Alec Kirkley

alec.w.kirkley@gmail.com
https://aleckirkley.com/

EDUCATION

University of Michigan, Ann Arbor, Michigan, USA

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

University of Rochester, Rochester, New York, USA

BS Physics, BA Mathematics — May 2017
- Summa Cum Laude, Phi Beta Kappa, Highest distinction in Physics and Mathematics

WORKING PAPERS

- **Kirkley, Alec**. Scale independent network analysis of distributional socioeconomic data
- Aguilar, J. *et al.* Multi-scale impact of mobility restriction measures on contact disease propagation
- **Kirkley, Alec**, Cantwell, G. T. & Newman, M. E. J. Statistical physics of loopy networks
- Cantwell, G. T., **Kirkley, Alec** & Newman, M. E. J. The friendship paradox and network structure
- Li, G., **Kirkley, Alec**, Krofcheck, D. & Klein, B. Entropy in mountainous river networks

UNDER REVIEW

- Klishin, A., **Kirkley, Alec**, Singer, D. J. & van Anders, G. Robust design in systems physics. *arXiv:1805.02691*

PEER REVIEWED PUBLICATIONS

- Feng, S. & **Kirkley, Alec**. Mixing patterns in interdisciplinary co-authorship networks at multiple scales. *Scientific Reports* **10**, 1–11 (2020)
- **Kirkley, Alec**, Cantwell, G. T. & Newman, M. E. J. Balance in signed networks. *Physical Review E* **99**, 012320 (2019)
- **Kirkley, Alec**, 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)

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

OUTSIDE PROJECTS

Detroit Data For Transportation UM Collaboration

- Utilized methods in network science and spatial statistics to determine at which regions and times of day electric scooters are being ridden dangerously in Detroit, and whether or not geofencing these regions was worthwhile
- Communicated results regularly with city of Detroit to impact local policy

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.

CODING EXPERIENCE

Languages/Frameworks: Python, C++, Cython, Bash, Tensorflow, Stan, Keras, Git

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

PROFESSIONAL ACTIVITIES

- Workshops and schools:
  - Understanding and Exploring Network Epidemiology in the Time of Coronavirus (Net-COVID), Online through UMD COMBINE and UVM, April 2020
  - Complex Networks Winter Workshop, Quebec City, December 2019
  - Complex Systems Summer School, Santa Fe Institute, June 2019
- Conference contributions:
  - "Balance in Signed Networks" (Poster), NetSci, University of Vermont, May 2019
- Invited lectures:
  - "Statistical Physics and Social Systems", The University of Hong Kong, January 2020
- Referee experience:
  - *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

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