Nora Ayanian, Ph.D.

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Education History

2005 – 2011 **University of Pennsylvania, Philadelphia, PA**

8/2011 Ph.D. in Mechanical Engineering and Applied Mechanics
Thesis: Coordination of Multirobot Teams and Groups in Constrained Environments: Models, Abstractions, and Control Policies

5/2008 M.S. in Mechanical Engineering and Applied Mechanics

2000 – 2005 **Drexel University, Philadelphia, PA**

6/2005 B.S. in Mechanical Engineering, *Summa Cum Laude*, 2nd in the graduating class

Professional Experience

Assistant Professor, University of Southern California

Andrew and Erna Viterbi Early Career Chair	Aug 2017 – present
Gabilan Assistant Professor	Aug 2013 – Aug 2017
Department of Computer Science	Aug 2013 – present

Concurrent Appointments

Associate Director, USC Center for Artificial Intelligence in Society	Aug 2016 – Aug 2017
Founding Director, Automatic Coordination of Teams Laboratory	Aug 2013 – present

Postdoctoral Associate, Massachusetts Institute of Technology

Computer Science and Artificial Intelligence Laboratory	Aug 2011 – Aug 2013
Advisor: Prof. Daniela Rus	

Graduate Research Assistant, University of Pennsylvania

Department of Mechanical Engineering and Applied Mechanics	Aug 2005 – Aug 2011
Advisors: Prof. Vijay Kumar and Prof. Daniel Koditschek	

Honors and Awards

University of Southern California

2019 USC Stevens Center Commercialization Award, in recognition of the successful licensing of technology

2018 Most Active Technical Committee, IEEE Robotics and Automation Society Technical Committee on Multi-Robot Systems (I am co-founder and co-chair)

2017 Third place, "Blue Sky Ideas" Track, IFRR (International Foundation of Robotics Research) International Symposium for Robotics Research, Puerto Varas, Chile, talk available: https://vimeo.com/246403036

2017 Andrew and Erna Viterbi Early Career Chair

2016 MIT Technology Review's 35 Innovators Under 35 (TR35)
https://www.technologyreview.com/lists/innovators-under-35/2016/visionary/nora-ayanian/

2016 Okawa Foundation Research Grant: for studies and analyses in the fields of information and telecommunications. http://www.okawa-foundation.or.jp/en/activities/research_grant/list_2016.html

2016 Robohub's 25 Women in Robotics you Need to Know About
http://robohub.org/25-women-in-robotics-you-need-to-know-about-2016/

2016 Outstanding Paper in Robotics Track, International Conference on Automated Planning and Scheduling, London, UK

2016 NSF CAREER Award, "Crowdsourcing for Multirobot Coordination"

2015 Hanna Reisler Mentorship Award (University of Southern California): recognizes individuals at USC who have advanced the careers of women in science and engineering through generous and committed professional mentorship

2015 Mic.com Mic50: celebrating the next generation of impactful leaders, cultural influencers, and breakthrough innovators: http://www.mic50.com/nora-ayanian
Chosen for video profile: https://www.youtube.com/watch?v=x8oY4OkkVgY

2014 NerdWallet 40 Under 40: Professors who Inspire

2013 WiSE Gabilan Assistant Professorship

2013 IEEE Intelligent Systems "AI's 10 to Watch": Biennial celebration of 10 young stars in the field of Artificial Intelligence

Prior to joining USC

2011 John A. Goff Prize (University of Pennsylvania): awarded annually to a graduate student in the Department of Mechanical Engineering and Applied Mechanics, selected by the faculty on the basis of scholarship, resourcefulness, and leadership

2009 Honorable Mention, IEEE Robotics & Automation Society Fellowship

2008 Best Student Paper Award, IEEE International Conference on Robotics and Automation (ICRA), Pasadena, CA

2005 – 2010 National Science Foundation Graduate Research Fellowship

2005 Second in the graduating class, Mechanical Engineering and Mechanics, Drexel University

Research Grants

Secured a total of \$3.5M in funding. \$2.9M in committed research funding for my lab (excludes REU Site, DURIP, and future years for CRAs). Over \$1.7M in funds from the National Science Foundation (excluding REU Site). Lead PI on \$2.0M in funding.

Ongoing research support

[G12] Amazon Research Award
"Hierarchical MAPF Planning for Warehouse Solutions"

Role:	Co-Principal Investigator (PI Sven Koenig, USC)
Source:	Amazon
Award Period:	3/1/2019 – 2/29/2020
Total amount:	\$80,000 (\$40,000 to N.A.) plus \$20,000 AWS credits (shared)
Effort:	0%

[G11] Internet of Battlefield Things Cooperative Research Agreement W911NF-17-2-0196
"Alliance for IoBT Research on Evolving Intelligent Goal-driven Networks (IoBT REIGN)"

Role:	Co-Principal Investigator (PI Tarek Abdelzaher, UIUC)
Source:	Army Research Laboratory
Award Period:	11/01/2018 – 10/30/2023
Total amount:	\$25M (Amount committed to N.A. (yrs 1-3): \$386,236)
Effort:	1 academic month

[G10] Distributed and Collaborative Intelligent Systems and Technology Cooperative Research Agreement W911NF-17-2-0181

"Autonomous, Resilient, Cognitive, Heterogeneous Swarms (DCIST ARCHeS)"

Role: Co-Principal Investigator (PI Vijay Kumar, UPenn)
Source: Army Research Laboratory
Award Period: 11/01/2018 – 10/30/2023
Total amount: $27M (Amount committed to N.A. (yrs 1-2): $239,534)
Effort: 0.86 academic month

[G9] NSF IIS-1837779

"CPS: Small: Novel Algorithmic Techniques for Drone Flight Planning on a Large Scale"

Role: Co-PI (PI Sven Koenig, USC)
Source: National Science Foundation
Award Period: 10/01/2018 – 9/30/2021
Total amount: $500,000 ($244,807 to N.A.)
Effort: 0.06 summer months

[G8] NSF IIS-1724399

"S&AS: Collab: The Human-Ocean Interface: Ocean Monitoring for Marine Co-Robotic Operations"

Role: Principal Investigator (co-PI M. Ani Hsieh, UPenn)
Source: National Science Foundation
Award Period: 9/1/2017 – 8/31/2020
Total amount: $699,992 ($353,063 to N.A.)
Effort: 0.75 summer month

[G7] NSF IIS-1724392

"S&AS: FND: Long-Term Planning and Robust Plan Execution for Multi-Robot Systems"

Role: Co-Principal Investigator (PI Sven Koenig, USC)
Source: National Science Foundation
Award Period: 9/1/2017 – 8/31/2020
Total amount: $599,999 ($254,770 to N.A.)
Effort: 0.15 summer month

[G6] NSF CNS-1659838

"REU Site: Robotics and Autonomous Systems"

Role: Principal Investigator (Co-PI Gaurav Sukhatme, USC)
Source: National Science Foundation
Award Period: 6/01/2016 – 5/31/2019
Total amount: $333,627
Effort: 0.05 summer month

[G5] NSF IIS-1553726

"CAREER: Crowdsourcing for Multirobot Coordination"

Role: Principal Investigator
Source: National Science Foundation
Award Period: 02/01/2016 – 01/31/2021
Total amount: $525,000
Effort: 1 summer month

Completed research support

[G4] Okawa Foundation Research Grant

"Learning New Multirobot Coordination Policies from Multiplayer Games"

Role: Principal Investigator
Source: Okawa Foundation
Award Period: 09/22/2016 – 09/21/2017
Total amount: $10,000
Effort: 0%

[G3] ONR DURIP N00014-16-1-2907
"Acquisition of a Motion Capture System for DoD-Sponsored Research in Robotics, Communication and Sensing"
Role: Co-Principal Investigator (PI: Gaurav Sukhatme, USC)
Source: Office of Naval Research
Award Period: 07/15/2016 – 07/14/2017
Total amount: $209,753 (shared resource)
Effort: 0%

[G2] ARO W911NF-14-D-0005
"Robotically Augmented and Assisted Trainer"
Role: Principal Investigator
Source: Army Research Office
Award Period: 11/01/2014 – 10/31/2017
Total amount: $148,765
Effort: 0.25 summer month

[G1] ONR N00014-14-1-0734
"Dynamic Resource Allocation in Autonomous Multiagent Systems"
Role: Principal Investigator
Source: Office of Naval Research
Award Period: 05/15/2014 – 11/15/2018
Total amount: $649,469
Effort: 1 summer month

Publications

Where known, acceptance rates and 2017 impact factors (from InCites Journal Citation Reports) are listed. All publications, except those under Edited Works, Doctoral Dissertation, and Under Review, are refereed. Underline denotes senior author(s).
Research group members:
^{R}Research scientist, ^{P}Ph.D. student, ^{V}Visiting Ph.D. student, ^{M}Master's student, ^{U}Undergraduate student

Refereed Journal Articles

In revision

[J10] W. Hönig^P, T. K. S. Kumar^R, L. Cohen, H. Ma, H. Xu, **N. Ayanian**, and S. Koenig, "Multi-agent path finding with kinematic constraints," in *Journal of Artificial Intelligence Research*, Accepted, In Revision.

Published or in press

[J9] **N. Ayanian**, "DART: Diversity-enhanced autonomy in robot teams," *International Journal of Robotics Research*, Accepted, In Press.
Impact Factor 4.047. DOI: 10.1177/0278364919839137

[J8] W. Hönig^P, S. Kiesel, A. Tinka, J. W. Durham, and **N. Ayanian**, "Persistent and robust execution of MAPF schedules in warehouses," *IEEE Robotics and Automation Letters*, vol. 4, no. 2, pp. 1125–1131, April 2019.
DOI: 10.1109/LRA.2019.2894217

[J7] T. Abdelzaher, **N. Ayanian**, T. Basar, S. Diggavi, J. Diesner, D. Ganesan, R. Govindan, S. Jha, T. Lepoint, B. Marlin, K. Nahrstedt, D. Nicol, R. Rajkumar, S. Russell, S. Seshia, F. Sha, P. Shenoy, M. Srivastava, G. Sukhatme, A. Swami, P. Tabuada, D. Towsley, N. Vaidya and V. Veeravalli, "Toward an internet of battlefield things: A resilience perspective," *Computer*, vol. 51, no. 11, pp. 24–36, Nov 2018.
Impact Factor 1.940. DOI: 10.1109/MC.2018.2876048

[J6] W. Hönig[P], J. Preiss, T. K. S. Kumar, G. Sukhatme, and **<u>N. Ayanian</u>**, "Trajectory planning for quadrotor swarms," *IEEE Transactions on Robotics*, vol. 34, no. 4, pp. 856–869, Aug 2018.
Impact Factor 4.264. DOI: 10.1109/TRO.2018.2853613

[J5] N. Kamra[P], T. K. S. Kumar[R], and **<u>N. Ayanian</u>**, "Combinatorial problems in multi-robot battery exchange systems," *IEEE Transactions on Automation Science and Engineering*, vol. 15, no. 2, pp. 852–862, 2018.
Impact Factor 3.667. DOI: 10.1109/TASE.2017.2767379

[J4] H. Ma, W. Hönig[P], L. Cohen, T. Uras, H. Xu, T. K. S. Kumar[R], **<u>N. Ayanian</u>**, and <u>S. Koenig</u>, "Overview: A hierarchical framework for plan generation and execution in multirobot systems," *IEEE Intelligent Systems*, vol. 32, no. 6, pp. 6–12, Nov/Dec 2017.
Impact Factor 2.596. DOI: 10.1109/MIS.2017.4531217

[J3] K. Hausman, J. Mueller, A. Hariharan[M], **<u>N. Ayanian</u>**, and <u>G. Sukhatme</u>, "Cooperative control for target tracking with onboard sensing," *International Journal of Robotics Research*, vol. 34, no. 13, pp. 1660–1677, November 2015.
Impact Factor 4.047. DOI: 10.1177/0278364915602321

Prior to joining USC

[J2] **N. Ayanian** and <u>V. Kumar</u>, "Decentralized feedback controllers for multiagent teams in environments with obstacles," *IEEE Transactions on Robotics*, vol. 26, no. 5, pp. 878 – 887, October 2010.
Impact Factor 4.264. DOI: 10.1177/0278364915602321

[J1] **N. Ayanian**, J. Keller, D. Cappelleri, and <u>V. Kumar</u>, "Development of a successful open-ended robotics design course at the high school level," *ASEE Computers in Education Journal*, vol. 20, no. 3, pp. 21–31, Jul–Sep 2010.

Edited Works

[E2] "Multi-Robot and Multi-Agent Systems," special issue of *Autonomous Robots*, **N. Ayanian**, R. Fitch, A. Franchi, P. Giordano, and L. Sabattini, eds., to be published.

[E1] "Robotics: Science and Systems," special issue of *Autonomous Robots*, S. Srinivasan, A. Majumdar, and **N. Ayanian**, eds., Jan 2019. DOI: 10.1007/s10514-018-09825-0

Refereed Book Chapters

[B1] W. Hönig[P] and **<u>N. Ayanian</u>**, "Flying multiple UAVs using ROS," in *Robot Operating System (ROS)*, ser. Studies in Computational Intelligence, A. Koubaa, Ed. Springer, Cham, 2017, vol. 707, pp. 88–118.
DOI: 10.1007/978-3-319-54927-9_3

Refereed Conference Articles

Under review or in revision

[C34] A. Molchanov, T. Chen, W. Hönig[P], J.A. Preiss, **<u>N. Ayanian</u>**, and <u>G.S. Sukhatme</u>, "Sim- to-(Multi)-Real: Transfer of Low-Level Robust Control Policies to Multiple Quadrotors," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2019. Accepted, to appear.
Acceptance Rate 45%. On arXiv: https://arxiv.org/abs/1903.04628

Published or in press

[C33] E. Boroson[P] and **<u>N. Ayanian</u>**, "3D keypoint repeatability for heterogeneous multi-robot SLAM," in *IEEE International Conference on Robotics and Automation*, Montreal, QC, Canada, May 2019, pp. 6337–6343.
Acceptance Rate 44%

[C32] H. Ma, W. Hönig^P, T. K. S. Kumar, **N. Ayanian**, and S. Koenig, "Lifelong path planning with kinematic constraints for multi-agent pickup and delivery," in *AAAI Conference on Artificial Intelligence*, Honolulu, HI, USA, Jan 2019.
Acceptance Rate 16.2%

[C31] B. Şenbaşlar^M, W. Hönig^P, and **N. Ayanian**, "Robust trajectory execution for multi-robot teams using distributed real-time replanning," in *International Symposium on Distributed Autonomous Robotic Systems*, Boulder, CO, USA, Oct 2018, pp. 167–181.
DOI: 10.1007/978-3-030-05816-6_12

[C30] M. Debord^M, W. Hönig^P, and **N. Ayanian**, "Trajectory planning for heterogeneous robot teams," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Madrid, Spain, Oct 2018, pp. 7924–7931.
Acceptance Rate 46.7%. DOI: 10.1109/IROS.2018.8593876

[C29] J. A. Tran, P. Ghosh, Y. Gu, R. Kim, D. D'Souza, **N. Ayanian**, and B. Krishnamachari, "Intelligent robotic IoT system testbed (IRIS)," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Madrid, Spain, Oct 2018, pp. 7961–7966.
Acceptance Rate 46.7%. DOI: 10.1109/IROS.2018.8593636

[C28] T. Abdelzaher, **N. Ayanian**, T. Basar, S. Diggavi, J. Diesner, D. Ganesan, R. Govindan, S. Jha, T. Lepoint, B. Marlin, K. Nahrstedt, D. Nicol, R. Rajkumar, S. Russell, S. Seshia, F. Sha, P. Shenoy, M. Srivastava, G. Sukhatme, A. Swami, P. Tabuada, D. Towsley, N. Vaidya, and V. Veeravalli, "Will distributed computing revolutionize peace? The emergence of battlefield IoT," in *IEEE Int'l Conference on Distributed Computing Systems*, Vienna, Austria, Jul 2018, pp. 1129–1138.

[C27] W. Hönig^P, S. Kiesel, A. Tinka, J.W. Durham, and **N. Ayanian**, "Conflict-based search with optimal task assignment," in *International Conference on Autonomous Agents and Multiagent Systems*, Stockholm, Sweden, Jul 2018, pp. 757–765.
Acceptance Rate 25%. URL: http://dl.acm.org/citation.cfm?id=3237495

[C26] **N. Ayanian**, "DART: Diversity-enhanced autonomy in robot teams," in *International Symposium of Robotics Research*, Chile, Dec 2017. Talk available online https://vimeo.com/246403036.
DOI: 10.1177/0278364919839137

[C25] J. A. Preiss, W. Hönig^P, **N. Ayanian**, and G. S. Sukhatme, "Downwash-aware trajectory planning for large quadrotor teams," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Vancouver, BC, Canada, Sep 2017, pp. 250–257.
Acceptance Rate 44.8%. DOI: 10.1109/IROS.2017.8202165

[C24] W. Hönig^P, T. K. S. Kumar, L. Cohen, H. Ma, H. Xu, **N. Ayanian**, and S. Koenig, "Summary: Multi-agent path finding with kinematic contraints," in *International Joint Conferences on Artificial Intelligence*, Melbourne, Australia, Aug 2017, pp. 4869–4873.
Acceptance Rate 26%. DOI: 10.24963/ijcai.2017/684

[C23] J. A. Preiss, W. Hönig^P, G. S. Sukhatme, and **N. Ayanian**, "Crazyswarm: A large nano-quadcopter swarm," in *IEEE International Conference on Robotics and Automation*, Singapore, May 2017, pp. 3299–3304.
Acceptance Rate 41%. DOI: 10.1109/ICRA.2017.7989376

[C22] A. Hamza^M and **N. Ayanian**, "Forecasting battery state of charge for robot missions," in *ACM Symposium on Applied Computing, Intelligent Robotics and Multi-Agent Systems (IRMAS) track*, Marrakech, Morocco, Apr 2017, pp. 249–255.
Acceptance Rate 23%. DOI: 10.1145/3019612.3019705

[C21] H. Xu, T. K. S. Kumar^R, D. Johnke, **N. Ayanian**, and S. Koenig, "SAGL: A new heuristic for multi-robot routing with complex tasks," in *IEEE International Conference on Tools with Artificial Intelligence*, San Jose, CA, Nov 2016, pp. 530–535.
Acceptance Rate 31%. DOI: 10.1109/ICTAI.2016.0087

[C20] L. Cohen, T. Uras, T. K. S. Kumar^R, H. Xu, **N. Ayanian**, and S. Koenig, "Improved solvers for bounded-suboptimal multi-agent path finding," in *International Joint Conference on Artificial Intelligence*, New York, Jul 2016, pp. 3067–3074.
Acceptance Rate 25%. DOI: 10.1109/ICTAI.2016.0087

[C19] W. Hönig^P and **N. Ayanian**, "Dynamic multi-target coverage with robotic cameras," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Daejeon, Korea, Oct 2016, pp. 1871–1878.
Acceptance Rate 48%. DOI: 10.1109/IROS.2016.7759297

[C18] W. Hönig^P, T. K. S. Kumar^R, H. Ma, S. Koenig, and **N. Ayanian**, "Formation change for robot groups in occluded environments," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Deajeon, Korea, Oct 2016, pp. 4836–4842.
Acceptance Rate 48%. DOI: 10.1109/IROS.2016.7759710

[C17] W. Hönig^P, T. K. S. Kumar^R, L. Cohen, H. Ma, H. Xu, **N. Ayanian**, and S. Koenig, "Multi-agent path finding with kinematic constraints," in *International Conference on Automated Planning and Scheduling*, London, UK, Jun 2016, pp. 477–485.
Acceptance Rate 35%. URL: www.aaai.org/ocs/index.php/ICAPS/ICAPS16/paper/view/13183
Awarded outstanding paper in robotics track

[C16] W. Hönig^P, C. Milanes^U, L. Scaria^U, T. Phan, M. Bolas, and **N. Ayanian**, "Mixed reality for robotics," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Hamburg, Germany, Sep 2015, pp. 5382–5387.
Acceptance Rate 45%. DOI: 10.1109/IROS.2015.7354138

[C15] S. Wang, B. Krishnamachari, and **N. Ayanian**, "The optimism principle: A unified framework for optimal robotic network deployment in an unknown obstructed environment," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Hamburg, Germany, Sep 2015, pp. 2578 – 2584.
Acceptance Rate 45%. DOI: 10.1109/IROS.2015.7353728

[C14] N. Kamra^P and **N. Ayanian**, "A mixed integer programming model for timed deliveries in multirobot systems," in *IEEE International Conference on Automation Science and Engineering*, Gothenburg, Sweden, Aug 2015, pp. 612 – 617.
Acceptance Rate 60%. DOI: 10.1109/CoASE.2015.7294146

[C13] S. Garg^P and **N. Ayanian**, "Persistent monitoring of stochastic spatio-temporal phenomena with a small team of robots," in *Robotics: Science and Systems*, Berkeley, CA, Jul 2014, pp. 1–10.
Acceptance Rate 32%. URL: www.roboticsproceedings.org/rss10/p38.pdf

[C12] K. Hausman, J. Müller, A. Hariharan^M, **N. Ayanian**, and G. Sukhatme, "Cooperative control for target tracking with onboard sensing," in *International Symposium on Experimental Robotics*, Morocco, Jun 2014, pp. 879–892.
DOI: 10.1007/978-3-319-23778-7_58

Prior to joining USC
Supervisees: ^{s}Research staff, ^{p}Ph.D. student, ^{u}Undergraduate Student

[C11] **N. Ayanian**, A. Spielberg^s, M. Arbesfeld^u, J. Strauss^u, and D. Rus, "Controlling a team of robots from a single input," in *IEEE International Conference on Robotics and Automation*, Hong Kong, Jun 2014, pp. 1755–1762.
Acceptance Rate 48%. DOI: 10.1109/ICRA.2014.6907088

[C10] C. Sung^p, **N. Ayanian**, and D. Rus, "Improving the performance of multi-robot systems by task switching," in *IEEE International Conference on Robotics and Automation*, Karlsruhe, Germany, May 2013, pp. 2984–2991.
Acceptance Rate 39%. DOI: 10.1109/ICRA.2013.6630993

[C9] **N. Ayanian**, <u>D. Rus</u>, and <u>V. Kumar</u>, "Decentralized multirobot control in partially known environments with dynamic task reassignment," in *IFAC Workshop on Distributed Estimation and Control in Networked Systems*, Santa Barbara, CA, Sept 2012, pp. 311–316.
DOI: 10.3182/20120914-2-US-4030.00029

[C8] **N. Ayanian**, V. Kallem, and <u>V. Kumar</u>, "Synthesis of feedback controllers for multiple aerial robots with geometric constraints," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, San Francisco, CA, Sept. 2011, pp. 3126–3131.
Acceptance Rate 32%. DOI: 10.1109/IROS.2011.6094943

[C7] **N. Ayanian**, J. F. Keller, P. J. White, and <u>V. Kumar</u>, "Sparking a lifelong interest in engineering through a summer academy in robotics," in *ASME IDETC Mechanisms and Robotics Conference*, Montreal, QC, Canada, Aug 2010, pp. 1019–1028.
DOI: 10.1115/DETC2010-29154

[C6] **N. Ayanian** and <u>V. Kumar</u>, "Abstractions and controllers for groups of robots in environments with obstacles," in *IEEE International Conference on Robotics and Automation*, Anchorage, AK, May 2010, pp. 3537 – 3542.
Acceptance Rate 41%. DOI: 10.1109/ROBOT.2010.5509534

[C5] **N. Ayanian**, <u>V. Kumar</u>, and <u>D. Koditschek</u>, "Synthesis of controllers to create, maintain, and reconfigure robot formations with communication constraints," in *Proceedings of the 2009 International Symposium on Robotics Research*, ser. Springer Tracts in Advanced Robotics, C. Pradalier, R. Siegwart, and G. Hirzinger, Eds. Springer Berlin / Heidelberg, 2011, vol. 70, pp. 625–642.
DOI: 10.1007/978-3-642-19457-3_37

[C4] J. Keller, D. Cappelleri, T. Kientz, **N. Ayanian**, P. J. White, and <u>V. Kumar</u>, "Capturing the interest of future engineers: The development of an intensive three-week summer academy in robotics for high school students," in *Fall ASEE Mid-Atlantic Section Conference*, Stevens Inst. Tech., Hoboken, NJ, 2008.

[C3] H. Kress-Gazit, **N. Ayanian**, <u>G. J. Pappas</u>, and <u>V. Kumar</u>, "Recycling controllers," in *IEEE International Conference on Automation Science and Engineering*, Washington, DC, Aug 2008, pp. 772–777.
Acceptance Rate 58%. DOI: 10.1109/COASE.2008.4626521

[C2] **N. Ayanian**, P. J. White, Á. Hálász, <u>M. Yim</u>, and <u>V. Kumar</u>, "Stochastic control for self-assembly of XBots," in *ASME IDETC Mechanisms and Robotics Conference*, vol. 2, New York, NY, August 2008, pp. 1169–1176.
DOI: 10.1115/DETC2008-49535

[C1] **N. Ayanian** and <u>V. Kumar</u>, "Decentralized feedback controllers for multi-agent teams in environments with obstacles," in *IEEE International Conference on Robotics and Automation*, Pasadena, CA, May 2008, pp. 1936–1941.
Acceptance Rate 45%. DOI: 10.1109/ROBOT.2008.4543490
Awarded best student paper.

Refereed Conference Extended Abstracts and Posters

Published or in press

[A12] H. Ma, W. Hönig[P], <u>T.K.S. Kumar</u>, **N. Ayanian**, and <u>S. Koenig</u>, "Lifelong Path Planning with Kinematic Constraints for Multi-Agent Pickup and Delivery," in *AAAI Symposium on Combinatorial Search*, Napa, CA, July 2019.

[A11] B. Şenbaşlar[M], W. Hönig[P], and **N. Ayanian**, "Robust Trajectory Execution for Multi-Robot Teams Using Distributed Real-time Replanning," in *Southern California Robotics Symposium*, Los Angeles, CA, April 2019.

[**A11**] E. Boroson[P] and **N. Ayanian**, "3D keypoint repeatability for heterogeneous multi-robot SLAM," in *Southern California Robotics Symposium*, Los Angeles, CA, April 2019.

[**A10**] D. Albani[V], W. Hönig[P], **N. Ayanian**, D. Nardi, and V. Trianni, "Distributed task assignment and path planning with limited communication for robot teams," in *International Conference on Autonomous Agents and Multiagent Systems*, Montreal, Quebec: International Foundation for Autonomous Agents and Multiagent Systems, 2019, pp. 1–2.

[**A9**] T. Phan, W. Hönig[P], and **N. Ayanian**, "Mixed reality collaboration between human-agent teams," in *IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Reutlingen, Germany, March 2018, pp. 659–660. DOI: 10.1109/VR.2018.8446542

[**A8**] M. Debord[M], W. Hönig[P], and **N. Ayanian**, "Trajectory planning for heterogeneous robot teams," in *International Symposium on Aerial Robotics*, Philadelphia, PA, 2018, pp. 1–2.

[**A7**] E. Boroson[P] and **N. Ayanian**, "Model-Free Policy Gradients for Multi-Agent Shape Formation," in *IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS) (Poster)*, Los Angeles, CA, December 2017.

[**A6**] E. Boroson[P] and **N. Ayanian**, "Model-Free Policy Gradients for Multi-Agent Shape Formation (Extended Abstract)," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vancouver, BC, Canada, September 2017.

[**A5**] J. A. Preiss, W. Hönig[P], **N. Ayanian**, and G. S. Sukhatme, "Downwash-aware trajectory planning for quadrotor swarms," in *International Symposium on Aerial Robotics*, Philadelphia, PA, June 2017.

[**A4**] J. A. Preiss, W. Hönig[P], G. S. Sukhatme, and **N. Ayanian**, "Crazyswarm: A large nano-quadcopter swarm (extended abstract)," in *IEEE/RSJ Intl Conf Intelligent Robots and Systems (Late breaking)*, 2016.

[**A3**] T. Cai, D. Zhang, T. K. S. Kumar, S. Koenig, and **N. Ayanian**, "Local search on trees and a framework for automated construction using multiple identical robots (extended abstract)," in *International Conference on Autonomous Agents and Multiagent Systems*, Singapore, May 2016, pp. 1301–1302.

[**A2**] A. Tavakoli[M], H. Nalbandian[U], and **N. Ayanian**, "Crowdsourced coordination through online games (late breaking report)," in *ACM/IEEE Intl Conf Human-Robot Interaction*, Christchurch, New Zealand, Mar 2016.

Prior to joining USC

[**A1**] G. Wagner, H. Choset, and **N. Ayanian**, "Subdimensional expansion and optimal task reassignment," in *AAAI Symposium on Combinatorial Search*, Niagara Falls, ON, Canada, July 2012, pp. 177–178.

Refereed Workshop Papers

[**W1**] W. Hönig[U], A. Tavakoli[M], and **N. Ayanian**, "Seamless robot simulation integration for education: A case study," in *Workshop on Role of Simulation in Robot Programming at IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots*, 2016.

Doctoral Dissertation

N. Ayanian, "Coordination of multirobot teams and groups in constrained environments: Models, abstractions, and control policies," Ph.D. dissertation, University of Pennsylvania, 2011.

Keynote and Plenary Talks

- Early Career Spotlight, International Joint Conference on Artificial Intelligence, "Coordinating Multi-robot Systems in the Physical World," Macau, August 2019.

- Plenary Speaker, Third International Symposium on Aerial Robotics, "Downwash-aware trajectory planning for large teams of robots," Toronto, May 2019.

- "DART: Diversity-enhanced autonomy in robot teams," International Symposium for Robotics Research, Puerto Varas, Chile, Dec 2017. (also listed under conference publications) Available online: https://vimeo.com/246403036

- "Where are the swarms?" Keynote, Lakeside Labs Research Days, Klagenfurt, Austria, July 11, 2017.

- "Teams of robots with real world impact," TEDx Cibeles, Madrid, Spain May 27, 2017. https://www.youtube.com/watch?v=ww-uovuCfDU&t=10s

Other Invited Talks

2019: "Crossing the Reality Gap: Coordinating Multirobot Systems in The Physical World," NASA Jet Propulsion Laboratory, Pasadena, CA, June 2019 • "Crossing the Reality Gap: Coordinating Multirobot Systems in The Physical World," Stanford University, Palo Alto, CA, May 2019 • "Crossing the Reality Gap: Coordinating Multirobot Systems in The Physical World," University of California Riverside, Riverside, CA, Feb 2019 • "Crossing the Reality Gap: Coordinating Multirobot Systems in The Physical World," Southwest Robotics Symposium, Arizona State University, Tempe, AZ, Jan 2019 • "Crossing the Reality Gap: Coordinating Multirobot Systems in The Physical World," Computer Science Symposium, Yale University, New Haven, CT, Jan 2019

2018: *Parental leave and no travel due to pregnancy and childbirth.*

2017: "Where are the swarms?" IEEE Los Angeles Young Professionals Tech Talk, University of Southern California, Los Angeles, CA, Oct 2017 • "Where are the swarms?" GRASP Special Seminar, University of Pennsylvania, Philadelphia, PA, Oct 2017 • "Where are the swarms?" Computer Science Colloquium, Harvey Mudd College, Claremont, CA, Oct 2017 • "Where are the swarms?" Robotics: Science and Systems; Workshop on Robot Communication in the Wild: Meeting the Challenges of Real-World Systems, Cambridge, MA, July 2017 • "Behavioral diversity in robotics," Mechanical Engineering Seminar, Drexel University, Philadelphia, PA, May 2017 • "Crowdsourcing diversity in robotics," SpaceX, Hawthorne, CA, April 2017 • "Behavioral diversity in robotics," Decision and Control Laboratory Seminar, University of Illinois at Urbana-Champaign, Urbana, IL, March 2017

2016: "Crowdsourcing diversity in robotics," MIT Technology Review Emerging Technologies (EmTech) Conference, Cambridge, MA, Oct 2016 • "Crowdsourcing diversity in robotics," IBM Edge Conference, Las Vegas, Sept 2016. • "Using online games to inspire distributed multi-robot controllers," Workshop on Heterogeneity, Diversity, and Resilience in Multi-Robot Systems, Arlington, VA, Aug 2016 • "Using online games to inspire stochastic distributed multirobot controllers," Robotics: Science and Systems; Workshop on Challenges in Modeling and Control of Centimeter-Scale Robots, Ann Arbor, MI, June 2016 • "Multirobot coordination: From high-level specification to correct execution," Intl Conf on Automated Planning and Scheduling; Workshop on Distributed and Multi-Agent Planning (DMAP), London, June 2016 • "Multirobot coordination: From high-level specification to correct execution," Center for Control, Dynamical-Systems, and Computation, UC Santa Barbara, Santa Barbara, CA, Apr 2016 • "Multirobot coordination: From high-level specification to correct execution," School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, Mar 2016 • "Multirobot coordination: From high-level specification to correct execution," CS Colloquium, Sonoma State University, Sonoma, CA, Feb 2016

2015: "Multirobot coordination: Methods and applications," Institute for Robotics and Intelligent Machines, Georgia Tech, Atlanta, GA, Dec 2015 • "Mixed reality experimentation for multirobot systems," Workshop on Embodied sensorimotor interaction: from locomotion to collective behavior, International Symposium on Swarm Behavior and Bio-Inspired Robotics (SWARM), Kyoto, Japan, October 2015 • "Multirobot coordination: Methods and applications of the future," DARPA JASON Summer Study on Unmanned Air Systems Technology, San Diego, CA, June 2015 • "Distributed multirobot coordination: From specification to provably correct execution," College of Science and Engineering, American University of Armenia, Yerevan, Armenia July 2015

2014: "Automated synthesis of feedback policies for multi-robot teams and groups from high-level specifications," Workshop on Advanced Robotics PLUS, Munich, Germany October 2014

2013: "Distributed multirobot coordination," ISI Graduate Student Symposium, Information Sciences Institute, Marina Del Rey, CA, Nov 2013 • "Distributed multirobot coordination: From specification to provably correct execution," Computer Science Colloquium, University of Southern California, Los Angeles, CA, April 2013 • "Distributed multirobot coordination: From specification to provably correct execution," Computer Science Colloquium, Rensselaer Polytechnic Institute, Troy, NY, March 2013 • "Multirobot coordination: From specification to provably correct execution," Mechanical Engineering and Materials Science Seminar, Yale University, New Haven, CT, February 2013 • "Coordination and optimization for enabling smart cities," Civil and Environmental Engineering Seminar, University of California Berkeley, Berkeley, CA, February 2013

2012: "Multirobot coordination: From specification to provably correct execution," Mechanical Engineering Seminar, Johns Hopkins University, Baltimore, MD, March 2012

2011: "Coordination of mutirobot teams and groups in constrained environments," Hybrid and Networked Systems Lab, Boston University, Boston, MA, December 2011 • "Automatic synthesis of multirobot feedback control policies," Invited Seminar, Robotic Embedded Systems Lab, University of Southern California, Los Angeles, CA, April 2011 • "Automatic synthesis of multirobot feedback control policies," Robotics and Embedded Systems Seminar, University of California, Berkeley, CA, March 2011 • "Automatic synthesis of multirobot feedback control policies," Invited Seminar, Distributed Robotics Laboratory, Massachusetts Institute of Technology, Cambridge, MA, March 2011

2010: "Automated synthesis of feedback policies for multi-robot teams and groups from high-level specifications," Dept. of Computer Science, University of Illinois at Urbana-Champaign, Urbana, IL, November 2010 • "Automated synthesis of feedback policies for multi-robot teams and groups from high-level specifications," Robotics and Controls Seminar, Dept. of Mechanical Engineering, Stevens Institute of Technology, Hoboken, NJ, October 2010 • "Automated synthesis of feedback policies for multi-robot teams and groups from high-level specifications," Departmental Seminar, Dept. of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, PA, July 2010 • "Automated synthesis of feedback policies for multi-robot teams and groups from high-level specifications," IEEE ICRA Workshop on Network Science and Systems Issues in Multirobot Autonomy, Anchorage, AK, May 2010.

2009: "Synthesis of controllers to create, maintain and reconfigure robot formations with communication constraints," Invited Seminar, Center for the Foundations of Robotics, The Robotics Institute at Carnegie Mellon University, Pittsburgh, PA, October 2009 • "Synthesis of decentralized controllers to form, maintain or break-up robot formations," Invited Semnar, Self-Organizing Systems Lab and Distributed Space Systems Lab, University of Washington, Seattle, WA, March 2009.

Teaching

At USC

Introduction to Robotics (CSCI 445, undergraduate laboratory), USC, Dept. of Computer Science
Upper-level undergraduate course on mobile robotics with a lab component. The course attracts students from across USC, including students from the Marshall School of Business. Due to challenges with failing

hardware and the diversity of students in the course, I fully revamped the course and lab in 2016 (first iteration of new course marked * below), with new hardware, new lecture material, and new labs, including a custom in-house built simulator. Prior to this course reboot, the largest challenges were in dealing with hardware anomalies and bugs in copied code; the new course focuses on understanding how to use robot hardware and implementing algorithmic solutions for robotics, with more rigorous labs and evaluation. This course is now taught twice yearly due to demand.

	Fall 2014	Fall 2015	Spring 2016*	Spring 2017	Fall 2018	Fall 2019
Instructor Rating:	4.23	3.46	3.91	4.29	4.5	
Course Rating:	n/a	3.71	3.58	3.76	4.14	

Coordinated Mobile Robotics (CSCI 599/646, PhD-level), USC, Dept. of Computer Science
New Ph.D. level course I developed on state-of-the-art methods in mobile robotics and multi-robot coordination. The course stresses self-directed learning and presentation skills.

	Spring 2014	Spring 2015	Fall 2016	Fall 2019
Instructor Rating:	4.31	4.78	4.86	
Course Rating:	4	4.33	4.86	

Prior to joining USC

Teaching Certificate, UPenn Center for Teaching and Learning, Oct 2010.
Provides doctoral students with support for improving teaching: completed five pedagogical workshops, completed more than two semesters of teaching assistantship, had a full teaching session observed and reviewed, and developed a teaching philosophy.

Co-Instructor, Summer Academy in Applied Science and Technology: Robotics, UPenn, July 2009, July 2008.

Teaching Assistant, Mechanical Engineering Design Labs (MEAM 247, undergraduate), UPenn, Dept. Mechanical Engineering and Applied Mechanics, Fall 2007
Teaching Assistant, Mechanical Engineering Design Labs (MEAM 247b/347b, undergraduate), UPenn, Dept. Mechanical Engineering and Applied Mechanics, Spring 2007.
As a TA for 247 and for 247b/347b, I designed and aided in the design of new labs with real-life applications, including robotics, vibration, heat transfer, modeling, and design.

Teaching Assistant, Robotics (CSE 390, MEAM 420/520, undergraduate and Master's), UPenn, Fall 2006.

Teaching Assistant, Introduction to Controls (MEM 255, undergraduate), Drexel University, Dept. of Mechanical Engineering and Mechanics, Fall 2003, Winter 2004.

Mentoring

Current trainees

Postdoctoral Researchers

- Elahe Aghapour, Ph.D.   beginning August 2019

Doctoral Students

- Elizabeth R. Boroson, Computer Science, USC   Aug 2016–present
  Passed Screening Fall 2017; Written Qualifier Fall 2018; Oral Qualifier Spring 2019
  Awards: 2018 NASA Space Technology Fellowship
- Jingyao Ren, Computer Science, USC   Aug 2017–present
  Passed Screening Fall 2018
- Eric Ewing, Computer Science, USC   June 2019–present
  Was previously student of Milind Tambe

- Baskın Şenbaşlar, Computer Science, USC   beginning Aug 2019
- Kegan Strawn, Computer Science, USC   beginning Aug 2019
- Connie Zhang, Computer Science, USC   beginning Aug 2019

Master's Students

- Roshan Pasupathy, USC, Computer Science,   Sep 2018–present
- Alp Cevikel, USC, Computer Science   Sep 2018–present
- Alexander Winger, USC, Computer Science   Sep 2018–present

Undergraduate Students

- Andrew-Richard Opem, USC, Electrical Engineering   Feb 2019–present

Former trainees

Research Scientists

- T.K. Satish Kumar, USC   Oct 2015–Aug 2016
  Currently Research Assistant Professor in Computer Science at USC

Former Doctoral Students

- Wolfgang Hönig, Computer Science, USC   Aug 2014–Mar 2019
  Dissertation: *Motion Coordination for Large Multi-Robot Teams in Obstacle-Rich Environments*
  2019 Computer Science Best Dissertation; 2017 Jenny Wang Excellence in Teaching; 2017 Best research
  assistant in Computer Science; 2017 Best teaching assistant in Computer Science; 2016 Best paper in
  robotics track at ICAPS; 2016 Best presentation at USC CS annual research review poster session;
  2015 Best demo at USC CS annual research review poster session
  Currently Postdoc at Caltech
- Nitin Kamra, Computer Science, USC   Aug 2014–May 2016
  Changed research area to machine learning

Graduated Master's Students

- Baskın Şenbaşlar, USC, Electrical Engineering,   Sep 2017–May 2019
- Arash Tavakoli, Computer Science, USC   Sep 2014–May 2016
- Ameer Hamza, Computer Science, USC   Sep 2014–Dec 2015
  Thesis: *Predicting mission power requirement for mobile robots*

Former Undergraduate Students

- Eric Yi Han Chen, USC, Electrical Engineering   Sep 2016–Dec 2018
  Awards: Provost's Undergraduate Research Fellowship
- Alex Colello, USC, Computer Science   Sep 2017–Dec 2018
  Awards: Provost's Undergraduate Research Fellowship
- Ceasar Navarro, Norco College, Mechanical Engineering (through REU Site)   Jun 2018–Aug 2018
- Daniel Lytle, USC, Electrical Engineering   Sep 2016–May 2018
- Trevor Nielsen, USC, Electrical Engineering   Sep 2016–May 2018
- John Zeiders, USC, Computer Science and Economics Mathematics   Nov 2016–May 2018
- Jillian Khoo, USC, Computer Science   Sep 2017–May 2018
- Virginia Dudley, USC, Computer Science and Business Administration   Sep 2017–May 2018
- Colin Heath, USC, Computer Science   Sep 2017–May 2018
- Barbara Boyadjian, USC, Biomedical Engineering   Sep 2017–May 2018
- Eric Liu, USC, Electrical Engineering   Jan 2017–May 2017
- Spencer Powers, USC, Aerospace and Mechanical Engineering   Sep 2016–Dec 2016
- Joao Victor Cordeiro Coutinho, Federal University of Pernambuco (Brazil)   Jan 2016–Aug 2016

- Kim Luong, USC, Aerospace and Mechanical Engineering   Jan 2015–Aug 2016
  Awards: Provost's Undergraduate Research Fellowship
- Jacob Swanson, USC, Electrical and Computer Engineering   Jan 2016–May 2016
- Michael Thorson, USC, Aerospace and Mechanical Engineering   Jan 2016–May 2016
- Lindsay White, USC, Electrical and Computer Engineering   Feb 2016–May 2016
- Darian Wood, USC, Aerospace and Mechanical Engineering   Feb 2016–May 2016
- Christina Milanes, USC, Electrical Engineering   Jan 2014–May 2015
- Lisa Scaria, USC, Electrical Engineering   Apr 2014–May 2015
  Awards: Provost's Undergraduate Research Fellowship
- Haig Nalbandian, USC, Computer Science   Jan 2015–Dec 2015

Ph.D. Committees
- Ariyan Kabir, Aerospace and Mechanical Engineering, USC   Jul 2019
- Bharath Sankaran*, Computer Science, USC   Jul 2018
  **I chaired this committee in the absence of Stefan Schaal*
- Pradipta Ghosh, Electrical Engineering, USC   Jun 2018
- Stephanie Kemna, Computer Science, USC   Apr 2018
- James Tanner, Computer Science, USC   Dec 2017
- Mahdi Azmandian, Computer Science, USC   Dec 2017
- Shangxing Wang, Electrical Engineering, USC   Apr 2016
- Aaron St. Clair, Computer Science, USC   May 2015
- Juan Fasola, Computer Science, USC   May 2014
- Megha Gupta, Computer Science, USC   May 2014

Qualifying Exam Committees
- Served on qualifying exam committee for more than 30 students from CS, EE, and AME

Media and Impact

Media Appearances and Interviews

1. To appear in Amazon show in a four scientist roundtable discussing the future of technology, 2019.

2. Featured in a 5-minute segment on Discovery Channel Canada's "Daily Planet", 2017.

3. Featured on Discovery Channel Canada's "Daily Planet" Discoveries segment, February 22, 2017.

4. Featured on Tech Insider UK's Facebook page, posted Feb 22, 2017, and received more than 5.8 million views in five days (**more than 9.8M total views**)

5. Featured in a Reuters video on Feb 21, 2017, and was syndicated over many channels. http://www.reuters.com/video/2017/02/22/coordinated-drones-fly-in-synchronized-f?videoId=371168586&videoChannel=6

6. Featured on the CISCO Women Rock-IT TV series, November 29, 2016. https://www.cisco.com/c/m/en_sg/partners/women-rock-it/presentations.html

7. Interviewed by local Los Angeles ABC 3pm anchor Ellen Leyva on Sept 8, 2016 regarding my research and the MIT Technology Review 35 Innovators Under 35. The segment aired live.

Guest Blog Posts

1. "Diversity in the IT Industry is Key to Solving Global Problems," Cisco, November 17, 2016. https://blogs.cisco.com/csr/diversity-in-the-it-industry-is-key-to-solving-global-problems

Podcasts and Radio

1. M. Frauenfelder and D. Pescovitz, "Podcast: How to teach robots teamwork," *For Future Reference*, Institute for the Future, April 7, 2017.
https://boingboing.net/2017/04/07/how-to-teach-robots-teamwork.html

2. E. Salinas, "Podcast: Robot Teams with Nora Ayanian," *The Women in Tech Show*, Edaena Salinas, March 20, 2017.
https://thewomenintechshow.com/2017/03/20/robot-teams-with-nora-ayanian/

3. A. H. Nissen, Harddisken (The Hard Disk Drive), Danish Broadcasting Corporation, October 21, 2016.

4. V. Garrick, *Annenberg Radio News Update*, October 19, 2016.
http://www.uscannenbergmedia.com/2016/10/19/la-news-in-10-minutes-october-19-2016/

5. O. Bennett-Jones, "Podcast: California dreaming of new drone uses – even to paint graffiti," *Drone News from the Bureau of Investigative Journalism*, Episode 35, March 27, 2015.

Print and Online Articles About My Research

1. J. Kehe, "Drone swarms as you know them are just an illusion–for now," *Wired*, August 14, 2018.
https://www.wired.com/story/drone-swarms-are-an-illusion-for-now/

2. S. C. Stuart, "Drone light shows look cool, but how do they work?" *PCMag*, January 22, 2018.
https://www.pcmag.com/news/358651/drone-light-shows-look-cool-but-how-do-they-work

3. V. Collera, "Nora Ayanian, adiestradora de drones," (Translation: Nora Ayanian, drone trainer) *El Pais Semanal*, July 6, 2017.
https://elpais.com/elpais/2017/07/06/eps/1499292327_149929.html

4. J. Graham, "You can teach drones to fly together. Just ask their instructor," *USA Today*, March 31, 2017.
https://www.usatoday.com/story/tech/talkingtech/2017/03/31/you-can-teach-drones-fly-together-just-ask-their-instructor/99848778/

5. A. Keay, K. Perlongo, S. Hauert, and H. Siegel, "25 women in robotics you need to know about – 2016," Robohub.org, October 11, 2016.
http://robohub.org/25-women-in-robotics-you-need-to-know-about-2016/

6. R. Bradley, "To build better machines, a roboticist goes far outside her field for guidance." *MIT Technology Review*, Aug 23, 2016.
https://www.technologyreview.com/lists/innovators-under-35/2016/visionary/nora-ayanian/

7. J. Warren Duffie, "Brilliant at any age: ONR researchers, robots and MIT," Armed with Science, The official U.S. Defense Department Science Blog, Sept 18, 2016.
http://science.dodlive.mil/2016/09/18/brilliant-at-any-age-onr-researchers-robots-and-mit/

8. M. Stålnacke, "Telehaptic control," *Ericsson Research Blog*, Feb 20, 2016.
My lab's ROS package for Crazyflie was used in an Ericsson Live Demo at Mobile World Congress
https://www.ericsson.com/en/press-releases/2016/2/ericsson-showcases-5g-internet-of-things-and-cloud-innovation-at-mwc-2016

9. S. Corey, "Can robots come to your rescue in a burning building?" *Viterbi News*, November 6, 2015.
http://news.usc.edu/88394/can-robots-come-to-the-rescue-in-a-burning-building/

10. H. Vu, "From the battlefield to the playing field," *Viterbi Magazine*, Fall 2015.
https://magazine.viterbi.usc.edu/fall-2015/intro-2/from-the-battlefield-to-the-playing-field/

11. Mic.com, "Mic 50's Nora Ayanian shows us the future of drones," July 9, 2015.
https://www.youtube.com/watch?v=x8oY4OkkVgY

12. A. Fielding-Smith, "California dreaming of new drone uses – even to paint graffiti," *Drone News from the Bureau of Investigative Journalism*, March 27, 2015.
https://www.thebureauinvestigates.com/2015/03/27/podcast-california-dreaming-of-new-drone-uses-even-to-paint-graffiti/

13. S. Shimada, "Why won't the robots make me a sandwich?" *Viterbi News*, August 02, 2013.
http://viterbi.usc.edu/news/news/2013/bringing-robotics-to.htm

Service

Service to the Field

Advisory Board/Committee Memberships

- Co-Founder and Co-Chair, IEEE Robotics and Automation Society (RAS) Technical Committee on Multi-Robot Systems, 2014 – present
- College of Science and Engineering Advisory Board, American University of Armenia, 2017-present

Editorial Boards

- Swarm Intelligence Journal, Jan 2017 – present
- Autonomous Robots, Jan 2019 – present

Organizing Committees

- Publicity chair, International Conference on Robotics and Automation (ICRA) 2023, London, UK.
- Workshop and Tutorials chair, International Conference on Robotics and Automation (ICRA) 2022, Philadelphia, PA, USA.
- Finance Chair, International Symposium on Multi-Robot and Multi-Agent Systems (MRS) 2019, Los Angeles, CA.
- General Chair and Local Arrangements, International Symposium on Multi-Robot and Multi-Agent Systems (MRS) 2017, USC, Los Angeles, CA, USA. http://multirobotsystems.org/mrs2017
- Organizer, Southern California Robotics Symposium (SCR) 2017, USC, Los Angeles, CA, USA.
- Publication Chair, Robotics: Science and Systems (RSS) 2017, MIT, Cambridge, MA, USA.
- Publicity Chair, International Conference on Robotics and Automation (ICRA) 2015.
  In this capacity, I oversaw the creation of the first ICRA Trailer
  Short version: http://www.youtube.com/watch?v=qoKyYX4WWoc
  Long version: http://www.youtube.com/watch?v=OM_1F33fcWk)
- Local Arrangements, Workshop on Swarming in Natural and Engineered Systems 2007, Philadelphia, PA, USA.
- Local Arrangements, Robotics: Science and Systems (RSS) 2006, Philadelphia, PA, USA.

Program Committees

- Program Committee, Robotics: Science and Systems (RSS) 2013, 2014, 2016.
- Program Committee, Symposium on Applied Computing (SAC) Intelligent Robotics and Multi-Agent Systems (IRMAS) track 2016, 2019.
- Associate Editor, International Conference on Intelligent Robots and Systems (IROS) 2014, 2015, 2016.
- Associate Editor, International Conference on Robotics and Automation (ICRA) 2014, 2015.
- Associate Editor, AAAI Conference on Artificial Intelligence (AAAI) Conference (2014).
- Associate Editor, Distributed Autonomous Robotic Systems (DARS) 2014.

Workshop Organization

- Y. Wang, A. Franchi, **N. Ayanian**, L. Sabattini, and R. Fitch, "Human Multi-Robot Systems Interaction," IEEE International Conference on Robotics and Automation (ICRA) 2017, Singapore.
- L. Sabattini, A. Franchi, R. Fitch, and **N. Ayanian**, "Principles of Multirobot Systems," Robotics: Science and Systems (RSS) 2015, Rome, Italy.

- L. Sabattini, A. Franchi, D. Shell, and **N. Ayanian**, "The Future of Multiple Robot Research and its Multiple Identities," IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2014, Chicago, IL.
- **N. Ayanian**, S. Gil, D. Katabi, S. Kumar, and D. Rus, "Communication-aware Robotics: New Tools for Multi-robot Networks, Autonomous Vehicles, and Localization," Robotics: Science and Systems (RSS) 2014, Berkeley, CA.
- **N. Ayanian**, S. Gil, and D. Rus, "Networked Multi-Agent Systems: From Theory to Practice," IEEE International Conference on Robotics and Automation (ICRA) 2013, Karlsruhe, Germany.

Summer School Organization

- Co-organizing 2nd Summer School on Multi-Robot Systems, to be held in Prague, summer 2019
- Co-organizing 3rd Summer School on Cognitive Robotics, to be hosted at USC, summer 2019
- Co-organized summer school on Multi-Robot Systems, sponsored by IEEE RAS, at the National University of Singapore, in summer 2016. With the other organizers, we were able to secure $80,000 in funds for the summer school from the IEEE. More than 80 participants attended, and 12 international guest speakers presented both lectures and labs.

Invited Workshop Participation (not including talks listed above)

- Basic Research Office of the Assistant Secretary of Defense for Research and Engineering Workshop on "Foundations of Intelligent Sensing, Action and Learning," Philadelphia, PA, October 2015.
- NSF workshop, "Future Directions in Cyber Physical Systems, Robotics, and Autonomy," Washington, DC, September 2015.
- The National Academies, Government University Industry Research Roundtable, "Unmanned Aircraft Systems: Use and Regulation," Washington, DC, June 2015.
- NSF/CISE and Computing Community Consortium (CCC) Workshop, "Visions 2025: Interacting With the Computers All Around Us," Washington, DC, May 2014.

Invited Panelist

- MILCOM, "Technical Panel: Resource Sharing in a Network of Unmanned Aerial Vehicles (UAVs) and Drones," October 29, 2018.
- International Drone Expo, "The Future Of Education And Jobs In sUAS," Dec 11, 2015, Los Angeles, CA.
- USC Alumni Veterans Network Panel, "The Future of Drones," Nov 11, 2015, Los Angeles, CA.

Conference Session Chair

- Chair of Session on "Autonomous Multi-agent Systems" IEEE Conference on Automation Science and Engineering (CASE) 2015, Gotteborg, Sweden.
- Chair of Session on "Distributed Robotic Systems IV" IEEE International Conference on Robotics and Automation (ICRA) 2014, Hong Kong, PRC.

Judging

- MIT Technology Review 35 Innovators under 35 Judge, 2019

Reviewing

- **Granting Agencies:** NSF • Carnegie Mellon–Portugal Program

- **Journals:** International Journal of Robotics Research • IEEE Transactions on Robotics • IEEE Robotics and Automation Magazine • IEEE/ASME Transactions on Mechatronics• IEEE Transactions on Automation Science and Engineering • Autonomous Robots • Automatica • ACM Transactions on Mobile Computing

- **Conferences:** AAAI Conference on Artificial Intelligence (AAAI) • Robotics: Science and Systems (RSS) • IEEE International Conference on Robotics and Automation (ICRA) • IEEE International Conference on Intelligent Robots and Systems (IROS) • International Symposium on Distributed Robotic Systems (DARS) • International Symposium on Experimental Robotics (ISER) • International Symposium of Robotics Research (ISRR) • ACM/SIGAPP Symposium on Applied Computing, Intelligent Robotics and Multi-Agent Systems track • IEEE Conference on Decision and Control (CDC) • IEEE American Control Conference (ACC) • IEEE Conference on Automation Science and Engineering (CASE) • ASME International Design Engineering Technical Conferences: Mechanisms and Robotics (IDETC:MR)

Editing

- The National Academies Government-University-Industry Research Roundtable, "Unmanned Aircraft Systems: Use and Regulation," June 23-24, 2015, Meeting-in-Brief: http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_168433.pdf

Society Memberships

- American Society of Mechanical Engineers (since 2008) • Institute of Electrical and Electronics Engineers (since 2007) • IEEE Robotics and Automation Society (since 2008) • Association for Computing Machinery (since 2016)

Outreach   *Indicates item is also listed under service within USC

- *PI of NSF Funded USC REU Site on Robotics and Autonomous Systems
- Annual Viterbi Robotics Open House (http://rasc.usc.edu/roboticsopenhouse/), April 2014, 2015, 2016, 2017, 2018
- Tour for Girls who Code, May 7, 2017
- Lab tour for 20 high school women from Branksome Hall Asia, March 23, 2017
- Skype chat with Terra Linda High School Innovation Lab in San Rafael, CA, Dec 2016 https://maya-bartolf-8mw4.squarespace.com/blog/2016/11/7/nora-ayanian-mits-top-innovator-2017-usc-roboticist
- Speaker in Women Rock-IT Cisco TV Series, Nov 2016 https://www.cisco.com/c/m/en_sg/partners/women-rock-it/presentations.html
- *Faculty advisor of RoboGals, using robotics for K-12 outreach activities, Oct 2016–present
- *Viterbi STEM Spotlight on Computer Science, November 2015
- *Viterbi K-12 Spotlight (https://vimeo.com/139500731), September 2015
- Guest speaker to 6-8th graders, Armenian Sisters' Academy, Radnor, PA, October 2015
- Guest speaker at Girls Who Code Workshops, Los Angeles, CA, (http://girlswhocode.com) July 2015
- Organized field trip for local Girls Who Code Workshop to USC to meet graduate and undergraduate students in computer science, July 2015
- Three Research presentations at Kent Place School, grades 6-12, Summit, NJ, May 2015
- Presentation at Computer Science Guidance Counselors' & Teachers' Day, UPenn, Nov 2009
- Presentation at Women in Computer Science High School Day, UPenn, Apr 2008, 2009

Service within USC

Service to the CS Department

- Host faculty candidate, 2019
- Computer Science Faculty Merit Review Committee, 2016, 2019
- Faculty Advisor, Women in Computer Science (WiCS), 2016, 2017, 2018, 2019
- Computer Science Search Committee, 2015, 2016, 2017
- Judge, CS Department annual review poster session, 2014, 2015, 2016
- Computer Science Ph.D. Admissions and Fellowship Committee, 2014, 2015, 2016, 2017, 2018
- Viterbi Postdoc Committee, 2014
- Computer Science Colloquium Committee 2013/2014

- Computer Science Bluesky Ideas Committee, 2013/2014

Service to the Viterbi School of Engineering

- Faculty panelist, Summer Research for Undergraduates (SURE) program, Applying for the Ph.D., June 2019
- PI of NSF Funded USC REU Site on Robotics and Autonomous Systems, summer 2018, 2019, 2020 (planned)
- Faculty Advisor, Robogals, 2016, 2017, 2018, 2019.
- USC Viterbi School of Engineering Faculty Innovation Committee, 2016, 2017, 2018
- Created the USC Viterbi New Year's message (www.youtube.com/watch?v=yEl6pSN4Xp8), 2018
- Viterbi STEM Spotlight on Computer Science, November 2015
- Viterbi K-12 Spotlight (https://vimeo.com/139500731), September 2015

Service to the University

- Speaker, WiSE Research Horizons Symposium, 2019
- Hannah Reisler Mentorship Award Committee, 2016
- USC Beyond the Ph.D. Academic Panel 2014, 2015