Curriculum Vitae

Alec Kirkley

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Education

University of Michigan, Department of Physics — 2021
Ph.D in Physics. Advisor: Mark Newman
Thesis: "Complex Networks: Structure and Inference"

University of Rochester, Departments of Physics & Astronomy and Mathematics — 2017
B.S. in Physics and B.A. in Mathematics, *summa cum laude*

Work Experience

Assistant Professor, University of Hong Kong — 2022 –
Musketeers Foundation Institute of Data Science
Department of Urban Planning and Design
HKU-100 Scholar

Assistant Professor, City University of Hong Kong — 2022
School of Data Science
Member, Centre for Complexity and Complex Networks

PhD Student, University of Michigan — 2018 – 2021
Department of Physics
Advisor: Mark Newman
National Defense Science and Engineering Graduate (NDSEG) Fellow

Undergraduate Research Assistant, University of Rochester — 2016 – 2017
Department of Physics and Astronomy
Advisor: Gourab Ghoshal

Research Interests

Theory of complex networks:

- characterization of structure in networks with metadata
- analysis and algorithms for statistical inference with network data

Statistical physics of urban systems:

- structure and dynamics of human mobility
- spatial socioeconomic inequality

Publications

† denotes first/co-first authorship, * denotes corresponding authorship

Representative works

- **A. Kirkley**[†,*] and M. E. J. Newman, Representative community divisions of networks. *Communications Physics* **5**, 40 (2022).

- **A. Kirkley**[†,*], G. T. Cantwell, and M. E. J. Newman, Belief propagation for networks with loops. *Science Advances* **7**, eabf1211 (2021).
- **A. Kirkley**[†,*], Information theoretic network approach to socioeconomic correlations. *Physical Review Research* **2**, 043212 (2020).
- **A. Kirkley**[†], H. Barbosa, M. Barthelemy, and G. Ghoshal, From the betweenness centrality in street networks to structural invariants in random planar graphs. *Nature Communications* **9**, 2501 (2018).

Other Peer Reviewed Papers

- J, Aguilar, A. Bassolas, G. Ghoshal, S. Hazarie, **A. Kirkley**, M. Mazzoli, S. Meloni, S. Mimar, V. Nicosia, J. J. Ramasco, and A. Sadilek, Impact of urban structure on infectious disease spreading. *Scientific Reports* **12**, 3816 (2022).
- J-G. Young, **A. Kirkley**[†], and M. E. J. Newman, Clustering of heterogeneous populations of networks. *Physical Review E* **105**, 014312 (2022).
- G. T. Cantwell, **A. Kirkley**, and M. E. J. Newman, The friendship paradox in real and model networks. *Journal of Complex Networks* **9**, cnab011 (2021).
- S. Feng and **A. Kirkley**[†,*], Integrating online and offline data for crisis management: Online geolocalized emotion, policy response, and local mobility during the COVID crisis. *Scientific Reports* **11**, 8514 (2021).
- A. A. Klishin, **A. Kirkley**, D. J. Singer, and G. van Anders, Robust design from systems physics. *Scientific Reports* **10**, 14334 (2020).
- S. Feng and **A. Kirkley**[†,*], Mixing patterns in interdisciplinary co-authorship networks at multiple scales. *Scientific Reports* **10**, 7731 (2020).
- **A. Kirkley**[†,*], G. T. Cantwell, and M. E. J. Newman, Balance in signed networks. *Physical Review E* **99**, 012320 (2019).

Preprints

- S. Mimar, D. Soriano-Panos, **A. Kirkley**, H. Barbosa, A. Sadilek, A. Arenas, J. Gomez-Gardenes, and G. Ghoshal, The impact of inter-city mobility on urban welfare. *Preprint arXiv:2112.14646* (2022). Submitted to *Science Advances*.
- **A. Kirkley**[†,*], Spatial regionalization as optimal data compression. *Preprint arXiv:2111.01813* (2021). Submitted to *Communications Physics*.

Funding

NDSEG Fellowship
Funding source: US Department of Defense
Duration: 2019 – 2021
Description: Fellowship supporting all graduate school expenses
Role: Fellowship recipient

NSF GRFP
Funding source: US National Science Foundation
Duration: (forced to decline to accept NDSEG Fellowship)
Description: Fellowship supporting all graduate school expenses
Role: Fellowship recipient

Rackham Research Grant
Funding source: University of Michigan
Duration: 2019
Description: Funding to support graduate school research
Role: PI

Awards and Honors

Summa cum laude, University of Rochester 2017
Awarded to top 2% of students in the graduating class across all fields

Phi Beta Kappa, University of Rochester 2016
Awarded to top 1% of students in the junior class across all fields

University of Rochester Physics Honors Prize 2016
Awarded to top performing junior undergraduate in physics

Teaching Experience

Center for the Study of Complex Systems, University of Michigan 2018 – 2020
Network Theory, Teaching Assistant

Department of Physics, University of Michigan 2017 – 2018
Mechanics, Lab Instructor

Department of Physics, University of Rochester 2014 – 2016
Mechanics, Teaching Assistant
Introductory General Physics, Workshop Leader

Department of Mathematics, University of Rochester 2014 – 2015
Mathematics Tutor

Skills and Coursework

Data science: network analysis, Bayesian inference, geospatial analysis, time series modelling, data mining, algorithms, optimization, high performance computing

Mathematics: probability and statistics, linear algebra, discrete math, algebra, analysis, differential equations

Physics: statistical physics, computational physics, thermodynamics, quantum theory, mechanics, electromagnetism

Referee Experience

Physical Review E, Journal of Complex Networks, Philosophical Transactions of the Royal Society A, Scientific Reports, ACM Transactions on Knowledge Discovery from Data, Knowledge and Information Systems, Royal Society Open Science, IEEE Access, PLOS One, Heliyon, Humanities and Social Sciences Communications

Peer Reviewed Conference Contributions

"Regionalization through optimal information compression on spatial networks" — Jul. 2022
NetSci 2022, Shanghai (talk)

"The Paradox of Interdisciplinary Collaboration" (with Shihui Feng) — Jul. 2021
NetSci 2021, Indiana (talk)

"Multimodal Community Structure in Networks" — Jul. 2021
NetSci 2021, Indiana (talk)

"Probabilistic Models on Networks with Loops" — Sep. 2020
NetSci 2020, Rome (talk)

"Balance in Signed Networks" — May 2019
NetSci 2019, Vermont (poster)

Invited Talks

"Advancing Urban Analytics and Fundamental Data Science with Complex Networks" — Feb. 2022
Institute of Data Science and Department of Urban Planning, University of Hong Kong

"Summarizing Heterogeneous Landscapes of Network Community Divisions" — Feb. 2022
Centre for Complexity and Complex Networks, City University of Hong Kong

"Social Network Analysis: Concepts and Measures" — Jan. 2022
Social Data Science Program, University of Hong Kong

"Complex Networks: From Theoretical Modelling to Applications in Urban Data Science" — Feb. 2021
School of Data Science, City University of Hong Kong

"Information Theoretic Network Approach to Socioeconomic Correlations" — Dec. 2020
Network Science Institute, Northeastern University

"Statistical Physics and Social Systems" — Jan. 2020
Social Data Science Program (guest lecture), University of Hong Kong

Invited Academic Workshops

Network Epidemiology in the Time of Coronavirus (Net-COVID) — Apr. 2020
University of Maryland COMBINE and University of Vermont

Complex Networks Winter Workshop — Dec. 2019
Laval University, Quebec

SFI Complex Systems Summer School — Jun. 2019
Santa Fe Institute, New Mexico

Conference Chairing/Organization

Spatial Analysis Parallel Session (Chair) — Jul. 2022
NetSci 2022, Shanghai

Other Academic Activities/Service

CityU Learning Classroom Series for Secondary School Students — 2022
Lecture series for local secondary school students in Hong Kong discussing how data science is used to enhance our modern society.
Lectured about a range of problems and methods for improving urban wellbeing and career opportunities in this field.

Michigan Data Informed Cities for Everyone (M-DICE) — 2020 – 2021
Utilized methods in network science and statistical inference to assist in identification of regions for effective scooter geo-fencing and bike lane construction.
Communicated results regularly with city of Detroit to impact local policy.

Michigan Data Science Team — 2019 – 2020
Implemented time series models to predict future development indicator data for the United Nations Development Goals Challenge.
Used natural language processing models to predict drug ratings given customer reviews.