CURRICULUM VITAE Amir Ajorlou

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Education & Academic Appointments

Massachusetts Institute of Technology, Cambridge, MA, USA Research Scientist, Laboratory for Information & Decision Systems (LIDS), July 2017-present.

Massachusetts Institute of Technology, Cambridge, MA, USA Postdoctoral Fellow, Laboratory for Information & Decision Systems (LIDS), Sep. 2014- June 2017.

University of Pennsylvania, Philadelphia, PA, USA Postdoctoral Research Associate, Sep. 2013-2014.

Concordia University, Montreal, Quebec, Canada Ph.D. in Electrical Engineering (focus: Control Systems), 2008-2013.

Sharif University of Technology, Tehran, Iran B.Sc. in Electrical Engineering, 1999-2004.

Selected Awards and Honors

Governor General of Canada Academic Gold Medal, 2014.¹

NSERC Postdoctoral Fellowship, 2014 (3 awarded across Canada in Control Systems).

Concordia University Doctoral Prize in Engineering and Computer Science, 2014.

David J. Azrieli Graduate Fellowship Award, 2011-2012.

Canadian National Award in Transportation Studies, 2010-2012.

Gold Medalist of the 40th International Mathematical Olympiad, Romania, 1999.

Gold Medalist of the 39th International Mathematical Olympiad, Taiwan, 1998 (ranked 1st in the world).

TEACHING EXPERIENCE

- Instructor, Introduction to Network Models, MIT, Fall 2018, Fall 2020-2023.
- Co-Instructor, Co-Developer, Introduction to Network Models, MIT, Fall 2017.
- Instructor, Nonlinear Optimization, MIT, Spring 2017.

¹The highest academic recognition for a graduate student at Canadian universities.

Research Interests

My recent research is primarily focused on two fronts:

- Social learning: I strive to develop a profound understanding of learning and decision making under uncertainty in large population of strategic agents under computational, communication, and cognitive constraints. This requires incorporating tools and techniques from game theory, finite/infinite dimensional optimization, control theory, modern probability theory, and statistics.

- Transformers and self-attention networks: My aim is to make a better understanding of the inner working of transformers and attention mechanisms by analyzing them through the lens of control theory and dynamical systems.

PUBLICATIONS

JOURNAL PAPERS

- 1. J. Tang, A. Adler, A. Ajorlou, and A. Jadbabaie, "Estimating true beliefs from declared opinions," *IEEE Trans. on Automatic Control*, conditionally accepted.
- 2. J. Tang, A. Adler, A. Ajorlou, and A. Jadbabaie, "Stochastic opinion dynamics under social pressure in arbitrary networks," *IEEE Trans. on Automatic Control*, under review.
- 3. C. Hsu, A. Ajorlou, M. Yildiz, and A. Jadbabaie, "Subscription networks, verification, and media bias," *Review of Economic Studies*, under review.
- 4. C. Hsu, A. Ajorlou, and A. Jadbabaie, "A game-theoretic model of misinformation spread on social networks," *Games and Economic Behavior*, under review.
- 5. A. Ajorlou and A. Jadbabaie, "Sales-Based rebate design," *Management Science*, vol. 69, pp. 5983–6000, 2023.
- 6. C. Hsu, A. Ajorlou, and A. Jadbabaie, "Persuasion, news sharing, and cascades on social networks," available at SSRN, 2021.
- 7. A. Ajorlou and A. Jadbabaie, "Local optimality of almost piecewise-linear quantizers for Witsenhausen's problem," *IEEE Trans. on Automatic Control*, vol. 66, pp. 3152-3168, 2020.
- 8. A. Ajorlou, A. Jadbabaie, and A. Kakhbod, "Dynamic pricing in social networks: The word of mouth effect," *Management Science*, vol. 64, pp. 971-979, 2018.
- 9. A. Fazeli, A. Ajorlou, and A. Jadbabaie, "Competitive diffusion in social networks: quality or seeding?," *IEEE Trans. on Control of Network Systems*, vol. 2, pp. 665- 675, 2017.
- 10. M. M. Asadi, A. Ajorlou, and A. G. Aghdam, "Distributed control of a network of single integrators with limited angular fields of view," *Automatica*, vol. 63, pp. 187-197, 2016.
- 11. A. Ajorlou, M. M. Asadi, A. G. Aghdam, and S. Blouin, "Distributed consensus control of unicycle agents in the presence of external disturbances," *Systems & Control Letters*, vol. 82, pp. 86-90, 2015.
- 12. M. A. Rahimian, A. Ajorlou, and A. G. Aghdam, "Digraphs with distinguishable dynamics under the multiagent agreement protocol," *Asian Journal of Control*, vol. 16, no. 5, pp. 1300-1311, 2014 (invited paper).
- 13. A. Ajorlou and A. G. Aghdam, "A bounded distributed connectivity preserving aggregation strategy with collision avoidance property," Systems & Control Letters, vol. 62, no. 11, pp. 1098-1104, 2013.
- 14. A. Ajorlou and A. G. Aghdam, "Connectivity preservation in nonholonomic multi-agent systems: A bounded distributed control strategy," *IEEE Trans. on Automatic Control*, vol. 58, no. 9, pp. 2366-2371, 2013.
- 15. A. Ajorlou, K. Moezzi, A. G. Aghdam, and S. G. Nersesov, "Two-stage time-optimal formation reconfiguration strategy," *Systems & Control Letters*, vol. 62, no. 6, pp. 496-502, 2013.
- 16. A. Ajorlou, K. Moezzi, A. G. Aghdam, S. Tafazoli, and S. G. Nersesov, "Two-stage energy-optimal formation reconfiguration strategy," *Automatica*, vol. 48, no. 10, pp. 2587-2591, 2012.

- 17. S. Jafari, A. Ajorlou, and A. G. Aghdam, "Leader localization in multi-agent systems subject to failure: a graph-theoretic approach," *Automatica*, vol. 47, no. 8, pp. 1744-1750, 2011.
- 18. A. Ajorlou, A. Momeni, and A. G. Aghdam, "Sufficient conditions for the convergence of a class of nonlinear distributed consensus algorithms," *Automatica*, vol. 47, no. 3, pp. 625-629, 2011.
- 19. A. Ajorlou, A. Momeni, and A. G. Aghdam, "A class of bounded distributed control strategies for connectivity preservation in multi-agent systems," *IEEE Trans. on Automatic Control*, vol. 55, no. 12, pp. 2828-2833, 2010.

PEER-REVIEWED CONFERENCE PAPERS

- X. Wu, A. Ajorlou, Y. Wang, S. Jegelka, and A. Jadbabaie, "On the role of attention masks and LayerNorm in self-attention dynamics," *Advances in Neural Information Processing Systems (NeurIPS)*, 2024, under review.
- M. JafariNodeh, A. Ajorlou, and A. Jadbabaie, "Belief samples are all you need for social learning," 63rd IEEE Conference on Decision and Control, 2024, under review.
- 22. J. Tang, A. Ajorlou, and A. Jadbabaie, "Evolution of opinions under social pressure on random graphs," in *Proceedings of 2024 American Control Conference*.
- 23. J. Tang, A. Adler, A. Ajorlou, and A. Jadbabaie, "Estimating true beliefs from declared opinions," in *Proceedings of 2024 American Control Conference*.
- 24. X. Wu, A. Ajorlou, Z. Wu, and A. Jadbabaie, "Demystifying oversmoothing in attention-based graph neural networks," in *Advances in Neural Information Processing Systems (NeurIPS)*, 2023 (spotlight paper).
- J. Tang, A. Adler, A. Ajorlou, and A. Jadbabaie, "Convergence of opinion dynamics under social pressure for general networks," in *Proceedings of the 62nd IEEE Conference on Decision and Control*, 2023.
- 26. C. Hsu, A. Ajorlou, and A. Jadbabaie, "Persuasion, news sharing, and cascades on social networks," in *Proceedings of the 60th IEEE Conference on Decision and Control*, 2021.
- 27. R. Salhab, A. Ajorlou, and A. Jadbabaie, "Social learning with sparse belief samples," in *Proceedings of the* 59th IEEE Conference on Decision and Control, 2020.
- 28. C. Hsu, A. Ajorlou, M. Yildiz, and A. Jadbabaie, "Information disclosure and network formation in news subscription services," in *Proceedings of the 59th IEEE Conference on Decision and Control*, 2020.
- 29. A. Ajorlou and A. Jadbabaie, "A class of near-optimal local minima for Witsenhausen's problem," in *Proceedings of the 58th IEEE Conference on Decision and Control*, 2019.
- 30. M. Siami, A. Ajorlou, and A. Jadbabaie, "Competitive contagion with sparse seeding," in *Proceedings of the* 8th IFAC Workshop on Distributed Estimation and Control in Networked Systems, 2019.
- 31. A. Ajorlou, A. Jadbabaie, and M. Dahleh, "Dynamic public learning in networks of strategic agents: the role of inter/intra-community ties," in *Proceedings of the 56th IEEE Conference on Decision and Control*, 2017.
- 32. A. Ajorlou and A. Jadbabaie, "A game theoretic approach to promotion design in two-sided platforms," in *Proceedings of the 55th Annual Allerton Conference on Communication, Control, and Computing*, 2017.
- A. Ajorlou and A. Jadbabaie, "Slopey quantizers are locally optimal for Witsenhausen's counterexample," in Proceedings of the 55th IEEE Conference on Decision and Control, 2016, pp. 3566-3571.
- 34. A. Ajorlou and A. Jadbabaie, "Equilibrium analysis for a leader-follower game with noisy observations: A pace forward in Witsenhausen's counterexample conjecture," in *Proceedings of the 54th Annual Allerton Conference* on Communication, Control, and Computing, 2016.
- 35. A. Fazeli, A. Ajorlou, and A. Jadbabaie, "Duopoly budget allocation in social networks: a Nash analysis approach," in *Proceedings of the 54th IEEE Conference on Decision and Control*, 2015, pp. 2901-2906.
- A. Ajorlou, A. Awasthi, and A. G. Aghdam, "Distributed urban traffic control based on locally observable cell occupancies," in *Proceedings of American Control Conference*, 2015, pp. 1035-1040.

- 37. A. Fazeli, A. Ajorlou, and A. Jadbabaie, "Optimal budget allocation in social networks: quality or seeding?," in Proceedings of the 53rd IEEE Conference on Decision and Control, 2014, pp. 4455-4460.
- A. Ajorlou, A. Jadbabaie, and A. Kakhbod, "Strategic information diffusion: spread vs. exploit," in Proceedings of the joint Workshop on Pricing and Incentives in Networks and Systems (W-PIN+NetEcon in conjunction with ACM Sigmetrics), 2014.
- M. M. Asadi, A. Ajorlou, A. G. Aghdam, and S. Blouin, "Global network connectivity assessment via local data exchange for underwater acoustic sensor networks," in *Proceedings of ACM International Conference on Reliable and Convergent Systems*, 2013, pp. 277-282.
- 40. A. Ajorlou, M. M. Asadi, A. G. Aghdam, and S. Blouin, "A consensus control strategy for unicycles in the presence of disturbances," in *Proceedings of American Control Conference*, 2013, pp. 4039-4043.
- 41. M. A. Rahimian, A. Ajorlou, R. Tutunov, and A. G. Aghdam, "Identifiability of links and nodes in multi-agent systems under the agreement protocol," in *Proceedings of American Control Conference*, 2013, pp. 6853-6858.
- 42. M. M. Asadi, A. Ajorlou, and A. G. Aghdam, "Distributed control of multi-agent systems with rotating field of view," in *Proceedings of American Control Conference*, 2013, pp. 2044-2049.
- A. Ajorlou and A. G. Aghdam, "A bounded connectivity preserving aggregation strategy with collision avoidance property for single-integrator agents," in *Proceedings of the 51st IEEE Conference on Decision and Control*, 2012, pp. 4003-4008.
- M. A. Rahimian, A. Ajorlou, and A. G. Aghdam, "Detectability of multiple link failures in multi-agent systems under the agreement protocol," in *Proceedings of the 51st IEEE Conference on Decision and Control*, 2012, pp. 118-123.
- M. Tousi, A. Ajorlou, H. Mahboubi, and A. G. Aghdam, "Decentralized pole-placement using generalized sampled-data hold functions," in *Proceedings of the 51st IEEE Conference on Decision and Control*, 2012, pp. 6921-6925.
- A. Ajorlou, A. G. Aghdam, and A. Jadbabaie, "A connectivity preserving containment control strategy for unicycles with static leaders," in *Proceedings of American Control Conference*, 2012, pp. 4186-4191.
- 47. A. Ajorlou and A. G. Aghdam, "Convergence analysis for a class of bounded distributed connectivity preserving consensus algorithms for unicycles," in *Proceedings of American Control Conference*, 2012, pp. 1585-1590.
- 48. M. A. Rahimian, A. Ajorlou, and A. G. Aghdam, "Characterization of link failures in multi-agent systems under the agreement protocol," in *Proceedings of American Control Conference*, 2012, pp. 5258-5263.
- 49. M. M. Asadi, A. Ajorlou, and A. G. Aghdam, "Cooperative control of multi-agent systems with limited angular field of view," in *Proceedings of American Control Conference*, 2012, pp. 2388-2393.
- F. Salehisadaghiani, A. Ajorlou, and A. G. Aghdam, "Distributed connectivity preservation of a team of single integrator agents subject to measurement error," in *Proceedings of IEEE Multiconference on Systems & Control*, 2011, pp. 626-631.
- 51. A. Ajorlou, A. Momeni, and A. G. Aghdam, "A connectivity preserving containment control strategy for a network of single integrator agents," in *Proceedings of American Control Conference*, 2011, pp. 499-501.
- 52. A. Ajorlou, A. Momeni, and A. G. Aghdam, "Relaxed convergence conditions for multi-agent systems under a class of consensus algorithms," in *Proceedings of American Control Conference*, 2011, pp. 2795-2800.
- 53. S. Jafari, A. Ajorlou, and A. G. Aghdam, "Leader selection in multi-agent systems subject to partial failure," in *Proceedings of American Control Conference*, 2011, pp. 5330-5335.
- 54. A. Ajorlou and A. G. Aghdam, "A class of bounded distributed controllers for connectivity preservation of unicycles," in *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010, pp. 3072-3077.
- A. Ajorlou, K. Moezzi, A. G. Aghdam, and S. G. Nersesov, "Two-stage time-optimal formation reconfiguration strategy under velocity and acceleration constraints," in *Proceedings of the 49th IEEE Conference on Decision* and Control, 2010, pp. 7455-7460.

- S. Jafari, A. Ajorlou, and A. G. Aghdam, "On the structural controllability of multi-agent systems subject to failure: A graph-theoretic approach," in *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010, pp. 4564-4570.
- S. Jafari, A. Ajorlou, and A. G. Aghdam, "Distributed control of formation flying spacecraft using deterministic communication schedulers," in *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010, pp. 3084-3090.
- 58. A. Ajorlou, A. Momeni, and A. G. Aghdam, "Convergence analysis for a class of nonlinear consensus algorithms," in *Proceedings of American Control Conference*, 2010, pp. 6318-6323.
- 59. A. Ajorlou, A. Momeni, and A. G. Aghdam, "Connectivity preservation in a network of single integrator agents," in *Proceedings of the 48th IEEE Conference on Decision and Control*, 2009, pp. 7061-7067.
- 60. A. Ajorlou, K. Moezzi, A. G. Aghdam, and S. Tafazoli, "Energy and time efficient formation reconfiguration strategies," in *Proceedings of the 48th IEEE Conference on Decision and Control*, 2009, pp. 3081-3086.
- 61. S. Ajorlou and A. Ajorlou, "A fuzzy-based design procedure for a single-stage sampling plan," in *Proceedings* of the IEEE International Conference on Fuzzy Systems, 2009, pp. 1869-1874.

LEADERSHIP AND SERVICES

• Associate Editor for the Conference Editorial Board of IEEE Control Systems Society, 2017-2023.

• Technical Program Committee Member of 9th IEEE International Workshop on Network Science for Communication Networks (NetSciCom)(2017), 10th IEEE International Conference on Systems Engineering (2015), IEEE International Conference on Wireless for Space and Extreme Environments (WiSEE) (2013), 8th IEEE International Conference on System of Systems Engineering (2013), 2012 Japan-Egypt Conference on Electronics, Communications and Computers.

• Chair and Organizer of the "Social and Economic Networks" invited session at the IEEE Conference on Decision and Control, 2014-2018.

- Chair of the session "Revenue Management and Pricing in Social Networks", INFORMS, 2015.
- Chair of Control Systems Chapter of IEEE Montreal Section, 2011.

• Co-Chair of the 3rd, 4th, and 5th Semi-Annual Workshops on Control Systems, Concordia University (2010-2011) and the Joint Workshop on Control and Communication Systems, McGill University (2010).

• **Reviewer** of IEEE Transactions on Automatic Control, IEEE Transactions on Control of Network Systems, IEEE Transactions on Network Science and Engineering, IEEE Transactions on Control Systems Technology, IEEE Transactions on Systems, Man and Cybernetics, IEEE Systems Journal, Automatica, and Systems & Control Letters, Management Science, Operations Research, Networks, and many conferences on decision and control.

Advising

Examiner:

• Luis Esteva Sueiro, Special Concentrations Program, Harvard University, Spring 2024.

Committee Member:

• Chin-Chia Hsu, "Misinformation, Persuasion, and News Media on Social Networks", MIT, Spring 2022.

External Evaluator:

• Elaheh Fata, "New problems in revenue management: theory and applications", MIT, Fall 2019.

Capstone Project Supervisor:

- Mark Mockett, "Modeling delay propagation in US airspace", MIT, Spring 2019.
- Anagh Tiwary, "An analysis of Brexit using global network modeling", MIT, Spring 2019.