

# 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*
- ▶ Qualifer: 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

2019–2021 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 (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 Inc), 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

- ▶ *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-Present Sreenath Reparti, *BS ISYE Georgia Tech 2019*, KPMG
- 2019-Present 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 Knauft, *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<sup>A</sup>T<sub>E</sub>X  
Continuous Integration/Deployment: Docker, DC/OS, Kubernetes  
Avid Linux User