

James Fairbanks, PhD

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Education

Georgia Institute of Technology (Atlanta, GA)

Ph.D Computational Science and Engineering, 2012 – 2016

- ▶ Adviser: Professor David A. Bader
- ▶ Committee: Rich Vuduc, Haesun Park, Polo Chau, Dana Randall, G. Sanders (LLNL)
- ▶ Dissertation: *Graph Analysis Combining Numerical Statistical and Streaming Techniques*
- ▶ Qualifier: Computational Data Analysis (ML) and High Performance Computing (HPC)
- ▶ Research Assistant 2012, 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

Georgia Tech Research Institute (GTRI) (Atlanta, GA)

Research Engineer II, May 2016 - Present

- ▶ Conduct research into high performance data analysis algorithms and applications
- ▶ Write grant proposals (see Funding)
- ▶ 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)

Conducted research into Malware structure and similarities, 2013

- ▶ Studied 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

- 2018 –2020 Principal Investigator, DARPA, *Artificial Intelligence Exploration – Automating Scientific Knowledge Extraction*, ≈1M
- 2016 –2018 Principal Investigator, National Inst. of Justice, *Developing Novel Means of Evidence Collection*, ≈400K
- 2019 –2023 Co-Principal Investigator, DARPA, *Artificial Social Intelligence for Successful Teams (ASIST)*, ≈400K
- 2019 –2022 Co-Principal Investigator, Office of Naval Research, *Extracting, Explaining, and Estimating Information in Sonar Data (E3ISD)*, 695K
- 2019 –2021 Co-Principal Investigator, Office of Naval Research, *MCM Situational Awareness*, ≈375K

- 2016–2019 Task Lead, Office of Naval Research, *Performance Estimation of Underwater MCM Operations*, ≈990K
- 2016–2019 Task Lead, GTRI Strategic Initiative, *Multi-source Anticipatory Intelligence*
- 2015–2019 Performer, Office of Naval Research, *Automation for UxV-based Mine Countermeasures*, 540K
- 2016–2017 Performer, GTRI Strategic Initiative, *Healthy Wealthy Wise*

Achievements

Honors, Awards, and Fellowships

- 2018 Office of the Director of National Intelligence – XAMINE Challenge
- 2013 - 2016 National Defense Science and Engineering Fellowship
- 2012 - 2016 Presidential Fellowship for Graduate Study at Georgia Tech
- 2011 - 2012 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

- 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

Research

Peer Reviewed Journal Articles

- ▶ *Behavioral Clusters in Dynamic Graphs*, J. P. Fairbanks, R. Kannan, H. Park, D. A. Bader, Parallel Computing Special Issue of Scientific Graph Analysis, 2015
- ▶ *A Ramsey Theorem for Indecomposable Matchings*, J. P. Fairbanks, Electronic Journal of Combinatorics, Vol 18(1), Dec 2011

Peer Reviewed Conference Publications

- ▶ *Constructing Knowledge Graphs from Scientific Texts*, K. Cao, J. P. Fairbanks, KDD workshop on Machine Learning in Graphs, Aug 2019
- ▶ *A Compositional Framework for Scientific Model Augmentation*, M. Halter, C. Herlihy, J. P. Fairbanks, Applied Category Theory, July 2019
- ▶ *Semantic Program Analysis for Scientific Model Augmentation*, J. P. Fairbanks, C. Herlihy, K. Cao, S. Reparthi, Modeling the Worlds Systems, May 2019
- ▶ *Digital Witness: Remote Methods for Volunteering Digital Evidence on Mobile Devices*, N. Campbell, T. Goodyear, W. Messer, E. Stuart, J. P. Fairbanks, IEEE Technologies for Homeland Security, Oct 2018
- ▶ *Performance Effects of Backing Data Stores in Community Detection Algorithms*, R. Varkey Thankachan, B. P. Swenson, J. P. Fairbanks, IEEE High Performance Extreme Computing, Sep 2018

- ▶ *Credibility Assessment in the News: Do we need to read?*, N. Fitch, N. Knauf, J. P. Fairbanks, E. Briscoe, ACM WSDM MIS2, Feb 2018
- ▶ *Integrating Productivity-Oriented Programming Languages with High-Performance Data Structures*, R. Varkey Thankachan, E. Hein, B. P. Swenson, J. P. Fairbanks, IEEE High Performance Extreme Computing, Sep 2017
- ▶ *Deriving Streaming Graph Algorithms from Static Definitions*, J. P. Fairbanks, D. M. Ediger, IEEE International Parallel and Distributed Processing Graph Algorithms Building Blocks, 2017
- ▶ *Graph Partitioning with Spectral Blends*, J. P. Fairbanks, D. A. Bader, and G. D. Sanders, Oxford Journal of Complex Networks, Jan 2017
- ▶ *Graph Ranking Guarantees for Numerical Approximations to Katz Centrality*, E. Nathan, G. Sanders, J. P. Fairbanks, V. Henson and D. Bader, International Conference On Computational Science, 2017
- ▶ *Deriving Streaming Graph Algorithms from Static Definitions.*, D. M. Ediger and J. P. Fairbanks, IEEE Parallel and Distributed Processing - Graph Algorithm Building Blocks, 2017
- ▶ *A local measure of community change in dynamic graphs.*, A. Zakrzewska, E. Nathan, J. P. Fairbanks, D. A. Bader, IEEE/ACM ASONAM
- ▶ *Novel Stopping Criteria for Spectral Partitioning*, J. P. Fairbanks, A. Zakrzewska, D.A. Bader, SIAM Network Science, Jul 2016
- ▶ *A Statistical Framework for Analyzing Streaming Graphs*, J. P. Fairbanks, D. Ediger, R. McColl, D.A. Bader, E. Gilbert, IEEE/ACM ASONAM, Aug 2013

Panels

- ▶ *Abstract Representations of Scientific Models*, Paul Cohen (Pitt), Eric Davis, 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, Clayton Morrison (Arizona), J. P. Fairbanks (GTRI), Modeling the World's Systems 2019, May 2019
Host: Paul Cohen (Pitt), Moderator: Bruce Childers (Pitt)

Oral Presentations

- ▶ *SemanticModels.jl: Not Just Another Modeling Framework*, J. P. Fairbanks and C. R. Herlihy, JuliaCon, Baltimore, MD, Jul 2019
- ▶ *Model IR Working Group: Initial Progress*, J. P. Fairbanks, E. Davis, C. Morrison, DARPA ASKE Program Meeting, Jun 2019
Host: Joshua Elliot (DARPA)
- ▶ *Semantic Program Analysis for Scientific Model Augmentation*, J. P. Fairbanks, Lawrence Livermore National Lab, April 2019
Host: Seth Bromberger (LLNL)
- ▶ *Complex Systems Analysis of Hybrid Warfare*, M. Nadolski and J. P. Fairbanks, Conference on Systems Engineering Research, Apr 2019
- ▶ *Program Analysis for Scientific Model Augmentation*, J. P. Fairbanks, University of Florida Informatics Institute Spring Symposium, March 2019
Host: UF Data Science and Informatics
- ▶ *Data Science and Graph Analytics with Julia*, J. P. Fairbanks, University of Florida Informatics Institute, Nov 2018
Host: UF Data Science and Informatics
- ▶ *Solving Applied Graph Theory Problems in the JuliaGraphs ecosystem*, J. P. Fairbanks, MIT CSAIL Seminar, 2018
Host: Alan Edelman, MIT Math/CSAIL
- ▶ *Graph Interfaces: Bespoke Graphs for Every Occasion*, M. Besançon, J. P. Fairbanks, JuliaCon, London, UK, 2018
- ▶ *The JuliaGraphs Ecosystem: Move Fast and Don't Break Things*, J. P. Fairbanks, JuliaCon, London, UK, 2018
- ▶ *Assessing Credibility in Global Media Networks*, J. P. Fairbanks, Human Language Technologies, 2017
- ▶ *Using Big Data to Predict and Analyze Cooperation and Conflict*, T. Frederick, C. Herlihy, J. P. Fairbanks, The Conflict Conference at UT-Austin, 2017
- ▶ *LightGraphs: Our Network, Our Story*, S. Bromberger, J. P. Fairbanks, JuliaCon, Berkeley, CA, 2017

Posters

- ▶ *Semantic Model Understanding for Scientific Model Augmentation*, J. P. Fairbanks, Systems Biology of Human Disease, May 2019
- ▶ *QueryGarden: growing healthy applications in well prepared SQL*, J. P. Fairbanks, OHDSI Symposium, 2017
- ▶ *Implementing Real-Time Patient Level Predictions Using PLP Models*, C. S. Brown, J. D. Duke, , J. P. Fairbanks, C. Herlihy, K. Mukadam, J. Poovey, M. Rost, OHDSI Symposium, 2017
- ▶ *Discovering Block Structure with Approximate Eigenvectors*, SIAM Computational Science and Engineering, Mar 2015
- ▶ *Ramsey Theorem for Indecomposable Matchings*, Graph Theory at Georgia Tech (GT@GT), 2012

Open Source

Core maintainer of *LightGraphs* the most widely used Graph Algorithm Package in *Julia*.
Developer of *STINGER* the fastest streaming dynamic graph library for shared memory parallel computers.

Teaching

Professional Education

- 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

Mentoring

- 2019-2020 Sreenath Reparti, *BS ISYE Georgia Tech 2019*, KPMG
2019 Kun Cao, *MS CS Georgia Tech 2019*, GT
2019 Abhinav Mehndiratta, *2019*, GSOC
2016-2018 Rohit Varkey, *MS CS Georgia Tech 2018*, Google
2016-2019 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, Python, C, SQL, Bash, Matlab
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 *NIX, git, make, L^AT_EX
Continuous Integration/Deployment: Docker, DC/OS, Kubernetes
Avid Linux User