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James Fairbanks, PhD

Education

Georgia Institute of Technology (Atlanta, GA)
Ph.D Computational Science and Engineering, 2012 – 2016

- Adviser: Professor David A. Bader
- Dissertation: *Graph Analysis Combining Numerical Statistical and Streaming Techniques*
- Qualifer: Computational Data Analysis (ML) and High Performance Computing (HPC)
- Research Assistant 2012, NDSEG Fellow 2013-16, Teaching Assistant 2016

University of Florida (Gainesville, FL)
B.S. Mathematics, 2009 – 2012

- Summa cum laude
- Thesis: *A Ramsey Theorem for Indecomposable Matchings*

Work Experience

University of Florida (Gainesville, FL)
Assistant Professor, Jan 2021 - Present

- Leading the Generalized Algebraic Techniques Advancing Science (GATAS) Lab
- Research focus: advancing computational science and engineering with the techniques of applied category theory
- Teaching focus: scientific computing

Georgia Tech Research Institute (GTRI) (Atlanta, GA)
Research Engineer, May 2016 - Dec 2020

- Conduct research into high performance data analysis algorithms and applications
- Win and manage federally funded research contracts
- Deliver applied research projects to sponsors such as source code, web applications, technical reports
- Mentor and advise students in connection to research projects

Ionic Security (Atlanta, GA)
Data Scientist, 2015

- Developed data analytics software
- Designed a service oriented architecture for near real time analysis written in Go and Julia
- Leveraged time series and network database technologies including Heka, InfluxDB, RabbitMQ, and ElasticSearch

DOE – Lawrence Livermore National Laboratory (Livermore, CA)
Institute for Scientific Computing Research Intern, 2014

- Studied relationship between numerical accuracy of eigensolvers and solution quality of mincut graph partitioning
- Developed very fast approximate eigensolvers for large graphs
- Applied probabilistic reasoning to describe numerical computations
- Presented results at LLNL poster session

IDA – Center for Computing Sciences (Bowie, MD)
Adjunct Faculty, 2013

- Conducted research into Malware structure and similarities by studying execution patterns of malicious programs
- Developed clustering and methods for understanding the structure of malicious programs with graph analytics
- Built a high performance distributed system for conducting these analyses with ZeroMQ communication

Funding

Research funding is summarized in Table 1

Dates	Role	Agency	Title	Amount
2023 – 2026	Principal Investigator	ONR	Domain Transfer for Continuity of Performance Across Synthetic Aperture Sonar	500K
2022 – 2023	Co-Investigator	ARO	Machine Learning-based Sensor Fusion for Electro-optical and Infrared Target Detection	175K
2022 – 2025	Principal Investigator	DARPA	ASKEM: Generalized Algebraic Techniques Advancing Scientific Discovery	5.8M
2022 – 2023	Principal Investigator	DARPA	Director's Fellowship: Model Aware Scientific Computing	250K
2022 – 2024	Co-PI	DARPA	Perceptual Task Guidance: ENKIx	4.8M
2020 – 2022	Principal Investigator	DARPA	Young Faculty Award: Model Aware Scientific Computing	500K
2020 – 2021	Principal Investigator	DARPA	AIE: Automating Scientific Knowledge Extraction Extended	700K
2019 – 2021	Principal Investigator	DARPA	Directly Computable Models: Generalized Algebraic Theories Enhancing Multiphysics	1M
2018 – 2020	Principal Investigator	DARPA	Artificial Intelligence Exporation: Automating Scientific Knowledge Extraction	1M
2019 – 2023	Principal Investigator	DARPA	Artificial Social Intelligence for Successful Teams (ASIST)	400K
2016 – 2018	Principal Investigator	NIJ	Developing Novel Means of Evidence Collection	400K
2019 – 2022	Co-PI	ONR	Extracting, Explaining, and Estimating Information in Sonar Data (E3ISD)	695K
2019 – 2021	Co-PI	ONR	Mine Counter-measures Situational Awareness	375K
2016 – 2019	Key Personnel	ONR	Performance Estimation of Underwater Mine Countermeasures Operations	990K
2016 – 2019	Key Personnel	GTRI SI	Multi-source Anticipatory Intelligence	900K

Table 1: Funded Projects. Abbreviations: ONR: Office of Naval Research, DARPA: Defense Advanced Research Projects Agency, NIJ: National Institutes of Justice, GTRI SI: Internally funded strategic initiative. Amounts rounded $1000

Teaching

University of Florida

Spring 2024 COT 4501 - Numerical Analysis a Computational Approach

Spring 2022 COT 4501 - Numerical Analysis a Computational Approach

Fall 2021 CIS 4930 - Abstraction Composition Computation

Fall 2021 CIS 6930 - Abstraction Composition Computation

Professional Education

Aug 2022 CANMOD Mathematical and Computational Modeling of Epidemics Workshop, Organizer and Instructor 1 week training for mathematical epidemiologists to learn applied category theoretic tools

Spring 2021 ACT Adjoint School Instructor

Spring 2019 Data Analytics Methodology with J. Poovey

Fall 2018 Programming for Data Science with Beverly Wright

Spring 2017 Data Analytics Methodology with J. Poovey, D. Ediger, and M. Rost.

Fall 2016 Big Data Analytics with J. Poovey, D. Ediger, and M. Rost.

Teaching Assistant at Georgia Tech

Spring 2016 CSE 6643 Numerical Linear Algebra with Prof. Haesun Park

Spring 2014 CSE 6220 High Performance Computing with Prof. Srinivas Aluru

Publications

Journal Articles

[1] R. Aduddell, J. Fairbanks, A. Kumar, P. S. Ocal, E. Patterson, and B. T. Shapiro. "A Compositional Account of Motifs, Mechanisms, and Dynamics in Biochemical Regulatory Networks". In: *Compositionality* 6 (May 13, 2024), p. 2. DOI: 10.32408/compositionality-6-2.

[2] L. Morris, A. Baas, J. Arias, M. Gatlin, E. Patterson, and J. P. Fairbanks. "Decapodes: A Diagrammatic Tool for Representing, Composing, and Computing Spatialized Partial Differential Equations". In: *Journal of Computational Science* 81 (Sept. 1, 2024), p. 102345. DOI: 10.1016/j.jocs.2024.102345.

[3] K. Brown, E. Patterson, T. Hanks, and J. Fairbanks. "Computational Category-Theoretic Rewriting". In: *Journal of Logical and Algebraic Methods in Programming* 134 (Aug. 1, 2023), p. 100888. DOI: 10.1016/j.jlamp.2023.100888. arXiv: 2111.03784.

[4] R. K. Garrett, J. P. Fairbanks, M. L. Loper, and J. D. Moreland. "The Application of Applied Category Theory to Quantify Mission Success". In: *Simulation* 99.2 (2023), pp. 201–220.

[5] E. Patterson, A. Baas, T. Hosgood, and J. Fairbanks. "A Diagrammatic View of Differential Equations in Physics". In: *Mathematics in Engineering* 5.2 (2023), pp. 1–59. DOI: 10.3934/mine.2023036.

[6] S. Libkind, A. Baas, M. Halter, E. Patterson, and J. P. Fairbanks. "An Algebraic Framework for Structured Epidemic Modelling". In: *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 380.2233 (Aug. 15, 2022), p. 20210309. DOI: 10.1098/rsta.2021.0309.

[7] E. Patterson, O. Lynch, and J. Fairbanks. "Categorical Data Structures for Technical Computing". In: *Compositionality* Volume 4 (2022) (Dec. 28, 2022). DOI: 10.32408/compositionality-4-5.

[8] Y. Mordecai, J. P. Fairbanks, and E. F. Crawley. "Category-Theoretic Formulation of the Model-Based Systems Architecting Cognitive-Computational Cycle". In: *Applied Sciences* 11.4 (2021), p. 1945.

[9] E. Briscoe and J. Fairbanks. "Artificial Scientific Intelligence and Its Impact on National Security and Foreign Policy". In: *Orbis* 64.4 (2020), pp. 544–554.

[10] M. Nadolski and J. Fairbanks. "Complex Systems Analysis of Hybrid Warfare". In: *Procedia Computer Science*. 17th Annual Conference on Systems Engineering Research (CSER) 153 (Jan. 1, 2019), pp. 210–217. DOI: 10.1016/j.procs.2019.05.072.

[11] J. P. Fairbanks, D. A. Bader, and G. D. Sanders. "Spectral Partitioning with Blends of Eigenvectors". In: *Journal of Complex Networks* 5.4 (2017), pp. 551–580.

[12] J. P. Fairbanks, R. Kannan, H. Park, and D. A. Bader. "Behavioral Clusters in Dynamic Graphs". In: *Parallel Computing* 47 (2015), pp. 38–50.

[13] J. Fairbanks. "A Ramsey Theorem for Indecomposable Matchings". 2011. arXiv: 1110.3314.

Preprints and Submitted Articles

[14] T. Hanks, H. Riess, S. Cohen, T. Gross, M. Hale, and J. Fairbanks. "Distributed Multi-Agent Coordination over Cellular Sheaves". 2025. arXiv: 2504.02049.

[15] K. Arlin, J. Fairbanks, T. Hosgood, and E. Patterson. "The Diagrammatic Presentation of Equations in Categories". 2024. arXiv: 2401.09751.

[16] B. M. Bumpus, M. Capucci, J. Fairbanks, and D. Rosiak. "Failures of Compositionality: A Short Note on Cohomology, Sheafification and Lavish Presheaves". 2024. arXiv: 2407.03488.

[17] B. M. Bumpus, J. Fairbanks, M. Karvonen, W. Leal, and F. Simard. *Towards a Unified Theory of Time-Varying Data*. Feb. 27, 2024. DOI: 10.48550/arXiv.2402.00206. arXiv: 2402.00206 [math]. URL: http://arxiv.org/abs/2402.00206 (visited on 03/01/2025). Pre-published.

[18] B. M. Bumpus, J. Fairbanks, and W. J. Turner. *Pushing Tree Decompositions Forward Along Graph Homomorphisms*. Sept. 30, 2024. DOI: 10.48550/arXiv.2408.15184. arXiv: 2408.15184 [math]. URL: http://arxiv.org/abs/2408.15184 (visited on 02/26/2025). Pre-published.

[19] T. Hanks, M. Klawonn, E. Patterson, M. Hale, and J. Fairbanks. *A Compositional Framework for First-Order Optimization*. Mar. 8, 2024. DOI: 10.48550/arXiv.2403.05711. arXiv: 2403.05711 [math]. URL: http://arxiv.org/abs/2403.05711 (visited on 03/01/2025). Pre-published.

[20] E. Althaus, B. M. Bumpus, J. Fairbanks, and D. Rosiak. *Compositional Algorithms on Compositional Data: Deciding Sheaves on Presheaves*. Oct. 3, 2023. DOI: 10.48550/arXiv.2302.05575. arXiv: 2302.05575 [cs]. URL: http://arxiv.org/abs/2302.05575 (visited on 02/26/2025). Pre-published.

Conference Papers

[21] M. Lary, R. Samuelson, A. Wilentz, A. Zare, M. Klawonn, and J. Fairbanks. "Learning Diagrams: A Graphical Language for Compositional Training Regimes". In: *The Thirteenth International Conference on Learning Representations*. International Conference on Learning Representations. Singapore, 2025.

[22] B. M. Bumpus, J. Fairbanks, F. Genovese, C. Puca, and D. Rosiak. "How Nice Is This Functor? Two Squares and Some Homology Go a Long Way". In: *Proceedings of Applied Category Theory* 2024 (2024).

[23] T. Hanks, M. Klawonn, and J. Fairbanks. "Generalized Gradient Descent Is a Hypergraph Functor". In: Applied Category Theory. arXiv, Mar. 28, 2024. DOI: 10.48550/arXiv.2403.19845. arXiv: 2403.19845 [math].

[24] T. Hanks, B. She, M. Hale, E. Patterson, M. Klawonn, and J. Fairbanks. "Modeling Model Predictive Control: A Category Theoretic Framework for Multistage Control Problems". In: *2024 American Control Conference (ACC)*. 2024 American Control Conference (ACC). Toronto, CA: IEEE, Mar. 9, 2024, pp. 4850–4857. DOI: 10.23919/ACC60939.2024.10644848. arXiv: 2305.03820 [math].

[25] O. Lynch, K. Brown, J. Fairbanks, and E. Patterson. "GATlab: Modeling and Programming with Generalized Algebraic Theories". In: *Electronic Notes in Theoretical Informatics and Computer Science*. 40th Conference on Mathematical Foundations of Programming Semantics. Vol. 4. Oxford, UK: Episciences. org, 2024.

[26] A. Aguinaldo, E. Patterson, J. Fairbanks, W. Regli, and J. Ruiz. "A Categorical Representation Language and Computational System for Knowledge-Based Robotic Task Planning [Best Paper Award]". In: *Proceedings of the AAAI Symposium Series*. Vol. 2. 2023, pp. 491–497. DOI: 10.1609/aaaiss.v2i1.27718.

[27] B. She, T. Hanks, J. Fairbanks, and M. Hale. "Characterizing Compositionality of LQR from the Categorical Perspective". In: *2023 62nd IEEE Conference on Decision and Control (CDC)*. 2023 62nd IEEE Conference on Decision and Control (CDC). Dec. 2023, pp. 1680–1685. DOI: 10.1109/CDC49753.2023.10383467.

[28] K. Brown, T. Hanks, and J. Fairbanks. "Compositional Exploration of Combinatorial Scientific Models". In: Applied Category Theory. Glasgow, UK, 2022. DOI: 10.48550/ARXIV.2206.08755.

[29] K. Brown, E. Patterson, T. Hanks, and J. Fairbanks. "Computational Category-Theoretic Rewriting [Best Paper]". In: *Graph Transformation: 15th International Conference, ICGT 2022, Held as Part of STAF 2022, Nantes, France, July 7–8, 2022, Proceedings*. Berlin, Heidelberg: Springer-Verlag, July 7, 2022, pp. 155–172. DOI: 10.1007/978-3-031-09843-7_9.

[30] S. Libkind, A. Baas, E. Patterson, and J. Fairbanks. "Operadic Modeling of Dynamical Systems: Mathematics and Computation". In: *Electronic Proceedings in Theoretical Computer Science* 372 (Nov. 3, 2022), pp. 192–206. DOI: 10.4204/EPTCS.372.14. arXiv: 2105.12282 [math].

[31] J. P. Fairbanks, N. Fitch, F. Bradfield, and E. Briscoe. "Credibility Development with Knowledge Graphs". In: *Lecture Notes in Computer Science*. Disinformation in Open Online Media. Ed. by C. Grimme, M. Preuss, F. W. Takes, and A. Waldherr. Vol. 12021. Multidisciplinary International Symposium on Disinformation in Open Online Media. Hamburg, DE: Springer International Publishing, 2020, pp. 33–47. DOI: 10.1007/978-3-030-39627-5_4.

[32] K. Cao and J. Fairbanks. "Unsupervised Construction of Knowledge Graphs From Text and Code". In: *SIGKDD Conference on Knowledge Discovery and Data Mining International Workshop on Mining and Learning with Graphs*. Vol. 15. Anchorage, AK: ACM, Aug. 2019.

[33] N. Campbell, T. Goodyear, W. Messer, E. Stuart, and J. Fairbanks. "Digital Witness: Remote Method for Volunteering Digital Evidence on Mobile Devices". In: *2018 IEEE International Symposium on Technologies for Homeland Security (HST)*. 2018 IEEE International Symposium on Technologies for Homeland Security (HST). IEEE, Oct. 2018, pp. 1–5. DOI: 10.1109/THS.2018.8574119.

[34] J. P. Fairbanks, N. Fitch, N. Knauf, and E. Briscoe. "Credibility Assessment in the News: Do We Need to Read?" In: *WSDM/MIS2*. Misinformation and Misbehavior Mining on the Web. Vol. 2. Los Angeles, CA, 2018.

[35] E. Nathan, J. Fairbanks, and D. Bader. "Ranking in Dynamic Graphs Using Exponential Centrality". In: *Complex Networks & Their Applications VI: Proceedings of Complex Networks 2017 (the Sixth International Conference on Complex Networks and Their Applications)*. Springer International Publishing, 2018, pp. 378–389.

[36] R. V. Thankachan, B. P. Swenson, and J. P. Fairbanks. "Performance Effects of Dynamic Graph Data Structures in Community Detection Algorithms". In: *2018 IEEE High Performance Extreme Computing Conference (HPEC)*. IEEE, 2018, pp. 1–7.

[37] D. Ediger and J. P. Fairbanks. "Deriving Streaming Graph Algorithms from Static Definitions". In: *2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*. 2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW). Graph Algorithms Building Blocks. IEEE, May 2017, pp. 637–642. DOI: 10.1109/IPDPSW.2017.146.

[38] J. Fairbanks, R. V. Thankachan, E. Hein, and B. Swenson. "Integrating Productivity-Oriented Programming Languages with High-Performance Data Structures". In: *2017 IEEE High Performance Extreme Computing Conference (HPEC)*. IEEE, 2017, pp. 1–8.

[39] E. Nathan, G. Sanders, J. Fairbanks, V. E. Henson, and D. A. Bader. "Graph Ranking Guarantees for Numerical Approximations to Katz Centrality". In: *Procedia Computer Science*. International Conference on Computational Science, ICCS 2017, 12-14 June 2017, Zurich, Switzerland 108 (Jan. 1, 2017), pp. 68–78. DOI: 10.1016/j.procs.2017.05.021.

[40] J. P. Fairbanks, A. Zakrzewska, and D. A. Bader. "New Stopping Criteria for Spectral Partitioning". In: *2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*. IEEE, 2016, pp. 25–32.

[41] A. Zakrzewska, E. Nathan, J. Fairbanks, and D. A. Bader. "A Local Measure of Community Change in Dynamic Graphs". In: *2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*. IEEE, 2016, pp. 349–353.

[42] J. Fairbanks, D. Ediger, R. McColl, D. A. Bader, and E. Gilbert. "A Statistical Framework for Streaming Graph Analysis". In: *2013 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2013)*. 2013 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2013). Ontario, CA, Aug. 2013, pp. 341–347. DOI: 10.1145/2492517.2492620.

Conference Talks

[43] J. P. Fairbanks, R. Aduddell, A. Kumar, P. S. Ocal, E. Patterson, and B. T. Shapiro. "A Compositional Account of Motifs, Mechanisms, and Dynamics in Biochemical Regulatory Networks". AMS Southeastern Sectional Meeting (Tallahassee, FL). Feb. 2024.

[44] R. Aduddell, P. S. Ocal, J. P. Fairbanks, E. Patterson, B. Shapiro, and A. Kumar. "A Categorical Framework for (Gene) Regulatory Networks". Joint Mathematics Meeting (Boston, MA). 2023.

[45] J. P. Fairbanks and O. Lynch. "Computational Category Theory in Applied Mathematics". Invited. Joint Mathematics Meetings (Boston, MA). 2023.

[46] S. Libkind, A. Baas, M. Halter, E. Patterson, and J. Fairbanks. "Typed and Stratified Models with Slice Categories". In: *Applied Category Theory*. Applied Category Theory. Glasgow, UK, July 2022, pp. 1–3.

[47] S. L. Wu, S. Libkind, K. Brown, E. Patterson, and J. Fairbanks. "Individual. Jl: Rewriting Individual-Based Models for Epidemiology Using Graph Rewriting". Extended Abstract. Applied Category Theory (Glasgow, UK). 2022.

[48] M. Jackson, M. Halter, T. Goodyear, B. O'Donnell, and J. Fairbanks. "Accelerating Automatic Target Recognition Performance Evaluation with a Relational Database". Tri-Service Radar Symposium. Sept. 2021.

[49] S. Libkind and J. Fairbanks. "AlgebraicDynamics: Compositional Dynamical Systems". JuliaCon (Virtual). July 2021.

[50] O. Lynch, E. Patterson, and J. Fairbanks. "Shaped Data with Acsets". JuliaCon (Virtual). July 2021.

[51] M. Halter, E. Patterson, A. Baas, and J. Fairbanks. "Compositional Scientific Computing with Catlab and SemanticModels". In: Applied Category Theory. Cambridge, MA (online), June 29, 2020. arXiv: 2005.04831.

[52] M. Halter, S. Raparti, K. Cao, C. Herlihy, and J. Fairbanks. "SemanticModels. Jl: A Julia Package for Scientific Model Augmentation". In: *Proceedings of the JuliaCon Conferences*. Vol. 1. 1. 2020, p. 57.

[53] M. Halter, C. Herlihy, and J. Fairbanks. "A Compositional Framework for Scientific Model Augmentation". 2019. arXiv: 1907.03536.

[54] C. Herlihy, K. Cao, S. Reparti, E. Briscoe, and J. Fairbanks. "Semantic Program Analysis for Scientific Model Augmentation". In: *Modeling the World's Systems* (2019), p. 7.

[55] C. Herlihy and J. Fairbanks. "Semanticmodels.Jl: Not Just Another Modeling Framework". JuliaCon (Baltimore, MD). July 2019.

[56] M. Besançon and J. Fairbanks. "Graph Interfaces: Bespoke Graphs for Every Occasion". JuliaCon (London, UK). 2018.

[57] J. Fairbanks. "The JuliaGraphs Ecosystem: Move Fast and Don't Break Things". JuliaCon (London, UK). 2018.

[58] S. Bromberger and J. Fairbanks. "LightGraphs: Our Network, Our Story". JuliaCon (Berkeley, CA). 2017.

[59] J. Fairbanks, N. Knauf, N. Fitch, C. Herlihy, and E. Briscoe. "Assessing Credibility in the Global News Media". 2017.

[60] T. Frederick, C. Herlihy, and J. Fairbanks. "Using Big Data to Predict and Analyze Cooperation and Conflict". The Conflict Conference (University of Texas, Austin, TX). 2017.

[61] D. Bader, A. Michalewicz, O. Green, J. Birkett-Rees, J. Riedy, J. Fairbanks, and A. Zakrzewska. "Semantic Database Applications at the Samtavro Cemetery, Georgia". In: *The 44th Computer Applications and Quantitative Methods in Archaeology Conference (CAA)*. The 44th Computer Applications and Quantitative Methods in Archaeology Conference (CAA). Oslo, NO: Archaeopress, Apr. 2, 2016.

Technical Reports

[62] E. Stuart and J. Fairbanks. *Remote Methods for Volunteering Digital Evidence on Mobile Devices National Institute of Justice*. Technical Report NCJ-300689. Washington, DC: National Institute of Justice, Dec. 1, 2018, p. 12.

Poster Presentations

[63] O. Lynch, J. P. Fairbanks, and P. Evan. "Graphical Semantic Modeling with Semagrams.Jl". Applied Category Theory (Cambridge, UK). June 2021.

[64] J. Perez, A. Baas, M. C. Ferrall-Fairbanks, M. O. Platt, and J. P. Fairbanks. "Parameter Estimation by Minimizing the Loss with Respect to a Finite Difference Approximation on the Vector Field". Biomedical Engineering Society Annial Meeting (Orlando, FL). Oct. 2021.

[65] J. P. Fairbanks. "Semantic Model Understanding for Scientific Model Augmentation". Systems Biology of Human Disease, (Berlin, DE). May 2019.

[66] C. S. Brown, J. Duke, J. P. Fairbanks, C. Herlihy, K. Mukadam, J. Poovey, and M. Rost. "Implementing Real-Time Patient Level Predictions Using PLP Models". OHDSI Symposium. 2017.

[67] J. P. Fairbanks. "QueryGarden: Growing Healthy Applications in Well Prepared SQL". OHDSI Symposium (New York, NY). 2017.

[68] J. Fairbanks and G. Sanders. "Discovering Block Structure in Graphs with Approximate Eigenvectors". poster. SIAM Computational Science and Engineering (Salt Lake City, UT). 2015.

[69] J. P. Fairbanks. "Discovering Block Structure with Approximate Eigenvectors". SIAM Computational Science and Engineering. Mar. 2015.

[70] J. P. Fairbanks. "Ramsey Theorem for Indecomposable Matchings". Graph Theory at Georgia Tech (GT@GT) (Atlanta, GA). 2012.

Invited Talks

[71] L. Morris, A. Baas, J. Arias, M. Gaitlin, and J. P. Fairbanks. "Abstraction and Composition in Modeling and Simulation". University of Florida Graduate Mathematics Association (GMA). unknown-date.

[72] T. Hanks, M. Klawonn, M. Hale, E. Patterson, and J. P. Fairbanks. "A Compositional Framework for First-Order Optimization". Air Force Research Lab - Rome, NY. Apr. 2024.

[73] R. Aduddell, J. P. Fairbanks, P. S. Ocal, A. Kumar, E. Patterson, and B. T. Shapiro. "A Compositional Account of Motifs, Mechanisms, and Dynamics in Biochemical Regulatory Networks". Applied Category Theory [Extended Abstract]. Aug. 2023.

[74] R. Aduddell, P. S. Ocal, J. P. Fairbanks, E. Patterson, B. Shapiro, and A. Kumar. "A Categorical Framework for (Gene) Regulatory Networks". Joint Mathematics Meetings. Jan. 2023.

[75] B. M. Bumpus and J. P. Fairbanks. "Chopping Things up to Decide Stuff Fast". 54th Southeastern International Conference on Combinatorics Graph Theory and Computing, Boca Raton, Florida, USA. Feb. 2023.

[76] J. P. Fairbanks. "Decapodes.Jl: A Framework for Multiphysics Simulation". MAE Department AFOSR Visit. Mar. 2023.

[77] J. P. Fairbanks and O. Lynch. "Computational Category Theory in Applied Mathematics". Joint Mathematics Meetings. Jan. 2023.

[78] L. Morris, A. Baas, J. Arias, M. Gaitlin, and J. P. Fairbanks. "Abstraction and Composition in Modeling and Simulation". SIAM Conference on Computational Science and Engineering. Aug. 2023.

[79] K. Brown and J. P. Fairbanks. "Automated Model Space Exploration". Topos Institute and UW-IHME Compositional Epidemiology Modeling Working Group. Spr. 2022.

[80] J. P. Fairbanks. "Abstraction and Composition in Modeling and Simulation Seminar". Mechanical and Aerospace Engineering Department Affiliate Seminar. Sept. 2022.

[81] J. P. Fairbanks. "Applied Category Theory for the Mathematics of Disease". Canadian Network for Modeling Infections Disease. Aug. 2022.

[82] J. P. Fairbanks. "Computational Modeling with Category Theory". Systems Medicine Laboratory Seminar at UF College of Medicine. May 2022.

[83] J. P. Fairbanks. "Computational Modeling with Category Theory". UF College of Medicine – Laboratory for Systems Medicine. Jan. 2022.

[84] J. P. Fairbanks. “Computational Physics with Categories”. Institute of Theoretical Physics Friedrich-Alexander-Universität Erlangen-Nürnberg. Oct. 2022.

[85] J. P. Fairbanks. “Diagrammatic Equations in Numerical Multiphysics”. Simula Research Laboratory Numerical Analysis Research Seminar (Oslo, NO). May 2022.

[86] J. P. Fairbanks. “Diagrammatic Equations in Physics: Directly Computable Models”. Lawrence Livermore National Laboratory Center for Applied Scientific Computing. June 2022.

[87] J. P. Fairbanks. “Introduction to Applied Category Theory”. Simula Research Laboratory Coffee and Theorems (Oslo, NO). May 2022.

[88] J. P. Fairbanks. “Model Aware Scientific Computing with Categories”. Air Force Research Lab – Information Directorate, Rome, NY. June 2022.

[89] J. P. Fairbanks. “Scientific and Engineering Modeling with Applied Category Theory”. MAE Control Theory Working Group. Aug. 2022.

[90] J. P. Fairbanks. “Scientific and Engineering Modeling with Applied Category Theory”. DARPA Young Faculty Colloquium. Nov. 2022.

[91] J. P. Fairbanks. “Scientific Modeling with AlgebraicJulia”. Rel.Ai Research Seminar. Mar. 2022.

[92] J. P. Fairbanks. “Using Category Theory to Design Computational Mathematics Software”. UF – Numerical Analysis and SIAM Seminar. Sept. 2022.

[93] J. P. Fairbanks and E. Patterson. “Enkix Task Reasoning”. DARPA Site Visit. Oct. 2022.

[94] J. P. Fairbanks and E. Patterson. “Enkix Task Reasoning”. DARPA Program Review. Nov. 2022.

[95] J. P. Fairbanks and A. Zare. “Diagrammatic Equations for Complex Machine Learning Formulations”. ECE Department ONR Site Visit. June 2022.

[96] S. Libkind and J. P. Fairbanks. “Compositional Modeling of Disease Dynamics”. Topos Institute and UW-IHME Compositional Epidemiology Modeling Working Group. Aut. 2022.

[97] J. P. Fairbanks. “Computational Categorical Algebra with Catlab”. Greta: Graph Transformation, Theory, and Applications Seminar. May 2021.

[98] J. P. Fairbanks. “Introduction to the AlgebraicJulia Software Ecosystem”. UF CISE and LLNL Advisory Board Annual Meeting. Feb. 2021.

[99] J. P. Fairbanks. “Model Aware Scientific Computing with Categories”. DARPA Young Faculty Award Principal Investigators Meeting Poster Session. Feb. 2021.

[100] J. P. Fairbanks. “Rethinking Set Theory and Applications”. UF University Math Society. Feb. 2021.

[101] J. P. Fairbanks. “The Algebraic Julia Ecosystem, a Categorical Approach to Technical Computing”. Topos Institute Berkeley Seminar. June 2021.

[102] E. Patterson and J. P. Fairbanks. “Compositional Modeling with AlgebraicJulia”. NIH IMAG MSM Viral Pandemic Meetings. July 2021.

[103] J. P. Fairbanks. “Automating Model Fusion with Decorated Cospan Categories”. MIT Category Theory Seminar. Feb. 2020.

[104] J. P. Fairbanks. “Program Analysis for Scientific Model Augmentation”. University of Florida Informatics Institute Spring Symposium. Mar. 2019.

[105] J. P. Fairbanks. “Semantic Program Analysis for Scientific Model Augmentation”. Lawrence Livermore National Lab. Apr. 2019.

[106] J. P. Fairbanks, E. Davis, and C. Morrison. “Model IR Working Group: Initial Progress”. DARPA ASKE Program Meeting. June 2019.

[107] J. P. Fairbanks. “Data Science and Graph Analytics with Julia”. University of Florida Informatics Institute. Nov. 2018.

[108] J. P. Fairbanks. “Solving Applied Graph Theory Problems in the JuliaGraphs Ecosystem”. MIT CSAIL Seminar. 2018.

Research

Panels

- *HWCOE Early Career Researcher Award Panel*, UF ECR Development Workshop, May 2022
  Host: Forrest Masters (UF)

- *Abstract Representations of Scientific Models*, Paul Cohen (Pitt), Eric Davis (Galois Inc), Alec Nielson (Azimov.io), DARPA ASKE Principal Investigator Meeting, May 2019
  Host: Josh Elliot (DARPA), Moderator: J. P. Fairbanks
- *Toward the Modeling Stack Panel*, Joshua Elliot (DARPA), John Bachman (Harvard Medical School), Eric Davis (Galois), Clayton Morrison (Arizona), J. P. Fairbanks (GTRI), Modeling the World's Systems 2019, May 2019
  Host: Paul Cohen (Pitt), Moderator: Bruce Childers (Pitt)

Open Source

Core Developer of *AlgebraicJulia*, the premier applied category theory software ecosystem.
Lead Developer of *SemanticModels*, a *Julia* package for representing scientific modes in a category theoretic framework.
Core maintainer of *Graphs.jl* the most widely used Graph Algorithm Package in *Julia*.
Developer of *STINGER* the fastest streaming dynamic graph library for shared memory parallel computers.
An up to date list of miscellaneous contributions can be found at `https://github.com/jpfairbanks`

Achievements

Honors, Awards, and Fellowships

May 2022 American Mathematical Society: Mathematical Research Community on Applied Category Theory
2018 Office of the Director of National Intelligence – XAMINE Challenge
2013-16 National Defense Science and Engineering Fellowship
2012-16 Presidential Fellowship for Graduate Study at Georgia Tech
2011-12 University Scholar at the University of Florida
2012 Kermit Sigmon Scholarship for service to the mathematical community
2015 Tau Beta Pi, Engineering Honor Society, Georgia Tech Chapter
2012 Phi Beta Kappa, University of Florida Chapter

Leadership and Service

2022 Proposal Referee: Army Research Office, Topic: Network Science
2022 Journal Referee: Compositionality
2023 Applied Category Theory Conference General Chair and Program Committee Member
2022 Applied Category Theory Conference Organizer and Program Committee Member
Aug 2022 DARPA AI Strategy meeting for UF

Spring 2021 Upper Division Cirriculum Committee
Developed Syllabi for new courses in CISE, including COP 4533 Algorithms Abstraction and Design
Spring 2021 Programming Language Task Force
Feb 2021 PhD Student Recruitment Panel
2019 JuliaCon Organizing Program Committee
2018 JuliaCon Organizing Committee Vice Program Chair
Organized the technical program of a 3 day international conference on the Julia programming language
Ran Program Committee meetings to decide on accepted abstracts and presentations
Led poster session preparations
2017 Tau Beta Pi Atlanta Alumni Chapter President
Organized professional networking events for local Atlanta Area Engineers
2015 Georgia Tech College of Computing Graduate Student Association VP for the School of CSE
Represented department students to university administration committees on curriculum and funding
Organized social and professional networking events for graduate students
Chaired the organizing committee of HotCSE graduate research seminar providing early career presentation opportunities to graduate students
2011 Univ. Florida Pi Mu Epsilon Chapter President
Organized a series of talks for the mathematics students at UF on diverse mathematical topics and skills incl. LaTeX, programming and technical communication in the field.
2009 Eagle Scout

Mentoring

2024-Present Richard Samuelson, *PhD Student 2024*, Thesis Advisor
2022-2023 University Multicultural Mentoring Program, *2023*, UMMP Mentor
2022-Present Adam Gregory, *PhD 2022*, Thesis Committee
2022-Present Hong Yu, *PhD 2022*, Thesis Committee
2022-Present Daniel A. Delgado, *PhD 2022*, Thesis Committee
2021-Present Luke Morris, *PhD 2021*, Thesis Advisor
2021-Present Tyler Hanks, *PhD Student, NSF GRFP Fellow 2021*, Thesis Advisor
2021-22 Kris Brown, *Post-Doctoral Researcher 2022*, UF
2021 UF HWCOE Mentoring Academy Participant, *2021*,
2021 ACT Adjoint School, *2021*, A. Knoerr, G. Generaux, A. Searle
2021-2022 Kris Brown, *Chemical Engineering, Stanford University 2021*,
2020-Present Sophie Libkind, *Mathematics, Stanford University 2021*,
2020-Present Owen Lynch, *Statistics University of Utrecht 2021*,
2021-22 Julian Perez, *BS BME GT 2021*,
2021 Stephen Wellburg, *BS DAS UF 2021*,
2018-19 Sreenath Reparti, *BS ISYE Georgia Tech 2019*, KPMG
2019 Kun Cao, *MS CS Georgia Tech 2019*, GT
2019 Abhinav Mehndiratta, *2019*, Google Summer of Code
2016-18 Rohit Varkey, *MS CS Georgia Tech 2018*, Google
2016-19 Micah Halter, *BS CS Georgia Tech 2019*, GTRI
2016 Nate Knauf, *BS CS Georgia Tech 2019*, GT
2015 Pushkar Godbole, *MS CSE Georgia Tech 2016*, Yelp

Selected Technical Skills

Programming languages (most familiar to least) Julia, Golang, SQL, Python, C, Bash
Computational Data Analysis (pandas, sklearn, Jupyter)
Web development with Golang and Python (flask)
Database Applications primarily with PostgreSQL and MongoDB
Practical computing skills such as `LINUX`, `git`, `make`, LaTeX
Continuous Integration/Deployment