Joshua J. Daymude

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Assistant Professor

Research Interests

I research algorithmic theory for the efficient control, coordination, and characterization of collective emergent behavior. I leverage expertise in distributed computing, stochastic processes, swarm intelligence, and bio-inspired algorithms to characterize how local interactions induce large-scale phenomena in complex social, biological, and engineered systems.

Academic Appointments

- Aug. 2022 * Assistant Professor, Arizona State University, Tempe, AZ, USA. School of Computing and Augmented Intelligence (50%) Biodesign Center for Biocomputing, Security and Society (50%)
 - 2021 2022 **Postdoctoral Researcher**, *The Biodesign Center for Biocomputing, Security and Society, Arizona State University*, Tempe, AZ, USA.
 - Fall 2017 Visiting Scholar, Georgia Institute of Technology, Atlanta, GA, USA.

Education

May 2021 Computer Science (Ph.D.), Arizona State University, Tempe, AZ, USA.

- Dissertation [25]. Collaborating in Motion: Distributed and Stochastic Algorithms for Emergent Behavior in Programmable Matter, March 2021.
- Advisor. Prof. Andréa W. Richa.
- Aug. 2016 Computer Science (B.S.) & Mathematics (B.S.), Barrett, the Honors College at Arizona State University, Tempe, AZ, USA.
 - Summa Cum Laude, 4.00 GPA.
 - Capstone Project. *Modding for Minecraft*, December 2015.
 - Honors Thesis [28]. Compression in Self-Organizing Particle Systems, April 2016.
 - Advisor. Prof. Andréa W. Richa.

Publications

Note that in many of the citations below (especially in algorithms and theoretical computer science), authors appear in alphabetical order. BibTeX entries and abstracts for all publications can be found at https://jdaymude.github.io.

Book Chapters

 Joshua J. Daymude, Kristian Hinnenthal, Andréa W. Richa, and Christian Scheideler. Computing by Programmable Particles. In *Distributed Computing by Mobile Entities: Current Research in Moving and Computing*, pages 615–681. Springer, Cham, January 2019. https://doi.org/10.1007/ 978-3-030-11072-7_22.

Refereed Journal Publications

[2] Antonio M. Espinoza, Joshua J. Daymude, Benjamin Mixon-Baca, Jeffrey Knockel, and Jedidiah R. Crandall. A Taxonomy and Comparative Analysis of IPv4 ID Selection Correctness, Security, and Performance. March 2023. Manuscript in preparation.

- [3] John Calvin Alumbaugh, Joshua J. Daymude, Erik D. Demaine, Matthew J. Patitz, and Andréa W. Richa. Simulation of Programmable Matter Systems Using Active Tile-Based Self-Assembly. February 2021. Submitted and under review.
- [4] Joshua J. Daymude, Andréa W. Richa, and Christian Scheideler. The Canonical Amoebot Model: Algorithms and Concurrency Control. *Distributed Computing*, February 2023. https://doi.org/10. 1007/s00446-023-00443-3.
- [5] Anna E. Carson Daymude, Joshua J. Daymude, and Roger Rochat. Labor and Delivery Unit Closures in Rural Georgia from 2012 to 2016 and the Impact on Black Women: A Mixed-Methods Investigation. *Maternal Child Health Journal*, 26(4):796–805, February 2022. https://doi.org/10.1007/ s10995-022-03380-y.
- [6] Robert Axelrod, Joshua J. Daymude, and Stephanie Forrest. Preventing Extreme Polarization of Political Attitudes. *Proceedings of the National Academy of Sciences*, 118(50):e2102139118, December 2021. https://doi.org/10.1073/pnas.2102139118.
- [7] Shengkai Li, Bahnisikha Dutta, Sarah Cannon, Joshua J. Daymude, Ram Avinery, Enes Aydin, Andréa W. Richa, Daniel I. Goldman, and Dana Randall. Programming Active Cohesive Granular Matter with Mechanically Induced Phase Changes. *Science Advances*, 7(17):eabe8494, April 2021. https://doi.org/10.1126/sciadv.abe8494.
- [8] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. A Stochastic Approach to Shortcut Bridging in Programmable Matter. *Natural Computing*, 17(4):723–741, December 2018. https://doi.org/10.1007/s11047-018-9714-x.
- [9] William Savoie, Sarah Cannon, Joshua J. Daymude, Ross Warkentin, Shengkai Li, Andréa W. Richa, Dana Randall, and Daniel I. Goldman. Phototactic Supersmarticles. *Artificial Life and Robotics*, 23(4):459–468, December 2018. https://doi.org/10.1007/s10015-018-0473-7.
- [10] Joshua J. Daymude, Zahra Derakhshandeh, Robert Gmyr, Alexandra Porter, Andréa W. Richa, Christian Scheideler, and Thim Strothmann. On the Runtime of Universal Coating for Programmable Matter. *Natural Computing*, 17(1):81–96, March 2018. https://doi.org/10.1007/s11047-017-9658-6.

Refereed Conference Publications

- [11] Joseph L. Briones, Tishya Chhabra, Joshua J. Daymude, and Andréa W. Richa. Invited Paper: Asynchronous Deterministic Leader Election in Three-Dimensional Programmable Matter. In *Proceedings* of the 24th International Conference on Distributed Computing and Networking, ICDCN 2023, pages 38–47, Kharagpur, India, January 2023. https://doi.org/10.1145/3571306.3571389.
- [12] Kirtus G. Leyba, Joshua J. Daymude, Jean-Gabriel Young, M. E. J. Newman, Jennifer Rexford, and Stephanie Forrest. Cutting Through the Noise to Infer Autonomous System Topology. In IEEE INFOCOM 2022 - IEEE Conference on Computer Communications, INFOCOM 2022, pages 1609–1618, Virtual Event, May 2022. https://doi.org/10.1109/INF0C0M48880.2022.9796874.
- [13] Joshua J. Daymude, Andréa W. Richa, and Christian Scheideler. Local Mutual Exclusion for Dynamic, Anonymous, Bounded Memory Message Passing Systems. In 1st Symposium on Algorithmic Foundations of Dynamic Networks, SAND 2022, pages 12:1–12:19, Virtual Event, April 2022. https://doi.org/ 10.4230/LIPIcs.SAND.2022.12.
- [14] Joshua J. Daymude, Noble C. Harasha, Andréa W. Richa, and Ryan Yiu. Deadlock and Noise in Self-Organized Aggregation Without Computation. In *Stabilization, Safety, and Security of Distributed Systems*, SSS 2021, pages 51–65, Virtual Event, November 2021. https://doi.org/10.1007/ 978-3-030-91081-5_4.
- [15] Joshua J. Daymude, Andréa W. Richa, and Christian Scheideler. The Canonical Amoebot Model: Algorithms and Concurrency Control. In *35th International Symposium on Distributed Computing*,

DISC 2021, pages 20:1-20:19, Freiburg, Germany (Hybrid Event), October 2021. https://doi.org/10.4230/LIPIcs.DISC.2021.20.

- [16] Joshua J. Daymude, Andréa W. Richa, and Jamison W. Weber. Bio-Inspired Energy Distribution for Programmable Matter. In International Conference on Distributed Computing and Networking 2021, ICDCN 2021, pages 86–95, Nara, Japan (Virtual Event), January 2021. https://doi.org/10.1145/ 3427796.3427835.
- [17] Joshua J. Daymude, Robert Gmyr, Kristian Hinnenthal, Irina Kostitsyna, Christian Scheideler, and Andréa W. Richa. Convex Hull Formation for Programmable Matter. In *Proceedings of the 21st International Conference on Distributed Computing and Networking*, ICDCN 2020, pages 2:1–2:10, Kolkata, India, January 2020. https://doi.org/10.1145/3369740.3372916.
- [18] Sarah Cannon, Joshua J. Daymude, Cem Gokmen, Dana Randall, and Andréa W. Richa. A Local Stochastic Algorithm for Separation in Heterogeneous Self-Organizing Particle Systems. In *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques*, APPROX/RANDOM 2019, pages 54:1–54:22, Boston, MA, USA, September 2019. https://doi.org/10.4230/LIPIcs. APPROX-RANDOM.2019.54.
- [19] John Calvin Alumbaugh, Joshua J. Daymude, Erik D. Demaine, Matthew J. Patitz, and Andréa W. Richa. Simulation of Programmable Matter Systems Using Active Tile-Based Self-Assembly. In DNA Computing and Molecular Programming, DNA 2019, pages 140–158, Seattle, WA, USA, August 2019. https://doi.org/10.1007/978-3-030-26807-7_8.
- [20] Sarah Cannon, Joshua J. Daymude, Cem Gokmen, Dana Randall, and Andréa W. Richa. Brief Announcement: A Local Stochastic Algorithm for Separation in Heterogeneous Self-Organizing Particle Systems. In *Proceedings of the 2018 ACM Symposium on Principles of Distributed Computing*, PODC 2018, pages 483–485, London, UK, July 2018. https://doi.org/10.1145/3212734.3212792.
- [21] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. A Stochastic Approach to Shortcut Bridging in Programmable Matter. In DNA Computing and Molecular Programming, DNA 2017, pages 122–138, Austin, TX, USA, September 2017. https: //doi.org/10.1007/978-3-319-66799-7_9.
- [22] Joshua J. Daymude, Robert Gmyr, Andréa W. Richa, Christian Scheideler, and Thim Strothmann. Improved Leader Election for Self-Organizing Programmable Matter. In *Algorithms for Sensor Systems*, ALGOSENSORS 2017, pages 127–140, Vienna, Austria, September 2017. https://doi.org/10. 1007/978-3-319-72751-6_10.
- [23] Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. A Markov Chain Algorithm for Compression in Self-Organizing Particle Systems. In *Proceedings of the 2016 ACM Symposium* on *Principles of Distributed Computing*, PODC 2016, pages 279–288, Chicago, IL, USA, July 2016. https://doi.org/10.1145/2933057.2933107.

Other Publications

- [24] Robert Axelrod, Stephanie Forrest, and Joshua J. Daymude. Reply to de Marchi: Modeling Polarization of Political Attitudes. *Proceedings of the National Academy of Sciences*, 119(17):e2202863119, April 2022. https://doi.org/10.1073/pnas.2202863119.
- [25] Joshua J. Daymude. Collaborating in Motion: Distributed and Stochastic Algorithms for Emergent Behavior in Programmable Matter. PhD Thesis, Arizona State University, Tempe, AZ, March 2021. Available online at http://login.ezproxy1.lib.asu.edu/login?url=https://www.proquest. com/dissertations-theses/collaborating-motion-distributed-stochastic/docview/ 2531565717/se-2?accountid=4485.

- [26] Sarah Cannon, Joshua J. Daymude, William Savoie, Ross Warkentin, Shengkai Li, Daniel I. Goldman, Dana Randall, and Andréa W. Richa. Phototactic Supersmarticles. Appeared at the 2nd International Symposium on Swarm Behavior and Bio-Inspired Robotics (SWARM 2017), October 2017.
- [27] Joshua J. Daymude, Zahra Derakhshandeh, Robert Gmyr, Thim Strothmann, Rida Bazzi, Andréa W. Richa, and Christian Scheideler. Leader Election and Shape Formation with Self-Organizing Programmable Matter. This updated version of the DNA 2015 conference paper is available online at https://arxiv.org/abs/1503.07991, March 2016.
- [28] Joshua J. Daymude. Compression in Self-Organizing Particle Systems. Undergraduate Honors Thesis, Barrett, the Honors College at Arizona State University, Tempe, AZ, April 2016. Available online at https://hdl.handle.net/2286/R.I.37219.

Presentations

Conference Talks

- [1] Joshua J. Daymude, Andréa W. Richa, and Christian Scheideler. Local Mutual Exclusion for Dynamic, Anonymous, Bounded Memory Message Passing Systems. In *Symposium on Algorithmic Foundations* of Dynamic Networks (SAND), Virtual Event, March 2022.
- [2] Joshua J. Daymude, Noble C. Harasha, Andréa W. Richa, and Ryan Yiu. Deadlock and Noise in Self-Organized Aggregation Without Computation. In *International Symposium on Stabilization, Safety,* and Security of Distributed Systems (SSS), Virtual Event, November 2021. Recording online at https://youtu.be/7CT9_9tD8VA.
- [3] Joshua J. Daymude, Andréa W. Richa, and Christian Scheideler. The Canonical Amoebot Model: Algorithms and Concurrency Control. In *International Symposium on Distributed Computing (DISC)*, Freiburg, Germany (Hybrid Event), October 2021. Recording online at https://youtu.be/L76EuAmpTL0.
- [4] Joshua J. Daymude, Andréa W. Richa, and Jamison W. Weber. Bio-Inspired Energy Distribution for Programmable Matter. In *International Conference on Distributed Computing and Networking (ICDCN)* 2021, Nara, Japan (Virtual Event), January 2021.
- [5] Sarah Cannon, Joshua J. Daymude, Cem Gokmen, Dana Randall, and Andréa W. Richa. A Local Stochastic Algorithm for Separation in Heterogeneous Self-Organizing Particle Systems. In International Conference on Randomization and Computation (RANDOM), Boston, MA, USA, September 2019.
- [6] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. Local Stochastic Algorithms for Compression and Shortcut Bridging in Programmable Matter. In *Biological Distributed Algorithms (BDA)*, Washington D.C., USA, July 2017.
- [7] Joshua J. Daymude, Robert Gmyr, Andréa W. Richa, Christian Scheideler, and Thim Strothmann. Convex Hull Formation for Programmable Matter. In *Biological Distributed Algorithms (BDA)*, Washington D.C., USA, July 2017.
- [8] Joshua J. Daymude, Robert Gmyr, Andréa W. Richa, Christian Scheideler, and Thim Strothmann. Compaction and Expansion in Self-Organizing Particle Systems. In DAAD Research Internships in Science and Engineering (RISE) Scholars Meeting, Heidelberg, Germany, July 2015.

Invited Talks

- [9] Joshua J. Daymude. Stochastic, Distributed Separation and Integration In Heterogeneous Particle Systems. In *Discrete Math Seminar*, Arizona State University, Tempe, AZ, USA, November 2021.
- [10] Joshua J. Daymude. Algorithmic Foundations of Emergent Behavior in Analog Collectives. In *Seminar*, Santa Fe Institute, Santa Fe, NM, USA, July 2021.

- [11] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Cem Gokmen, Dana Randall, and Andréa W. Richa. Stochastic Algorithms for Programable Matter. In *Discrete Math Seminar*, Arizona State University, Tempe, AZ, USA, April 2019.
- [12] Joshua J. Daymude, Kristian Hinnenthal, Andréa W. Richa, and Christian Scheideler. Self-Organizing Particle Systems: an Algorithmic Approach to Programmable Matter. In 2nd Workshop on Self-Organization in Swarm of Robots (WSSR), Tokyo, Japan, November 2018.
- [13] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. A Stochastic Approach to Shortcut Bridging in Programmable Matter. In *Algorithms, Combinatorics, and Opimization (ACO) Student Seminar*, Georgia Tech, Atlanta, GA, USA, October 2017.

Poster Presentations

- [14] Joshua J. Daymude, Andréa W. Richa, and Jamison W. Weber. Bio-Inspired Energy Distribution for Programmable Matter. In DNA Computing and Molecular Programming — 26th International Conference (DNA26), Virtual Presentation, September 2020.
- [15] Joshua J. Daymude and Andréa W. Richa. Self-Organizing Particle Systems: an Abstraction of Programmable Matter. In Achievement Rewards for College Scientists (ARCS) Awards Dinner, Phoenix, AZ, USA, April 2019.
- [16] Joshua J. Daymude and Andréa W. Richa. Self-Organizing Particle Systems: an Abstraction of Programmable Matter. In Achievement Rewards for College Scientists (ARCS) Awards Dinner, Phoenix, AZ, USA, April 2018.
- [17] Marta Andrés Arroyo, Sarah Cannon, Joshua J. Daymude, Dana Randall, and Andréa W. Richa. Compression and Shortcut Bridging in Self-Organizing Particle Systems. In *Google Ph.D. Intern Research Conference (PIRC)*, Mountain View, CA, USA, July 2017.
- [18] Joshua J. Daymude and Andréa W. Richa. Compression in Self-Organizing Particle Systems. In *Barrett Celebrating Honors Symposium (BCHS)*, Arizona State University, Tempe, AZ, USA, April 2016.
- [19] Joshua J. Daymude, Miles Laff, Zahra Derakhshandeh, Robert Gmyr, Alexandra Porter, and Andréa W. Richa. Compaction and Expansion in Self-Organizing Particle Systems. In *Biological Distributed Algorithms (BDA)*, Boston, MA, USA, August 2015.
- [20] Joshua J. Daymude, Miles Laff, Zahra Derakhshandeh, Robert Gmyr, and Andréa W. Richa. Compaction and Expansion in Self-Organizing Particle Systems. In *Structural Information and Communication Complexity (SIROCCO)*, Montserrat, Spain, July 2015.
- [21] Joshua J. Daymude and Andréa W. Richa. Compaction in Self-Organizing Particle Systems. In Fulton Undergraduate Research Initiative (FURI) Symposium, Arizona State University, Tempe, AZ, USA, April 2015.
- [22] Joshua J. Daymude, Miles Laff, and Andréa W. Richa. Self-Organizing Particle Systems. In *Barrett Celebrating Honors Symposium (BCHS)*, Arizona State University, Tempe, AZ, USA, April 2015.

Grants

Submitted

[1] Principal Investigator. AF: Medium: Concurrency and Adaptive Self-Organization in Anonymous Dynamic Networks. National Science Foundation, submitted December 2022.

Awarded

 [2] Research Fellow. Mistletoe Research Fellowship. Momental Foundation, \$10,000, June 2021 – June 2022.

Advising & Mentoring

PhD Students Supervised

- 2023 * **Sean Bergen**, *Arizona State University*, Computer Science, PhD Advisor. <u>Dissertation</u>: TBD
- 2022 * **Joseph Renzullo**, *Arizona State University*, Computer Science, PhD Committee Member. <u>Dissertation</u>: TBD
- 2022 * **Pengfei Zhang**, *Arizona State University*, Computer Science, PhD Committee Member. <u>Dissertation</u>: TBD

Master's Students Supervised

- 2022 * **Devendra Rajendra Parkar**, *Arizona State University*, Computer Science, MS Thesis Advisor. <u>Thesis</u>: TBD
- 2022 * **Garrett Parzych**, *Arizona State University*, Computer Science, MS Thesis Advisor. <u>Thesis</u>: TBD
- 2022 * Sanjana Saurin Shah, Arizona State University, Computer Science, MS Thesis Advisor. <u>Thesis</u>: TBD

Undergraduate Research Assistants Supervised

- 2023 * Saisumana Konatam, Arizona State University, Computer Science.
- 2021 * Fabio Calo, Instituto Tecnológico Autónomo de México, Computer Science.
- 2021 2022 Aditya Lankalapalli, *Arizona State University*, Biomedical Engineering, Honors Thesis (2nd Reader). <u>Thesis</u>: Analyzing the Effects of Cell Proliferation on the Evolution of Cancerous Systems
- 2019 2020 Ziad Abdelkarim, Arizona State University, Computer Science.
- 2018 2020 Ryan Yiu, Arizona State University, Computer Science.
- 2018 2020 Joseph Briones, Arizona State University, Computer Science & Mathematics.
- 2018 2019 Christopher Boor, Arizona State University, Computer Science.
- 2017 2019 Kevin Lough, Arizona State University, Computer Science & Mathematics.
- 2017 2018 Cem Gökmen, Georgia Institute of Technology, Computer Science.
- Summer 2017 Marta Andrés Arroyo, Georgia Institute of Technology, Computer Science.

High School Research Assistants Supervised

- Summer 2021 Nandini Ram, BASIS Chandler.
- Summer 2021 Neha Vontela, BASIS Scottsdale.
- 2020 2021 Noble Harasha, Peggy Payne Academy at McClintock High School.
- 2015 2016 Michaela Murray, BASIS Scottsdale.

Teaching

Courses Taught

Course and instructor evaluations are reported as [course] | [instructor], each on a scale of 1-5.

- ASU 101 **The ASU Experience (Computer Science)**, *Arizona State University*, Instructor. Evaluations: 4.36 | 4.71 (Fall 2022).
- CSE 450 **Design and Analysis of Algorithms**, *Arizona State University*, Honors Developer and Instructor. Evaluations: TBD | TBD (Spring 2023).
- CSE 550 **Combinatorial Algorithms and Intractability**, *Arizona State University*, Instructor. Evaluations: 4.79 | 4.89 (Fall 2022).

CSE 598 Markov Chain and Monte Carlo Methods, *Arizona State University*, Developer and Instructor. Evaluations: 4.54 | 4.81 (Fall 2019).

Courses Assisted

- CSE 550 **Combinatorial Algorithms and Intractability**, *Arizona State University*, Fall 2020. Assisted Prof. Andréa Richa in transitioning the course to a hybrid format, holding office hours, grading, and preparing lecture slides, assignments, and exams.
- CSE 552 **Randomized and Approximation Algorithms**, *Arizona State University*, Fall 2019. Assisted Prof. Andréa Richa by holding office hours and preparing and grading assignments and exams.
- MAT 208 **Discrete Mathematics for Secondary Teachers**, *Arizona State University*, Fall 2014. Assisted Prof. Hal Kierstead by holding office hours and preparing solutions and student study materials.

Academic Service

Academic Meeting Organization

- June 2023 Co-Organizer, SIROCCO 2023 Tutorial Session on Special Models of Computation, Alcala de Henares, Spain, June 6-9, 2022, https://sirocco2023.networks.imdea.org/ special-models-of-computation/.
- June 2022 Co-Organizer, Working Group: Distributed Computing Perspectives on Theoretical Immunology, Santa Fe Institute, NM, USA, June 8-10, 2022, https://www.santafe.edu/events/ distributed-computing-perspectives-theoretical-immunology.

Conference Program Committees

- SSS 2023 PC Member, 25th International Symposium on Stabilization, Safety, and Security of Distributed Systems, Jersey City, NJ, USA, October 2–4, 2023, https://www.stabilizationsafetysecurity2023.com/.
- BDA 2023 **PC Member**, 9th Workshop on Biological Distributed Algorithms, Orlando, FL, USA, June 23, 2023, https://sites.google.com/view/bda23/home.
- DISC 2022 **PC Member**, *36th International Symposium on Distributed Computing*, Augusta, GA, USA, October 25–27, 2022, http://www.disc-conference.org/wp/disc2022/.
- ICDCS 2022 **PC Member**, 42nd IEEE International Conference on Distributed Computing Systems, Bologna, Italy, July 10–13, 2022, https://icdcs2022.icdcs.org/.

Journal Reviews

- ALGO Reviewer, Algorithmica, Papers Reviewed: 1 (2019), 1 (2020), 1 (2021).
- CCPE Reviewer, Concurrency and Computation: Practice and Experience, Papers Reviewed: 1 (2020).
- DC **Reviewer**, *Distributed Computing*, Papers Reviewed: 1 (2020).
- JCSS Reviewer, Journal of Computer and System Sciences, Papers Reviewed: 1 (2018).
- JPDC Reviewer, Journal of Parallel and Distributed Computing, Papers Reviewed: 1 (2018).
- JTB Reviewer, Journal of Theoretical Biology, Papers Reviewed: 1 (2017).
- NCOMMS Reviewer, Nature Communications, Papers Reviewed: 1 (2022).
 - PONE Reviewer, PLOS One, Papers Reviewed: 1 (2022).
 - RA-L Reviewer, IEEE Robotics and Automation Letters, Papers Reviewed: 2 (2021).
 - SWRM Reviewer, Swarm Intelligence, Papers Reviewed: 1 (2020), 1 (2021).
 - TCS Reviewer, Theoretical Computer Science, Papers Reviewed: 1 (2021).

Honors and Awards

- Feb. 2020 Johnston Endowment Scholar (2020–2021), Achievement Rewards for College Scientists (ARCS) Foundation, Phoenix Chapter.
- Feb. 2019 Johnston Endowment Scholar (2019–2020), Achievement Rewards for College Scientists (ARCS) Foundation, Phoenix Chapter.
- Feb. 2018 Johnston Endowment Scholar (2018–2019), Achievement Rewards for College Scientists (ARCS) Foundation, Phoenix Chapter.
- Jan. 2018 Graduate College Fellowship (Spring 2018), Arizona State University Graduate College.
- May 2016 Moeur Award, Arizona State University Alumni Association.
- Apr. 2016 **Dean's Fellowship Award**, School for Computing, Informatics, Decision Systems Engineering, Arizona State University.
- Mar. 2016 Honorable Mention, Graduate Research Fellowship Program, National Science Foundation.
- Mar. 2016 Research Experience for Undergraduates (REU), National Science Foundation.
- Dec. 2015 Honorable Mention, Outstanding Undergraduate Male Researcher Award for Ph.D Granting Institutions, Computing Research Association.
- Jun. 2015 **Research Internships in Science and Engineering (RISE) Scholarship**, *German Academic Exchange Service (DAAD)*, Universität Paderborn, Germany.
- Jan. 2015 FURI Grant, Fulton Undergraduate Research Initiative, Arizona State University.
- Oct. 2014 Research Experience for Undergraduates (REU), National Science Foundation.
- Jan. 2012 **Regional Outstanding: High School Mathematical Contest in Modeling**, Consortium for Mathematics and its Applications.
- Jan. 2012 National Merit Scholar, National Merit Scholarship Corporation.

Industry Experience

- May 2019 Team Lead Research Intern, Systems Imagination, Tempe, AZ, USA.
- Aug. 2019 Led a team of three high school and undergraduate students in implementing state-of-the-art computer vision techniques for semantic and conceptual understanding of visual scenes.
- May 2017 Software Engineering Intern, Google, Inc., Mountain View, CA, USA.
- Aug. 2017 Developed an image-based data procurement and machine learning pipeline for improved location entry and departure detection using convolutional neural networks, achieving preliminary accuracy of 88%.
- May 2014 Software Engineering Intern, Jet Propulsion Laboratory, Pasadena, CA, USA.
- Aug. 2016 Interned with JPL's Data Capture and Delivery (DCD) substem of the Deep Space Network (DSN). Developed a neural network-based method for DCD bandwidth prediction, integrated automated static analysis into the DCD's build process, improved stability and robustness of a large C library responsible for logging DCD accountability data, and developed a script to synchronize Git and Harvest repositories.
- May 2013 AppleCare iOS Tier 1 Advisor, Apple, Inc., Tempe, AZ, USA.
- Apr. 2014 Provided frontline over-the-phone technical support to iOS users, receiving over fifty "Very Satisfied" customer satisfaction reports, with an average of 10–20% of my customers responding each month.