George Matthew Fricke
Curriculum Vitae (Long Form)

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APPOINTMENTS

Research Associate Professor   2024 - Current
Department of Computer Science, The University of New Mexico
Center for Advanced Research Computing, The University of New Mexico

Research Assistant Professor   2018 - 2024
Department of Computer Science, The University of New Mexico
Center for Advanced Research Computing, The University of New Mexico

Post-doctoral Fellow   2017 - 2018
Moses Biological Computation Lab, The University of New Mexico

EDUCATION

Doctor of Philosophy with distinction, Computer Science,   May 2017
The University of New Mexico
Title: "Search in T cell and Robot Swarms: Balancing Extent and Intensity"
Advisor: Melanie Moses, PhD
GPA: 3.85

Master of Science, Computer Science, concentration in Artificial Intelligence   August 2003
The University of New Mexico
Title: "Phylogenetic Reconstruction Using Competitive Neural Networks"
Advisor: Bernard Moret, PhD

Bachelor of Science, Mathematics *cum laude*   May 2012
The University of New Mexico

Bachelor of Art, Anthropology, concentration in Archaeology   December 1996
Appalachian State University

PUBLICATIONS   **Journals**

Ericksen, John, Tobias P Fischer, G Matthew Fricke, Scott Nowicki, Nemesio M Pérez, Pedro Hernández Pérez, Eleazar Padrón González, and Melanie E Moses. "Drone CO 2 measurements during the Tajogaite volcanic eruption". In: *Atmospheric Measurement Techniques* 17.15 (2024), pp. 4725–4736.

Ferdous, Jannatul, George Matthew Fricke, and Melanie E Moses. "More Is Faster: Why Population Size Matters in Biological Search". In: *Journal of Computational Biology* 31.5 (2024), pp. 429–444.

Fischer, Tobias P, Céline L Mandon, Scott Nowicki, John Ericksen, Felipe Rojas Vilches, Melissa A Pfeffer, Alessandro Aiuppa, Marcello Bitetto, Angelo Vitale, G Matthew Fricke, et al. "CO2 emissions during the 2023 Litli Hrútur eruption in Reykjanes, Iceland: fffdfffdfffd13C tracks magma degassing". In: *Bulletin of Volcanology* 86.6 (2024), pp. 1–10.

Nichol, Jake J, Michael Weylandt, Matthew Fricke, Melanie E Moses, Diana L Bull, and Laura Painton Swiler. "Space-Time Causal Discovery in Climate Science: A Local Stencil Learning Approach". In: *Authorea Preprints* (2024). preprint.

Nasimi, Roya, Fernando Moreu, and G Matthew Fricke. "Sensor Equipped UAS for Non-Contact Bridge Inspections: Field Application". In: *Sensors* 23.1 (2023), p. 470.

Ericksen, John, G Matthew Fricke, Scott Nowicki, Tobias P Fischer, Julie C Hayes, Karissa Rosenberger, Samantha R Wolf, Rafael Fierro, and Melanie E Moses. "Aerial survey robotics in extreme environments: Mapping volcanic CO_2 emissions with flocking UAVs". In: *Frontiers in Control Engineering* 3 (2022).

Chou, Luoth and 13 others. "Planetary Mass Spectrometry for Agnostic Life Detection in the Solar System". In: *Frontiers in Astronomy and Space Sciences* (2021), p. 173.

Nichol, J Jake, Matthew G Peterson, Kara J Peterson, G Matthew Fricke, and Melanie E Moses. "Machine learning feature analysis illuminates disparity between E3SM climate models and observed climate change". In: *Journal of Computational and Applied Mathematics* (2021).

Smith, Hillary and 14 others. "The Grayness of the Origin of Life". In: *Life* 11.6 (2021).

Botvinik-Nezer, Rotem and 196 others. "Variability in the analysis of a single neuroimaging dataset by many teams". In: *Nature* (2020), pp. 1–7.

Cannon, Judy L, Janie Rae Byrum, Rebekah Gridley, Paulus Mrass, Miriam Valenzuela, David J Torres, Matthew Fricke, and Melanie E Moses. "Interleukin 7 regulates naive T cell metabolism to promote motility of T cells". In: *The Journal of Immunology* (2020).

Liu, Emma J and 34 others. "Aerial strategies advance volcanic gas measurements at inaccessible, strongly degassing volcanoes". In: *Science advances* 6.44 (2020).

Lu, Qi, G Matthew Fricke, John C Ericksen, and Melanie E Moses. "Swarm Foraging Review: Closing the Gap Between Proof and Practice". In: *Current Robotics Reports* (2020), pp. 1–11.

Tasnim, Humayra, G Matthew Fricke, Janie R Byrum, Justyna O Sotiris, Judy L Cannon, and Melanie E Moses. "Quantitative Measurement of naïve T cell association With Dendritic cells, FRCs, and Blood Vessels in lymph nodes". In: *Frontiers in Immunology* 9 (2018).

Mrass, Paulus and 10 others. "ROCK regulates the intermittent mode of interstitial T cell migration in inflamed lungs". In: *Nature communications* 8.1 (2017), p. 1010.

Fricke, G. Matthew, Joshua Hecker, Judy Cannon, and Melanie Moses. "Immune-Inspired Search Strategies for Robot Swarms". In: *Robotica* (2016).

Fricke, G. Matthew, Kenneth Letendre, Melanie Moses, and Judy Cannon. "Persistence and adaptation in immunity: T cells balance the extent and thoroughness of search". In: *PLoS Computational Biology* (2016).

Flanagan, Tatiana P., Kenneth Letendre, William R. Burnside, G. Matthew Fricke, and Melanie E. Moses. "Quantifying the Effect of Colony Size and Food Distribution on Harvester Ant Foraging". In: *PLoS ONE* (2012).

Hu, Bin, G. Matthew Fricke, James R. Faeder, Richard G. Posner, and William S. Hlavacek. "GetBonNie for building, analyzing, and sharing rule-based models". In: *Bioinformatics* (2009).

Fricke, G. Matthew and James L. Thomas. "Receptor aggregation by intermembrane interactions: A Monte Carlo Study". In: *Biophysical Chemistry* (2006).

Book Chapters

Suderman, Ryan, G Matthew Fricke, and William Hlavacek. "Using RuleBuilder to Graphically Define and Visualize BioNetGen-Language Patterns and Reaction Rules". In: *Methods in Molecular Biology*. Vol. 1945. Apr. 2019, pp. 33–42.

Moses, Melanie, Tatiana Flanagan, Kenneth Letendre, and Matthew Fricke. "Ant Colonies as a Model of Human Computation". In: *Handbook of Human Computation*. Ed. by Pietro Michelucci. New York, NY: Springer, 2014, pp. 25–39.

Conference Proceedings

Ferdous, Jannatul, G Matthew Fricke, and Melanie E Moses. "Modeling Immune Search Through the Lymphatic Network". In: *International Conference on Swarm Intelligence*. Springer. 2022, pp. 332–340.

Ericksen, John, Abhinav Aggarwal, G Matthew Fricke, and Melanie E Moses. "LOCUS: A Multi-Robot Loss-Tolerant Algorithm for Surveying Volcanic Plumes". In: *IEEE Robotics and Computing Conference (IRC)*. IEEE, 2020.

Lu, Qi, G. Matthew Fricke, Takaya Tsuno, and Melanie E. Moses Moses. "A Bio-Inspired Transportation Network for Scalable Swarm Foraging". In: *IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2020, pp. 6120–6126. DOI: 10.1109/ICRA40945.2020.9196762.

Aggarwal, Abhinav, Diksha Gupta, William F. Vining, G. Matthew Fricke, and Melanie E. Moses. "Ignorance Is Not Bliss: An Analysis of Central-Place Foraging Algorithms". In: *Proceedings of the International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2019.

Qi, Lu, Antonio D. Griego, G. Matthew Fricke, and Melanie E Moses. "Comparing Physical and Simulated Performance of a Deterministic and a Bio-inspired Stochastic Foraging Strategy for Robot Swarms". In: *Proceedings of the International Conference on Robotics and Automation (ICRA)*. IEEE, 2019.

Fricke, G. Matthew, Joshua P Hecker, Antonio D. Griego, Linh Tran, and Melanie E Moses. "A Distributed Deterministic Spiral Search Algorithm for Robot Swarms". In: *Proceedings of the International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2016.

Fricke, G. Matthew, Joshua P Hecker, Sarah R Black, Judy L Cannon, and Melanie E Moses. "Distinguishing Adaptive Search From Random Search in Robots and T cells". In: *Proceedings of the Conference on Genetic and Evolutionary Computation (GECCO)*. ACM, 2015.

Fricke, G. Matthew, François Asperti-Boursin, Joshua Hecker, Judy Cannon, and Melanie Moses. "From Microbiology to Microcontrollers: Robot Search Patterns Inspired by T Cell Movement". In: *The European Conference on Artificial Life (ECAL)*. Vol. 12. 2013, pp. 1009–1016.

Flanagan, Tatiana P., Kenneth Letendre, William R. Burnside, G. Matthew Fricke, and Melanie E. Moses. "How Ants Turn Information Into Food: A Case Study in Distributed Search". In: *IEEE Symposium on Artificial Life (ALIFE)*. IEEE, 2011, pp. 178–185.

Technical Reports

Nichol, Jeffrey, Matthew Peterson, and Matthew Fricke. *Learning Why: Data-Driven Causal Evaluations of Climate Models.* Tech. rep. Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2021.

Nichol, Jeffrey, Matthew Gregor Peterson, Kara J Peterson, David John Stracuzzi, Matthew Fricke, and Melanie Moses. *Feature Comparison of Arctic Observations and Climate Models.* Tech. rep. Sandia National Lab.(SNL-NM), Albuquerque, NM (United States), 2019.

Claiborne, Andy, Matthew Fricke, Len Lopes, Joseph Lewis, and George Luger. "Emergent Representation in a Robot Control Architecture". In: UNM Computer Science Technical Report TR-CS-2000-5 (2000).

White Papers

Meadows, Victoria and 74 others. *Community Report from the Biosignatures Standards of Evidence Workshop.* Recommendations to the National Aeronautics and Space Agency. 2022.

Gipson Rankin, Sonia, Alfred Mathewson, Melanie Moses, G Matthew Fricke, Kathy Powers, Gabriel R Sanchez, Christopher Moore, Elizabeth Bradley, Mirta Galesic, and Joshua Garland. *Regarding Docket No. FR-6111-P-02, HUD's Implementation of the Fair Housing Act's Disparate Impact Standard.* Recommendations to the United States Department of Housing and Urban Development. 2019.

Abstracts, Workshops, and Supplements

Barnaby, Sachi O., Carter Frost, Antonio Griego, Humayra Tasnim, Akil Andrews, G. Matthew Fricke, and Melanie Moses. "Collaborative Robots in Action: How Friends Can Help Move Your Furniture". In: *8th Workshop on Biological Distributed Algorithms (BDA)*. 2023.

Cannon, Judy L, Melanie E Moses, Jannatul Ferdous, and G. Matthew Fricke. "Benefits of Being Big: How a T cell response can occur as rapidly in a human as a mouse". In: *The Journal of Immunology* 210.1_Supplement (2023).

Gong, Jian, Aaron C Bell, Timothy Gebhard, Jaden JA Hastings, Kimberly Warren-Rhodes, Michael Phillips, G. Matthew Fricke, Nathalie A Cabrol, Scott A Sandford, Massimo Mascaro, et al. "Molecular Complexity to Biosignatures: A Machine Learning Pipeline that Connects Mass Spectrometry to Molecular Synthesis and Reaction Networks". In: *Fall Meeting 2022*. AGU. 2022.

Nichol, Jeffrey J, Matthew Peterson, George M Fricke, and Kara Peterson. "Learning Why: Data-Driven Causal Evaluations of Climate Models". In: *ICML 2021 Workshop on Tackling Climate Change with Machine Learning*. 2021.

Wolf, Samantha, Scott Nowicki, Tobias Fischer, Karissa Rosenberger, John Ericksen, G Fricke, and Melanie Moses. "Quantifying the relationship between deep degassing structures (DDS) and deep thermal structures (DTS)". In: *AGU Fall Meeting Abstracts*. 2021.

Cannon, Judy L, Janie Rae Byrum, Rebekah Gridley, Paulus Mrass, Miriam Valenzuela, David J Torres, G. Matthew Fricke, and Melanie E Moses. "Interleukin 7 regulates naive T cell metabolism to promote motility of T cells". In: *The Journal of Immunology* 204.1 Supplement (2020).

Arellano, S. R., E. Liu, K. Wood, A. Aiuppa, A. Allan, M. Bitetto, N. Bobrowski, S. A. Carn, R. Clarke, E. Corrales, J. A. Diaz, M. Edmonds, T. P. Fischer, J. E. Freer, G. M. Fricke, B. Galle, G. Gerdes, G. Giudice, J. Jones, A. Gutmann, E. Mason, B. McCormick, K. Mulina, S. Nowicki, T. Richardson, J. Rüdiger, I. Schipper, M. Watson, M. Wordell, and Z. Voss. "UAV-based Measurements of the High-Altitude Plume of Manam Volcano". In: *AGU Fall Meeting Abstracts*. Vol. 2019. Dec. 2019.

Cannon, Judy L, Melanie E Moses, Janie R Byrum, Paulus Mrass, G Matthew Fricke, and Humayra Tasnim. "Modeling T Cell Motion in Tissues During Immune Responses". In: *Biophysical Journal* 116.3 (2019).

Ackerman, Sarah M, G Matthew Fricke, Joshua P Hecker, Kastro M Hamed, Samantha R Fowler, Antonio D Griego, Jarett C Jones, J Jake Nichol, Kurt W Leucht, and Melanie E Moses. "The swarmathon: An autonomous swarm robotics competition". In: *IEEE/RSJ International Conference on Robotics and Automation (ICRA) workshop on Swarms: From Biology to Robots and back*. 2018.

Fricke, G. Matthew, Diksha Gupta, and Melanie Moses. "Biologically-Inspired Distributed Spatial Search for Ground-Based Foraging Swarms". In: *5th Workshop on Biological Distributed Algorithms (BDA)*. 2017.

CONFERENCES **Presentations**

G. Matthew Fricke "Where Angels Fear to Tread: Extreme Environments and Extreme Passage Times", Issac Newton Institute for Mathematical Sciences Workshop on Collective Behaviour [MMVW02], Cambridge, UK, 2023 (invited presenter)

Jannatul Ferdous, G Matthew Fricke, and Moses, M. E. "Modeling Immune Search Through the Lymphatic Network" 13th ANTS International Conference on Swarm Intelligence, Malaga, Spain, 2022. (presenting author)

Samantha Wolf, Scott Nowicki, Tobias P. Fischer, Rosenberger, K., John C. Eriksen, G. Matthew Fricke., and Moses, M. E. "Quantifying the relationship between deep degassing structures (DDS) and deep thermal structures (DTS)" AGU Fall Meeting 2021. AGU, New Orleans, USA, 2021. (author)

G. Matthew Fricke, "The Volcan Swarm", Society for Industrial and Applied Mathematics (SIAM) Conference on Applications of Dynamical Systems, Online, 2021. (presenter)

Janie Rae Byrum et al., "Interleukin 7 regulates naïve T cell metabolism to promote motility of naïve T cells" American Association of Immunologists, Honolulu, Hawaii, US, 2020 (author)

Aggarwal, Abhinav, Diksha Gupta, William F. Vining, G. Matthew Fricke, and Melanie E. Moses, (presenting author) "Ignorance Is Not Bliss: An Analysis of Central-Place Foraging Algorithms", 32nd Annual International Conference on Intelligent Robots and Systems, Macau, China, 2019 (presenting author)

G. Matthew Fricke, Joshua P. Hecker, Antonio Griego, Linh Tran, and Melanie Moses, "A Distributed Deterministic Spiral Search Algorithm for Swarms", 29th Annual International Conference on Intelligent Robots and Systems, Daejeon, South Korea, 2016 (presenting author)

G. Matthew Fricke, "Swarmathon: Training the Next Generation of ROS Programmers", RosCon 2016 Lightning Talks, Seoul, South Korea, 2016 (presenter)

G. Matthew Fricke, Joshua P. Hecker, "Swarmathon Technical Tutoral: Extended Kalman Filters", Robotics: Science and Systems (RSS), Ann Arbor, MI, 2016, (presenter)

G. Matthew Fricke, Josh P. Hecker, Antonio Griego, Linh Tran, and Melanie Moses, "Spiral Search in Robot Swarms", 12th Annual UNM Computer Science Student Conference, 2016, Albuquerque, NM. (presenting author)

G. Matthew Fricke, Judy Cannon and Melanie Moses, "Effciency of T Cell Search in Lymph Nodes", 12th Annual Conference on Complex Systems, Phoenix, AZ. 2016 (presenting author)

G. Matthew Fricke, Judy Cannon, and Melanie Moses, "T Cell Search Inspired Computation",

Motility in the Immune System: From Microscopic Movement to Macroscopic Function, Workshop, Santa Fe Institute, Santa Fe, NM, 2015 (presenter)

Tatiana Flanagan, G. Matthew Fricke, Joshua P. Hecker, Kenneth Letendre, Drew Levin, Stephanie Forrest, Deborah Gordon and Melanie Moses, "Using Information to Improve Collective Search", 12th Annual Conference on Complex Systems, Phoenix, AZ, 2015, (author)

G. Matthew Fricke, Sarah R. Black, Joshua P. Hecker, Judy L. Cannon, and Melanie E. Moses. "Distinguishing Adaptive Search From Random Search in Robots and T Cells", 17th Annual Genetic and Evolutionary Computation Conference, Madrid, 2015 (presenting author)

G. Matthew Fricke, François Asperti-Boursin, Judy Cannon, and Melanie Moses, "T Cell Motility and Robotic Search", 10th Annual UNM Computer Science Student Conference, 2014 Apr 18th, Albuquerque, NM, (presenting author)

Posters

Timothy Gebhard, Aaron C. Bell, Jian Gong, Jaden J. A. Hastings, G. Matthew Fricke, Nathalie Cabrol, Scott Sandford, Michael Phillips, Kimberley Warren-Rhodes, Atilim Gunes Baydin, "Inferring molecular complexity from mass spectrometry data using machine learning" Neural Information and Information Processing (NeurIPS) Workshop on Machine Learning and the Physical Sciences, New Orleans, 2022

Victoria. Da Poian, Natalie Grefenstette, Lu Chou, G. Matthew Fricke, Heather Graham, Chris Kempes, P. Mahaffy, S. Sarah Johnson, "Comparing Agnostic Polymer Detection Methods Using Artificial Mass Spectrometry", NASA Goddard Space Flight Center: Early Career Science Forum, Washington DC, 2020

Jake Nichol, Matthew Peterson, Kara Peterson, David Stracuzzi, G. Matthew Fricke, and Melanie Moses, "Machine Learning to Compare Features of Simulated and Observed Arctic Sea Ice Extent.", American Geophysical Union (Fall Meeting), San Francisco, 2019

C. Kempes, L. Chou, N. Greenstette, V. Da Poian, M, Fricke, "Mass Spectrometry Agnostic Identification of Complexity", Mars Extant Life: What's Next Conference, Carlsbad, NM, 2019

Emma J. Liu et al. "The View From ABOVE: Aerial-Based Observations of Volcanic Emissions at Manam, Papua New Guinea", Deep Carbon Observatory Conference, Washington DC, 2019

Kirubel Tadesse, George Matthew Fricke, Joshua Peter Hecker, Melanie Moses, "April Tag Detection: Calculating Distance Use ROS Transform Package", 29th Annual International Conference on Intelligent Robots and Systems, Daejeon, South Korea, 2016

G. Matthew Fricke, Joshua P. Hecker, Melanie E. Moses, "The Adaptive Lévy Search Algorithm Applied to a Robot Swarm", Quantifying Complex Transport with Lévy Walks: From Cold Atoms to Humans and Robots, Physikzentrum Bad Honnef, 2016

Byrum, J.R., Tafoya, J., Fricke, G.M., Moses, M.E., Cannon, J.L. "Quantitating Dendritic Cell Distribution in Lymph Nodes", American Association of Immunologists, Seattle, WA. 2016

G. Matthew Fricke, Judy Cannon, François Asperti-Boursin and Melanie Moses, "T Cell Stochastic Search Patterns", Stochastic Single-Cell Dynamics in Immunology Experimental and Theoretical Approaches, Workshop, Netherlands Royal National Academy, Amsterdam, 2015

G. Matthew Fricke, François Asperti-Boursin, Judy Cannon, and Melanie Moses, "Efficiency and Robustness of T Cell Search", 3rd Biennial Conference on Systems Approaches to Immunology and Infectious Diseases, Santa Fe, NM, 2014

Tatiana M. Paz, G. Matthew Fricke, Kenneth Letendre, William R. Burnside and Melanie Moses, "Effects of Colony Size and Resource Distribution on the Foraging Behavior of Three Species of Desert Harvester Ants" 94th Ecological Society of America Annual Meeting, Albuquerque, NM, 2009

James R. Faeder, Michael L. Blinov, G. Matthew Fricke, Jeremy E. Kozdon, Nathan Lemons and William S. Hlavacek, "Rule-Based Modeling of Biochemical Networks with BioNetGen2" 6th International Conference on Systems Biology (ICSB), Boston, MA, 2005

GRANTS

Multi-Agent Robust Intelligent Autonomous Manipulation (MARIAM)
$197,416 ($98,907/yr, renewable for 5 years)   October 2022-May 2024
Co-I. Sandia National Labs. Award: LL005732-00001A.

Emergence of Function and Dynamics in Ecological Interaction Networks (URoLEN)

$323,630   October 2022-Nov 2026

Senior Personnel. National Science Foundation.

Computational Workforce Development

$1.5M   September 2023 - December 2024

Senior Personnel. Department of Education. Award: P116Z230032.

CONverging on Volcanic ERuption Science with Equity (CONVERSE)

$499,088   August 2022-August 2024

Co-I. National Science Foundation. Award: 004228-00001A

Co-Robots for Predicting Volcanic Eruptions (VolCAN)

$1,495,437   August 2021-August 2024

Co-I. National Science Foundation. Award: A21-0128-002

Agnostic Biosignatures for Life Detection

$288,261   Jan 2019-Dec 2023

PI. National Aeronautics and Space Agency. Award: AWD7773186-GR206006

TEACHING Most Recent Course Evaluation Scores: Overall Effectiveness: 4.13/5, Approachability: 4.58/5. Quotes from anonymous student feedback forms:

  - He was so reasonable and patient and I loved our final project. His interactive lectures were wonderful! I liked how he listened to students and took the time to understand how to improve the course as it went on.

  - I really appreciated that Prof. Fricke continued offering interactive lectures, even during the transition to online learning due to COVID-19. In other courses, I felt very isolated having no contact with the instructors or students, but that was not the case in this course! I felt that there was lots of support available, which helped me stay motivated throughout this course. Professor Fricke clearly cares a lot about his students.

  - As a visual learner, I need to vizualize what every line of code does when it executes in order to understand its purpose, and the professor did a great job explaining this in his lectures. It is difficult to engage such a large class during a lecture, and I appreciate how the professor tried. It showed that he really cared about the students and wanted to see them succeed.

High Performance Computing   Fall 2023-Fall 2024
The University of New Mexico Computer Science Dept.

- Funded to develop and teach a high-performance computing course from Fall 2023 through Fall 2024 under a Department of Education Grant (PI: Patrick Bridges). This course provides a practical and theoretical introduction to modern techniques for building and maintaining supercomputing clusters. Students learn to optimise applications to best take advantage of high performance hardware.

High Performance Computing Workshop Series   2018-Current
The University of New Mexico Center for Advanced Research Computing

- Developed and taught workshops on high performance computing (HPC) for UNM researchers four times a semester. In addition, I developed and taught domain specific workshops in support of specific classes (for example, MPI for CS442: Parallel Processing and Gaussian for CHEM501: Molecular Quantum Structural Theory). In the past year I taught (2023) workshops for 22 UNM courses in 10 departments (6 in Computer Science, 1 Mechanical Engineering, 5 Chemistry, 1 Physics and Astronomy, 4 Earth and Planetary Sciences, 2 Biology, 2 Math, and 1 Biological and Mechanical Engineering) reaching 364 students.

Computer Programming Fundamentals for Non-Majors   Spring 2020
The University of New Mexico Computer Science Dept.

- Instructor of Record. Provides a rigorous foundation in programming with application to mathematical modelling. This course is designed for students in the engineering school. Students learn Python and MATLAB.

Experimental Methods in Computer Science   Spring 2019
The University of New Mexico Computer Science Dept.

- Instructor of Record. Graduate students learn how to use a data-driven approach to understand computing phenomena, formulate hypotheses, design computing experiments to test and validate or refute hypotheses, and evaluate and interpret empirical results. This lays the foundation for rigorous graduate-level research.

Introduction to Programming Swarm Robots   Fall 2017
The University of New Mexico Computer Science Dept.

- Instructor of Record. Dual graduate and undergraduate course in Swarm Robotics. Students learn to program robots in hardware and using the Gazebo simulator. Emphasis on writing collaborative algorithms using the Robot Operating System (ROS) and ARGoS frameworks.

Complex Adaptive Systems   Spring 2017
The University of New Mexico Computer Science Dept.

- Instructor of Record. Graduate course in Complex Adaptive Systems. Topics included dynamical systems, genetic algorithms, game theory, cellular automata, and network theory.

Mathematical Foundations of Computer Science   Summer 2013
The University of New Mexico Computer Science Dept.

- Instructor of Record: Responsible for all aspects of this course in discrete math. Topics covered include proofs, set theory, logic, combinatorics, state machines, generator functions and recurrence relations.

Complex Adaptive Systems   Spring 2013
The University of New Mexico Computer Science Dept.

- Teaching Assistant: Assisted Prof. Moses in organizing, grading, and teaching this graduate level course.

Intermediate Programming with Java   Fall 2012
The University of New Mexico Computer Science Dept.

- Teaching Assistant: Lectured on Java programming, ran labs, designed and graded assignments and exams.

Computer Programming Fundamentals with C++   Summer 2003
The University of New Mexico Computer Science Dept.

- Instructor of Record. Responsible for all aspects of this course which provides engineering students with a foundation in problem solving using C++.

SERVICE

- **University Committees:** AI Use in the Classroom
- **Doctoral Committees:** John Ericksen, "Drone Strategies for Volcano Surveys" (Current); Jannatul Ferdous, "Bigger is Faster: Lymph Node Scaling and Search" , current; Jake Nichol, "CasTLE: Causal Relation Inference Methods for Understanding Climate", current; and Humayra Tasnim "Feature-Based Temporal Data Summaries using Information Based Fusion" (graduated 2024).
- **Masters Committees:** Quincy Wofford, "Performance Predictable Application Platforms for Distributed Computing", Graduated 2020; and Michael Gurule, "The Impact of Transfer Learning for Ungulate Recognition at Sevilleta National Wildlife Refuge", Graduated 2023.
- **Faculty Mentor:** NASA MINDS Competition (2021,2024 Grand Prize Winner), NASA Space Robotics Challenge II (2021 Finalist), Frontier Development Lab Summer Program (2022, NeurIPS and AGU Abstracts), Winter Classic HPC Challenge (2023, 2024), Supercomputing Student Cluster Challenge (2023, 2024).
- **Reviewer:** *Swarm Intelligence*, *Automatica*, *Journal of Theoretical Biology*, *IEEE Robotics and Automation Letters*, DARS: Distributed Autonomous Robotic Systems, IROS: IEEE/RSJ Intl. Conference on Intelligent Robots and Systems, Alife: Conference on the Synthesis and Simulation of Living Systems, BDA: Biological Distributed Algorithms, ICRA: International Conference on Robotics and Autonomy, and ISRR: International Symposium on Robotics Research, and Supercomputing Machine Learning Track.
- **Workshop Organizer:** Robotics Science and Systems Conference, Workshop Hackathon: "Become a swarm programmer overnight". MIT, 2017.
- **Program Committees:** Supercomputing 2024 Machine Learning Track, ANTS 2024
- **31st HOT Interconnects 2024 Online Chair**

Research Assistant Professor   2018-Current
Computer Science Department, The University of New Mexico

- Topic supervisor for graduate students in computer science researching synthetic biology, machine learning applied to climate change, and algorithms for swarm drone monitoring of volcanoes.
- Teach computer science courses as an Adjunct Assistant Professor as required (see teaching section).

Research Assistant Professor   2018-Current
Center for Advanced Research Computing, The University of New Mexico

- CARC is the primary high performance computing center at UNM and is one of the largest in New Mexico. I support scientific computing code to solve problems in fluid dynamics, radio-astronomy, quantum-computing, molecular biology, deep-learning, very large genome analysis, phylogenetic reconstruction, and others in support of the research community at UNM. I also teach HPC workshops. I supervise 3-4 graduate students each semester.

NASA Swarmathon Technical Lead   2015-2019
Department of Computer Science, The University of New Mexico, Albuquerque, NM

- Promoted from Software Lead in 2017.
- Supervise eight graduate and undergraduate programmers.
- Swarmathon: Responsible for all technical aspects of the UNM-NASA swarm robotics resource collection competition including software, hardware, team support, outreach organisation, and purchasing. This program has a budget of $3 million and has three components: outreach to more than 40 underserved universities and colleges (more than 1,500 students) and more than 50 high schools; novel swarm robot hardware, and development of swarm search algorithms for those robots.

Graduate Research Assistant   2012-2015
Dept. of Computer Science, The University of New Mexico

- Supervised two programmers and a mathematician.
- Analysis of immunological search processes.
- Development of novel swarm search algorithms using ARGoS and a Beowulf cluster.

Research Programmer   Spring 2011
Institute for Mathematics and Education, University of Arizona

- Designed and coded mathematical problems as examples of the Common Core States Standards for mathematics for the Illustrative Mathematics Project website. Funded by the Bill and Melinda Gates Foundation.

Research Programmer (Contractor)   2004-2010
Theoretical Biology and Biophysics Group, Los Alamos National Labs, Los Alamos, NM

- Team leader supervising two programmers.
- Developed a biochemical reaction network generator and analyzer (RuleBuilder) for BioNetGen using Perl and Java under Bill Hlavacek and James Faeder.
- Developed a web-based version of the software (GetBonnie) using PHP, Java, and SQL under Redhat linux (LAMP).

Graduate Research Assistant   Summer 2003
Department of Physics and Astronomy, University of New Mexico

- Developed a Monte-Carlo computer simulation of IgE cell signaling in C++ with James Thomas (UNM Physics).

Analyst-Programmer II   Summer 2002
Center for Advanced Research Computing, University of New Mexico

- Summer position working with Gregory Starr (UNM Mechanical Engineering) at the CoMeT (Computational Mechanics Toolkit) robotics group.
- Implemented Neural Networks, Fuzzy Logic Systems in order to generate robotic hand grasp parameters for nuclear waste handling in C++ and Scheme. Funded by the Department of Energy and the Idaho National Engineering and Environmental Laboratory.

Research Assistant
2001 - 2002

University of New Mexico NASA Pursue Program

- Worked in George Luger's (UNM Computer Science) lab on the design and implementation of an embodied, agent-based, robotic control system. Funded by the NASA Center for Autonomous Control Engineering.

Programmer II, Systems Analyst I
1993 - 1999

University of New Mexico Health Sciences Center, CPH and MHC.

- System administration, design, and implementation. Began as helpdesk technician II for several thousand computers in a heterogeneous network environment, promoted to systems analyst responsible for planning and administration of all computer and network systems for two UNM departments. Implemented system administration tools.
- Supervised three full time employees.

Field Archaeologist
1991-93

Mariah and Associates, National Park Service, and Appalachian State University

CERTIFICATIONS Microsoft Certified Systems Engineer (MCSE), Novell Certified Network Engineer (CNE), Certified Software Carpentry Instructor. Scuba Diver: PADI Advanced Open Water, Enriched Air. Drone Pilot: US FAA Part 107, EU A1 and A3, UK CAA.

PROF. ORGS.
- Association for Computing Machinery (ACM)
- International Association for Artificial Life (ALIFE)
- Institute of Electrical and Electronics Engineers (IEEE)
- Complex Systems Society (CSS)

AWARDS
- Biological Distributed Algorithms Workshop Travel Grant, 2017
- Best Poster, Quantifying Complex Transport with Lévy Walks at the From Cold Atoms to Humans and Robots Workshop, 2016
- NSF Travel Grant distributed by Rice University R3G410, 2016
- 1st place 12th Annual UNM Computer Science Graduate Conference, 2016
- University of New Mexico Office of Graduate Studies Travel Grant, 2015
- 2nd place 10th Annual UNM Computer Science Graduate Conference, 2014
- 1st place Tech New Mexico Competition 2013
- 1st place, Student Paper Competition, IEEE Symposium on Artificial Life, 2011
- Appalachian State University *dean's list* 1st year.

REFERENCES

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