEE Conference on Decision and Control (CDC) 2016*, Pages: 6990 - 6995 , Las Vegas, NV, United States of America, 12/2016.
22. S.-T. Tang and V. Subramanian, "Descending Price Algorithm for Determining Market Clearing Prices in Matching Markets," in *Proc. of Allerton Conference 2016*, Monticello, IL, United States of America, 09/2016.

23. M. Moharrami, V. Subramanian, M. Liu and M. Lelarge, "Impact of Community Structure on Cascades," EC'16, in *Proceedings of the 2016 ACM Conference on Economics and Computation* (Also see journal entry.), Maastricht, Netherlands, 07/2016.
24. T. Le, V. Subramanian and R. Berry, "Are imperfect reviews helpful in social learning?" in *Proc. of IEEE International Symposium on Information Theory (ISIT) 2016*, Pages: 2089 - 2093, Barcelona, Catalunya, Spain, 07/2016.
25. C. Chen, R. Berry, M. Honig and V. Subramanian, "The Impact of Unlicensed Access on Small-Cell Resource Allocation," in *Proc. of IEEE INFOCOM 2016*, Pages: 1 - 9, San Francisco, CA, USA, 2016.
26. C. Chen, R. Berry, M. Honig and V. Subramanian, "Bandwidth optimization in HetNets with Competing Service Providers," in *Proc. of IEEE Workshop on Smart Data Pricing 2015*, Hong Kong. (In conjunction with IEEE INFOCOM 2015.)
27. J. Li, R. Bhattacharya, S. Paul, S. Shakkottai, and V. Subramanian, "Incentivizing sharing in realtime D2D streaming networks: A mean field game perspective," in *Proc. of IEEE INFOCOM 2015*, Hong Kong.
28. T. Le V. Subramanian and R. Berry, "The Impact of Observation and Action Errors on Informational Cascades," in *Proc. of IEEE CDC 2014*, Los Angeles.
29. J. Nair, V. G. Subramanian, and A. Wierman, "On competitive provisioning of cloud services," in *Proc. of IFIP WG 7.3 PERFORMANCE 2014*, Torino, Italy.
30. G. Askalidis, R. Berry and V. Subramanian, "Explaining Snapshots of Network Diffusions: Structural and Hardness Results," Workshop on Computational Social Networks (CSoNet'14), Atlanta, Co-located with COCOON 2014.
31. T. Le, V. Subramanian and R. Berry, "The Value of Noise for Information Cascades," in *Proc. of IEEE ISIT 2014*, Hawaii.
32. W. Wang, V. Subramanian and D. Guo, "Low complexity scheduling algorithms for wireless networks with full duplex state exchange," 2014 48th Annual Conference on Information Sciences and Systems (CISS), Pages: 1 - 6 , Princeton, NJ, United States of America, 03/2014.
33. C. Chen, R. Berry, M. Honig and V. Subramanian, "Distributed Interference Pricing in Wireless Networks with Local Cooperation," in *Proc. of IEEE Globecom 2013*, Atlanta.
34. T. Nguyen, V. G. Subramanian and R. Berry, "Searching and bargaining with middlemen," in *Proc. of Allerton 2013*, Monticello.
35. R. Agrawal, N. Arulselvan, S. Kalyanasundaram, B. Natarajan, H. Xu and V. Subramanian, "Interference Penalty Algorithm (IPA)- A novel algorithm for uplink inter-cell interference co-ordination in LTE," in *Proc. of IEEE WCNC 2013*, Shanghai.
36. R. Berry, M. Honig, T. Nguyen, V. Subramanian, H. Zhou and R. Vohra, "On the nature of revenue-sharing contracts to incentivize spectrum-sharing," in *Proc. of INFOCOM 2013*, Turin.
37. X. Chen, V. Subramanian and D. Leith, "An Upper Bound on the Packet Error Rate of 802.11a/g Viterbi Soft Decision Decoding in the AWGN Channel", in *Proc. of IFIP Wireless Days 2012*, Dublin.
38. K.-H. Hui, V. Subramanian, D. Guo and R. Berry, "Diffusion of innovation in two-sided markets," in *Proc. of Allerton 2012*, Monticello.
39. R. Berry, M. Honig, T. Nguyen, V. Subramanian, H. Zhou and R. Vohra, "Newsvendor model of capacity sharing," in *Proc. of W-PIN 2012* (1st Workshop on Pricing and Incentives in Networks), June, 2012, in conjunction with ACM SIGMETRICS/Performance 2012 (London). (Also see corresponding journal entry.)
40. V. G. Subramanian and M. Alanyali, "Delay performance of CSMA in networks with bounded degree conflict graphs," in *Proc. of IEEE ISIT 2011*, St. Petersburg.
41. X. Chen, V. G. Subramanian and D. J. Leith, "Binary Symmetric Channel Based Aggregation with Coding for 802.11n WLANs," in *Proc. of IEEE Broadnets 2010*, Athens.

42. D. Vasudevan, V. G. Subramanian and D. J. Leith, "Scheduling jobs with hard deadlines over Multiple Access and Degraded Broadcast Channels," in *Proc. of IEEE ISIT 2010*, Austin.
43. D. Vasudevan, V. G. Subramanian and D. J. Leith, "On ARQ for Packet Erasure Channels with Bernoulli Arrivals," in *Proc. of IEEE ISIT 2010*, Austin.
44. H. Qi, D. Malone and V. G. Subramanian, "Does every bit need the same power? An investigation on unequal power allocation for irregular LDPC codes," in *Proc. of International Conference on Wireless Communications and Signal Processing 2009*, Nanjing.
45. A. Nedich, V. G. Subramanian, "Approximately Optimal Utility Maximization," in *Proc. of IT Workshop June 2009*, Volos.
46. V. G. Subramanian and D. J. Leith, "On a class of optimal rateless codes," in *Proc. of Allerton 2008*, Monticello.
47. S. Bodas, S. Viswanath and V. G. Subramanian, "Random access over multiple access channels: A queueing perspective," in *Proc. of CISS 2008*, Princeton.
48. T. Coleman, N. Kiyavash and V. G. Subramanian, "Alternate proof of rate-distortion function of a Poisson Process," in *Proc. of DCC 2008*, Snowbird.
49. J. Huang, V. G. Subramanian, R. Agrawal and R. Berry, "Scheduling and resource allocation for DL of OFDM systems," in *Proc. of CISS 2006*, Princeton.
50. R. Agrawal, V. Subramanian, and R. Berry, "Joint Scheduling and Resource Allocation in CDMA Systems," in *Proc. of WiOpt 2004*.
51. R. Agrawal, A. Bedekar, R. La, and V. Subramanian, "A Class and Channel-Condition based Weighted Proportionally Fair Scheduler," in *Proc. of ITC 2001*, Salvador.
52. V. G. Subramanian and B. Hajek, "Capacity and reliability function for small signal constraints," in *Proc. of CISS 2000*, Princeton.
53. B. Hajek and V. G. Subramanian, "Capacity and reliability function per fourth moment cost for WSSUS fading channels," in *Proc. of IT Workshop June 1999*, Kruger National Park.
54. V. G. Subramanian and B. Hajek, "Capacity and reliability function per unit cost for WSSUS fading channels," in *Proc. of CISS 1999*, Baltimore.
55. V. Subramanian and R. Srikant, "Tail probabilities of queue-lengths, workloads and waiting times," in *Proc. of IEEE CDC 1997*, San Diego.
56. V. G. Subramanian and U. Madhow, "Blind demodulation of direct-sequence CDMA signals using an antenna array," in *Proc. of CISS 1996*, Princeton.

INVITED CONFERENCE PAPERS:

1. H. Kao, Chen-Yu Wei and V. G. Subramanian, "Decentralized Cooperative Reinforcement Learning with Hierarchical Information Structure," in 2022 58th Annual Allerton Conference on Communication, Control, and Computing (Allerton). IEEE.
2. Vial, Daniel, and Vijay Subramanian. "Local non-Bayesian social learning with stubborn agents." In 2019 57th Annual Allerton Conference on Communication, Control, and Computing (Allerton), pp. 902-903. IEEE, 2019.
3. M. Moharrami, V. Subramanian, M. Liu and R. Sundaresan, "Local Weak Convergence Based Analysis of a New Graph Model," 2018 56th Annual Allerton Conference on Communication, Control, and Computing (Allerton), Monticello, IL, USA, 2018, pp. 502-503.
4. Le T., Subramanian V., Berry R., "Learning from randomly arriving agents," Allerton Conference 2017.
5. D. Vial and V. Subramanian, "Towards Fast Algorithms for Estimating Personalized PageRank Using Commonly Generated Random Walks," in *Proc. of Allerton Conference 2016*, Monticello, IL, United States of America, 09/2016.

6. C. Chen, R. Berry, M. Honig and V. Subramanian, "The Impact of Investment on Small-Cell Resource Allocation," in *Proc. of CISS 2016*, Princeton, NJ.
7. D. Vasal, A. Anastasopoulos and V. Subramanian, "Incentive Design for Learning in 2:45 PM User-Recommendation Systems," in *Proc. of Asilomar 2015*, Pacific Grove, CA.
8. J. Nair, V. Subramanian and A. Wierman, "On Competitive Provisioning Of Ad-Supported Cloud Services," in *Proc. of Allerton Conference 2014*.
9. C. Cheng, R. Berry, M. Honig and V. Subramanian, "Pricing and Bandwidth Optimization in Heterogeneous Wireless Networks," in *Proc. of Asilomar 2013*, Pacific Grove, CA.
10. T. Nguyen, V. Subramanian and R. Berry, "Bargaining with middlemen," in *Proc. of INFORMS 2013*, Minneapolis.
11. R. Berry, M. Honig, T. Nguyen, V. Subramanian and R. Vohra, "Market Structures for Wireless Service with Shared Spectrum," in *Proc. of Allerton 2013*, Monticello.
12. R. Berry and V. Subramanian, "Spotting trendsetters: Inference in network games," in *Proc. of Allerton 2012*, Monticello.
13. D. J. Leith and V. G. Subramanian, "Utility Fairness in 802.11-Based Wireless Mesh Networks," in *Proc. of Allerton 2010*, Monticello.
14. D. J. Leith, Q. Cao and V. G. Subramanian, "Realising Max-min Fairness in 802.11e Mesh Networks," in *Proc. of IEEE International Symposium on Wireless Pervasive Computing 2010*, Modena.
15. S. Kittipiyakul, T. Javidi and V. G. Subramanian, "Many sources large deviations of max-weight scheduling," appeared in *Proc. of Allerton Conference 2008*, Monticello.
16. V. G. Subramanian, "Large deviations of max-weight scheduling policies on convex rate regions," appeared in *Proc. of ITA 2008*, UCSD.
17. V. G. Subramanian and D. J. Leith, "Draining-time based scheduling algorithm," appeared in *Proc. of CDC 2007*, New Orleans.
18. J. Huang, V. G. Subramanian, R. Berry and R. Agrawal, "Scheduling and resource allocation for UL of OFDM systems," appeared in *Proc. of Asilomar 2007*, Pacific Grove.
19. R. Agrawal, R. Berry, J. Huang and V. G. Subramanian, "Scheduling and resource allocation for DL of OFDM systems," appeared in *Proc. of Asilomar 2006*, Pacific Grove.
20. R. Agrawal and V. Subramanian, "Optimality of Certain Channel Aware Scheduling Policies," in *Proc. of Allerton 2002*, Monticello.
21. R. Agrawal, A. Bedekar, R. La, R. Pazhyannur, and V. Subramanian, "A Class and Channel-Condition based Weighted Proportionally Fair Scheduler for EDGE/GPRS," in *Proc. of ITCOM'01*, Denver.

SUBMITTED CONFERENCE PAPERS:

1. Tang D, Subramanian VG. "Information Compression in Dynamic Information Disclosure Games." CDC 2024.

REFEREED POSTERS:

1. V. R. Raja, V. Ramaswamy, S. Shakkottai and V. Subramanian, "Mean Field Equilibria of Pricing Games in Internet Marketplaces," *Poster in ACM SIGMETRICS 2016*. (Also see corresponding journal entry.)
2. J. Li, B. Xia, X. Geng, H. Ming, L. Xie, S. Shakkottai, and V. Subramanian, "Energy coupon: A mean field game perspective on demand response in smart grids," *Poster in ACM SIGMETRICS 2015*, Portland, OR. (Also see corresponding journal entry.)
3. R. Berry, T. Nguyen and V. Subramanian, "The role of search friction in networked markets' stationarity," *Interdisciplinary Workshop on Information and Decision in Social Networks*, LIDS, MIT, 2012.

SUBMITTED JOURNAL PAPERS

1. D. Vial and V. Subramanian, “Restart perturbations for lazy, reversible Markov chains: Trichotomy and pre-cutoff equivalence.” to be submitted to *Random Structures and Algorithms*, April 2024.

WORKING PAPERS

1. M. Moharrami, V. Subramanian, M. Liu and M. Lelarge, “Impact of community structure on cascades,” document in preparation.
2. D. Tang and V. Subramanian, “Approximately envy-free spectrum allocation with complementarities,” document in preparation.
3. H. Kao and V. Subramanian, “Nonlinear Consensus for Distributed Optimization,” document in preparation.
4. D. Tang, T. Nguyen, V. Subramanian and R. Vohra, “Scarf’s algorithm for stable matching with couples,” document in preparation.
5. V. Reddyvari, S. Shakkottai and V. Subramanian, “On reputation mechanisms in large-scale crowd-source platforms,” document in preparation.
6. D. Tang and V. Subramanian, “Derandomized Load Balancing using Random Walks on Expander Graphs,” document in preparation.
7. S.-T. Su, V. Subramanian and G. Schoenebeck, “Social Learning with Questions,” document in preparation.

HONORS

- Ernest and Bettine Kuh Faculty Fellowship, Univ. of Michigan, 2023-2024.
- EECS Outstanding Achievement Award, Univ. of Michigan, 2019.

TEACHING

University of Michigan

- **Instructor & course designer**, *EECS 498 Introduction to Social, Economic and Technological Networks*, Fall 2015, 2016, Undergraduate/Graduate Technical Elective.
- **Instructor**, *EECS 557 Communication Networks*, Winter 2015-2018, Graduate Course.
- **Instructor & course designer**, *EECS 598 Probabilistic Analysis of Large Scale Systems*, Fall 2014, Graduate Course.
- **Instructor & course designer**, *EECS 444/544 Analysis of Societal Networks*, Fall 2018, 2019, 2021, 2023, Senior-level Technical Elective in Undergraduate Curriculum, Graduate Course.
- **Instructor**, *EECS 216 Signals and Systems*, Winter 2019, 2022, Undergraduate Required Course.
- **Instructor**, *EECS 502 Stochastic Processes*, Winter 2020, 2021, 2024, Graduate Course.
- **Instructor**, *EECS 496 Major Design Experience Professionalism*, Fall 2020, Undergraduate Required Course.
- **Instructor**, *EECS 301 Probabilistic Methods in Engineering*, Fall 2023, Undergraduate Required Course.

Northwestern University

- **Instructor**, *EECS 302 Probabilistic Systems and Random Signals*, Spring Quarter 2014, Undergraduate Course.

- **Co-Instructor**, *EECS 454 Advanced Communication Networks*, Spring Quarter 2013, Graduate Course.
- **Instructor & course designer**, *EECS 495 Stochastic Models for Web2.0*, Spring Quarter 2011. Graduate Course.

PH.D. STUDENTS

- Hossein Dabirian, 2021-present (Ph.D.), University of Michigan.
- Nouman Khan, 2019-present (Ph.D.), University of Michigan, Thesis title: *Sequential Decision-Making in Multi-Agent Systems with Joint Constraints*.
- Saghar Adler, 2019-present (Ph.D.), University of Michigan. Thesis title: *On the Importance of Inherent Structural Properties for Learning in Markov Decision Processes*. Graduated Dec 2023.
- Yili Zhang, 2019-present (Ph.D.), University of Michigan, Applied Mathematics student co-advised with Prof. A. Cohen. Thesis title: *Learning-based Decision-making under Stochastic and Adversarial Uncertainties*. Graduated July 2023. Huawei.
- Hsu Kao, 2015-2021 (Ph.D.), University of Michigan, Thesis title: *Efficient methods for optimizing decentralized multi-agent systems*. Graduated May 2022. JP Morgan.
- Shih-Tang Su, 2015-2021 (M.S. & Ph.D.), University of Michigan, Thesis title: *Strategic signaling under higher-order inference*. Graduated Dec 2021. Citibank.
- Dengwang Tang, 2015-2021 (SURE program, Undergraduate & Ph.D.), University of Michigan, Thesis title: *Games in multi-agent dynamic systems: Decision-making with compressed information*. Defended Sept 2021. Postdoc at USC under Rahul Jain, Ashutosh Nayyar and Pierluigi Nuzzo, 1st Postdoc at USC under R. Jain.
- Mehrdad Moharrami, 2014-2020 (Ph.D.), University of Michigan, Co-supervised with Prof. M. Liu, Thesis title: *A study of phase transition in new random graph families*. Graduated May 2020. Assistant Professor, CS Dept. University of Iowa, Fall 2023.
- Daniel Vial, 2015-2019 (Ph.D.), University of Michigan, Thesis title: *Structural results and applications for perturbed Markov chains*. Graduated Dec 2019. Securities and Exchange Commission (SEC), Fall 2023.
- Tho Le, 2012-2017 (Ph.D.), Northwestern University, “Information Cascades: Impact of Observation Noise and Imperfect Reviews,” Co-supervised with Prof. R. Berry. Graduated Nov 2017. Data Scientist, JD.com.
- Jian Li, 2011-2016 (Ph.D.), Texas A&M University, “In Pursuit of Desirable Equilibria in Large-Scale Networked Systems,” Co-supervised with Prof. Srinivas Shakkottai. Graduated Oct 2016. Asst. Prof., ECE Dept, SUNY Binghamton, NY, August 2019 onwards.
- Cheng Chen, 2011-2016 (Ph.D.), Northwestern University, “Pricing, Competition, and Resource Allocation in Heterogeneous Wireless Networks,” Co-supervised with Prof. M. Honig and Prof. R. Berry. Graduated Aug 2016. Research Engineer, Intel Corporation.
- Xiaomin Chen, 2008-2012 (Ph.D. Eng), National University of Ireland Maynooth, “Coding solutions to improve WiFi throughput,” Co-supervised with Prof. D. J. Leith. Graduated 2012. Lecturer, Computer and Information Sciences Dept, Northumbria University, Newcastle, Jan 2016 onwards.

MASTER’S STUDENTS

- Nouman Khan, 2018-2019 (M.S.), University of Michigan, Independent study on chunk selection policies in peer-to-peer networks.
- Akshit Kumar, 2018-2019 (M.S.), University of Michigan, Independent study on Lyapunov methods in Reinforcement Learning.

- Yang Xiao, 2016-2017 (M.S.), University of Michigan, Independent study.
- Lan Xing, 2012-2013 (M. Eng.), Northwestern University, “Capacity of cellular systems with random base-station placement.”
- Xiaochen Zhang, 2012-2013 (M. Eng.), Northwestern University, “Inference of early adopters.”

UNDERGRADUATE STUDENTS

- Aman Sharma, 2015-2016 (Undergraduate), University of Michigan, Independent study + senior honors thesis, “Analysis of Curing Strategies for Epidemics over Time-varying Connectivity Graphs.”
- Mack Lee, 2012-2014 (High-school), Illinois Math & Science Academy, Student Inquiry and Research, “Capacity of cellular systems with random base-station placement.”
- Motoki Mizuguchi, 2013-2014 (BS-MS), Northwestern University, Capstone Project, “Simulating an Information Cascade Model with Varying Private Signal Strengths.”
- Matt Dzugan, 2010-2011 (BS-MS), Capstone Project, Northwestern University, “Capacity of cellular systems with regular base-station placement.”

SUMMER INTERNS

- Jianwei Huang, 2004 & 2005, Summer Intern, Motorola Inc., Scheduling algorithms for Downlink and Uplink for WiMAX.
- Abhishek Sharma, 2005, Summer Intern, Motorola Inc., Distributed resource management with applications to WiMAX.
- Juan Alvarez, 2000, Summer Intern, Motorola Inc., Scheduling for GPRS/EDGE.

TUTORIALS

1. Tutorial at IEEE VTC Fall 2005, Scheduling in Wireless Networks, Dallas, TX, USA.

PRESENTATIONS

RECENT PRESENTATIONS:

1. ReStoq (Reinforcement learning and stochastic control in queues and networks) Workshop, held jointly with WiOpt 2021, Oct 2021.
2. WMLC (Workshop on machine learning in wireless communications), held jointly with WiOpt 2021, Oct 2021.
3. Michigan Speaker, MSSISS 2022 (The 2022 Michigan Student Symposium for Interdisciplinary Statistical Sciences), March 2022.
4. CESG Seminar, ECE Department, Texas A&M University, April 2022.
5. Learning-based Control of Queues and Networks (LBCQN) Workshop, held in conjunction with ACM Sigmetrics 2022, June 2022.
6. DCL Seminar, CSL, UIUC, Sept 2022.
7. SINE seminar, CSL, UIUC, Oct 2022.
8. Probability seminar, Mathematics Department, UIUC, Nov 2022.
9. ECE Department seminar, Iowa State University, Nov 2022.
10. Workshop on Reinforcement Learning and Multi-Agent Systems (RLMAS), Chicago, IL, Nov 2023.
11. Workshop on DeNetS: Decision-making in Networked Systems, Chicago, IL, Nov 2023.
12. EE Department, IIT Madras, Chennai, Jan 2024.

13. ITA Conference, San Diego, Feb 2024.
14. ECE Department, Northeastern University, Mar 2024.
15. NCRC Group, MIT, Mar 2024.

MISCELLANEOUS/SERVICE

- **Conference Organizing Committee:**

- General co-chair, ACM Sigmetrics 2025, Ann Arbor, MI.
- Finance co-chair, ISIT 2025, Ann Arbor, MI.
- Co-organizer, RLMAS Workshop, joint with IFIP WG 7.3 Performance 2023.
- Co-organizer, LBCQN Workshop, joint with ACM Sigmetrics 2022.
- Co-organizer, ReStoq Workshop, joint with WiOpt 2021.
- TPC Co-chair, WiOpt 2020.
- TPC Co-chair, ACM Mobihoc 2019.
- Tutorials Chair, ACM SIGMETRICS 2017 Organizing Committee, June 21 2017.
- Co-Chair, 6th Midwest Controls & Game Theory Workshop Organizing Committee, April 22-23 2017.
- Web-manager, HajekFest, UIUC, Oct 2015.
- Publicity Chair, COMSNETS 2014, Bangalore, India, Jan 2014; ITC 2020, Japan.
- Posters Chair, IEEE Communication Theory Workshop, Hawaii, May 2012.

- **NSF Review Panels:** CCF (March 2013), IIS (May 2013), CNS (Feb 2018), EPCN (Nov 2019), CCF (Jan 2020), CNS (Jun 2020), AI Institute (Feb 2021), CNS (Jun 2021), RINGS (Aug 2021), CNS (May 2022).

- **ARO Reviewer:** Oct-Nov 2016.

- **Editorial Board:** Mathematics of Operations Research (*Jan 2024 onwards*), Area Editor IEEE Trans. on Information Theory (*Dec 2023 onwards*), Associate Editor IEEE Trans. on Information Theory (*2021-Dec 2023*), IEEE/ACM Trans. on Networking (*2020 onwards*), Performance Evaluation (*2020 onwards*), Multimedia Communications Technical Committee IEEE Communications Society E-Letter, 2010.

- **Session Organizer:** Information Theory & Applications Workshop, University of California, San Diego, 2009 & 2010, Asilomar 2015, INFORMS 2018.

- **Technical Program Committee:** BroadWim2004, WCNC 2006, RAWNET2006, Wireless Networks Symposium of GLOBECOM 2008, WICON 2008, MACOM 2009, COMSNETS 2010-14, INFOCOM 2010 WIP Session, NETWORKING 2011, ACM MobiHoc 2011-12, 2015-2019, WiOpt 2013-18, 2020, ICCCN-MRTM 2013, ACM SIGMETRICS/PERFORMANCE 2014-16, 2020-21, NetEcon 2015-2016, EC'18, CCWDN'18, ISIT 2018-19, ITC 2019.

- **Project Technical Reviewer:** Reviewer for an EU FP7 project in 2009 and two projects in 2011
Projects: OPNEX (1.43 million Euros) & CONECT (1.94 million Euros)

- **Reviewing:**

IEEE Journals and Conferences: Trans. on Information Theory, Trans. on Communications, Trans. on Networking, Journal on Special Areas in Communication (JSAC), Trans. on Vehicular Technology, Trans. on Mobile Computing, Trans. on Wireless Communications, Trans. on Automatic Control, Trans. on Network Science and Engineering, INFOCOM, International Symposium on Information Theory (ISIT), Conference on Decision and Control (CDC), Personal Indoor and Mobile Radio Conference (PIMRC).

International Journals and Conferences: Annals of Applied Probability, Operations Research, Mathematics of Operations Research, Performance Analysis, Queueing Systems, Random Structures and Algorithms, EURASIP, ACM SIGMETRICS, ACM SIGCOMM, ACM MOBIHOC, ICC, AMS Mathematical Reviews, Nature Communications, PloS ONE, ACM EC, WiOpt, JMLR.

PATENTS

GRANTED:

1. US Patent, A method for packet scheduling and resource allocation in a wireless communication system, #6987738, Jan. 2006.
2. European Patent, Method for packet scheduling and radio resource allocation in a wireless communication system, #EP1227626, Oct. 2006.
3. Japan/Korea Patent, Method and apparatus for resource allocation and scheduling, #JP3950460, Jan. 2007.
4. US Patent, Method to facilitate determination of a data rate, #7447154, Nov. 2008.
5. US Patent, System and method for increased battery saving during idle mode in a wireless communication system, #7471942, Dec. 2008.
6. US Patent, Method and apparatus for improved channel maintenance signaling, #7492752, Feb. 2009.
7. US Patent, Variable reliability wireless communication transmission method and apparatus, #7539214, May 2009.
8. US Patent, Methods for dividing base station resources, #7558577, Jul. 2009.
9. US Patent, Method and apparatus for resource allocation and scheduling, #7564820, Jul. 2009.
10. US Patent, Method and system for allocating subcarriers to subscriber devices, #7586990, Sept. 2009.
11. US Patent, Method and apparatus for spreading channel code selection, #8009637, Aug. 2011.
12. US Patent, Method and apparatus for decreasing latencies during handover, #8175600, May 2012.
13. US Patent, Methods of load balancing, #10931583, Feb 2021.
14. US Patent, System of load balancing, #0194811, June 2021.

STANDARDS CONTRIBUTIONS

1. 802.16g - Contribution on Network Reference Model - October 2004.
2. 802.16e - Contributions on handover triggers, clarification on association procedures, May- June 2005.

PAST HONORS

- Recipient of the National Talent Scholarship - Govt. of India, 1987.
- Motorola Industrial Fellowship - for year 1998-99.