Alec Kirkley

alec.w.kirkley@gmail.com

EDUCATION

University of Michigan, Ann Arbor, Michigan, USA

Physics PhD Candidate — Sep 2017 –
- Studying complex systems and network theory
- Advisor: Mark Newman
- GPA: 4.00 / 4.00

University of Rochester, Rochester, New York, USA

BS Physics, BA Mathematics — May 2017
- GPA: 3.97 / 4.00
- Summa Cum Laude, Phi Beta Kappa, Highest distinction in Physics and Mathematics

CURRENT POSITION

Physics PhD Candidate, University of Michigan — May 2018 –
- Developed metrics to quantify balance in signed networks, and used these metrics to predict missing data
- Studied higher order statistics of generalized friendship paradox in networks, and associated impacts on polling and social perception
- Developing fast, parallelizable hybrid message passing Monte Carlo method for simulating spin glass systems
- Supervisor: Dr. Mark Newman

PUBLICATIONS

1. Cantwell, G. T., Kirkley, A. & Newman, M. E. J. The friendship paradox and network structure. *In Progress*
2. Klishin, A., Kirkley, A., Singer, D. J. & van Anders, G. Robust design in systems physics. *In Progress*
3. Kirkley, A., Cantwell, G. T. & Newman, M. E. J. Balance in signed networks. *Physical Review E* **99**, 012320 (2019)
4. Kirkley, A., Barbosa, H., Barthelemy, M. & Ghoshal, G. From the betweenness centrality in street networks to structural invariants in random planar graphs. *Nature Communications* **9**, 2501 (2018)

CODING EXPERIENCE

Languages/Frameworks: Python, C, Cython, Mathematica, Matlab, Bash, Hadoop, Tensorflow, Stan, Keras, Git

Methods: Bayesian inference, graph algorithms, combinatorial and continuous optimization, high performance computing, deep learning, data mining, time series analysis, non-parametric statistical methods, geospatial analysis, natural language processing, web scraping

PROFESSIONAL ACTIVITIES

- Complex Systems Summer School, Santa Fe Institute, June 2019
- Balance in Signed Networks (Poster), NetSci, University of Vermont, May 2019.
- Referee for *Journal of Complex Networks*

RELEVANT COURSES

University of Michigan (all graduate level)

- Statistical Inference, Estimation, and Learning
- Mining of Large Scale Graph Data
- Theory of Social and Technological Networks
- Advanced Condensed Matter Physics: Statistical Field Theory and Critical Phenomena
- Statistical Physics
- Quantum Theory I and II

University of Rochester

- Network Science Analytics (graduate level)
- Data Science I: Modern Statistics (graduate level)
- Data Science II: Complexity (graduate level)
- Computational Physics
- Physics and Finance
- Partial Differential Equations and Fourier Analysis
- Real Analysis
- Abstract Algebra
- Advanced Linear Algebra
- Game Theory
- Intermediate Microeconomics
- Intermediate Macroeconomics

GRANTS & AWARDS

National Defense Science and Engineering Graduate (NDSEG) Fellowship
NSF Graduate Research Fellowship (awarded, but declined)
UM Rackham Research Grant
UM Rackham Travel Grant
UM Rackham Professional Development Grant
Elected Phi Beta Kappa junior year at University of Rochester
University of Rochester Physics Honors Prize for top undergraduate after first two years

TEACHING EXPERIENCE

PHY 508: Network Theory, Teaching Assistant
University of Michigan Department of Physics
PHY 136: Mechanics, Graduate Student Instructor
University of Michigan Department of Physics
PHY 121: Mechanics, Teaching Assistant
University of Rochester Department of Physics and Astronomy
PHY 113: General Physics I, Teaching Assistant
University of Rochester Department of Physics and Astronomy
Private Math Tutor
University of Rochester Mathematics Department

OUTSIDE PROJECTS

Michigan Data Science Team

- Utilized time series models to predict future development indicator data for the United Nations Development Goals Challenge. Placed 18th out of 2000+ competitors by the challenge deadline.
- Led project implementing Natural Language Processing models (LSTM Network, N-gram model) to predict drug ratings given customer reviews for the Drugs.com drug review dataset.

Course Projects

- Data Science II (Complexity): Formulated model for optimal routing through city street networks given spatial covariates, and implemented method in Chicago street networks for routing children to and from schools to avoid violent crime.
- Mining of Large Scale Graph Data: Tracked the evolution of community structure over time in stock correlation and international alliance networks, and found temporal correlations with major world events. Identified anomalous nodes with unusually imbalanced ego networks in terms of signed frustration.
- Statistical Physics: Discovered phase transition in metric related to routing efficiency in random planar networks.
- Statistical Inference, Estimation, and Learning: Investigated long range sign correlations induced from a novel formulation of local triadic balance in signed networks.