

David Rushing Dewhurst

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Education

University of Vermont

Burlington, VT

Ph.D. Complex Systems and Data Science (GPA 4.0/4.0)

May 2018 - May 2020

- Ph.D. dissertation: "Essays on modeling and analysis of dynamic sociotechnical systems"
- Fully funded by the MITRE Corporation through DARPA award #W56KGU-17-C-0010 from May 2018 through September 2019; fully funded by MassMutual Center of Excellence in Complex Systems and Data Science from September 2019 through completion.
- Co-founder of UVM - MITRE Computational Finance Laboratory

University of Vermont

Burlington, VT

M.S. Mathematics (GPA 4.0/4.0)

September 2016 - May 2018

- M.S. thesis in functional analysis: "Some results on a class of functional optimization problems"
- Received J. Kenney award as the top mathematics graduate student
- Fully funded by graduate teaching fellowship, taught Calculus I

Mathematical Sciences Research Institute / University of Montreal

Montreal, PQ, Canada

Séminaire de Mathématiques Supérieures: Contemporary Dynamical Systems

July 2017

- Full financial support from MSRI

University of Vermont

Burlington, VT

B.A. Economics, Mathematics, and Political Science (GPA 3.3/4.0)

September 2011 - May 2016

- Member of Omicron Delta Epsilon (economics international honor society)

Experience

Charles River Analytics

Cambridge, MA

Scientist, probabilistic modeling and machine learning

August 2020 - present

- Drive research and development of statistical and machine learning methods for analyzing spatiotemporal data
- Design anomaly detection techniques for timeseries data in cybersecurity systems

UVM - MassMutual Center of Excellence in Complex Systems and Data Science

Burlington, VT

Research fellow

September 2019 - present

- Design research initiatives in sociotechnical time series data mining, analysis, and modeling
- Conduct analytical and computational research in financial markets, social media dynamics, and game theory
 - Supervise graduate and undergraduate researchers

MassMutual

Boston, MA

Lead data scientist

February 2020 - July 2020

- Serve as knowledge leader in nonparametric and Bayesian time series analysis and modeling
- Lead software development team automating economic capital risk management analysis pipeline
 - Architect and develop comprehensive Bayesian structural time series software leveraging cutting-edge machine learning and probabilistic programming research
 - Consult as economic and machine learning knowledge resource across data science organization, peer-review project designs and writeups, and mentor junior data scientists

The MITRE Corporation

Burlington, VT

Computer science graduate fellow

June 2017 - September 2019

- Design research in computational finance, create DARPA deliverables, and write scientific publications.
- Leverage nonparametric statistical procedures and design new signal processing algorithms to analyze petabytes of high-frequency financial data
 - Lead-authored empirical studies of U.S. equities market microstructure, led to extensive press coverage and creation of new DARPA program
 - Coordinate and execute financial market resilience strategy exercises as member of white-cell team, summarize strategies and generate insights for DARPA program managers

Publications

Listed in reverse chronological order (time ordering is first appearance on arXiv.org)

16. Alshaabi, T., Adams, J.L., Arnold, M.V., Minot, J.R., **Dewhurst, D.R.**, Reagan, A.J., Danforth, C.M. and Dodds, P.S., 2020. Storywrangler: A massive exploratorium for sociolinguistic, cultural, socioeconomic, and political timelines using Twitter. arXiv preprint arXiv:2007.12988. (Submitted for publication.)
15. Alshaabi, T., **Dewhurst, D.R.**, Bagrow, J.P., Dodds, P.S. and Danforth, C.M., 2020. The sociospatial factors of death: Analyzing effects of geospatially-distributed variables in a Bayesian mortality model for Hong Kong. arXiv preprint arXiv:2006.08527. (Submitted for publication.)
14. **Dewhurst, D.R.**, Alshaabi, T., Arnold, M.V., Minot, J.R., Danforth, C.M. and Dodds, P.S., 2020. Divergent modes of online collective attention to the COVID-19 pandemic are associated with future caseload variance. arXiv preprint arXiv:2004.03516.
13. Arnold, M.V., **Dewhurst, D.R.**, Alshaabi, T., Minot, J.R., Adams, J.L., Danforth, C.M., and Dodds, P.S., 2020. Hurricanes and hashtags: Characterizing online collective attention for natural disasters. arXiv preprint arXiv:2003.14291. (Submitted for publication.)
12. Alshaabi, T., Arnold, M.V., Minot, J.R., Adams, J.L., **Dewhurst, D.R.**, Reagan, A.J., Muhamad, R., Danforth, C.M., and Dodds, P.S., 2020. How the world's collective attention is being paid to a pandemic: COVID-19 related 1-gram time series for 24 languages on Twitter. arXiv preprint arXiv:2003.12614.
11. Alshaabi, T., **Dewhurst, D.R.**, Minot, J.R., Arnold, M.V., Adams, J.L., Danforth, C.M. and Dodds, P.S., 2020. The growing echo chamber of social media: Measuring temporal and social contagion dynamics for over 150 languages on Twitter for 2009–2020. arXiv preprint arXiv:2003.03667. (Submitted for publication.)
10. Dodds, P.S., Minot, J.R., Arnold, M.V., Alshaabi, T., Adams, J.L., **Dewhurst, D.R.**, Gray, T.J., Frank, M.R., Reagan, A.J. and Danforth, C.M., 2020. Allotaxonomy and rank-turbulence divergence: A universal instrument for comparing complex systems. arXiv preprint arXiv:2002.09770. (Submitted for publication.)
9. **Dewhurst, D.R.**, Li, Y., Bogdan, A. and Geng, J., 2020, July. Evolving *ab initio* trading strategies in heterogeneous environments. In Proceedings of the 2020 Genetic and Evolutionary Computation Conference (pp. 76-84).
8. Dodds, P.S., Minot, J.R., Arnold, M.V., Alshaabi, T., Adams, J.L., **Dewhurst, D.R.**, Reagan, A.J. and Danforth, C.M., 2019. Fame and Ultrafame: Measuring and comparing daily levels of being “talked about” for United States’ presidents, their rivals, God, countries, and K-pop. arXiv preprint arXiv:1910.00149. (Submitted for publication.)
7. **Dewhurst, D.R.**, Danforth, C.M. and Dodds, P.S., 2020. Noncooperative dynamics in election interference. Physical Review E, 101(2), p.022307.
6. **Dewhurst, D.R.**, Alshaabi, T., Kiley, D., Arnold, M.V., Minot, J.R., Danforth, C.M. and Dodds, P.S., 2020. The shocklet transform: a decomposition method for the identification of local, mechanism-driven dynamics in sociotechnical time series. EPJ Data Science, 9(1), p.3.
5. **Dewhurst, D.R.**, Arnold, M.V. and Van Oort, C.M., 2019, July. Selection mechanisms affect volatility in evolving markets. In Proceedings of the Genetic and Evolutionary Computation Conference (pp. 90-98). ACM.
4. **Dewhurst, D.R.**, Van Oort, C.M., Ring IV, J.H., Gray, T.J., Danforth, C.M. and Tivnan, B.F., 2019. Scaling of inefficiencies in the US equity markets: Evidence from three market indices and more than 2900 securities. arXiv preprint arXiv:1902.04691. (Submitted for publication.)
3. Tivnan, B.F., **Dewhurst, D.R.**, Van Oort, C.M., Ring IV, J.H., Gray, T.J., Tivnan, B.F., Koehler, M.T., McMahon, M.T., Slater, D.M., Veneman, J.G. and Danforth, C.M., 2020. Fragmentation and inefficiencies in US equity markets: Evidence from the Dow 30. PLoS one, 15(1), p.e0226968.
2. **Dewhurst, D.R.**, Danforth, C.M. and Dodds, P.S., 2018. Continuum rich-get-richer processes: Mean field analysis with an application to firm size. Physical Review E, 97(6), p.062317.
1. Dodds, P.S., **Dewhurst, D.R.**, Hazlehurst, F.F., Van Oort, C.M., Mitchell, L., Reagan, A.J., Williams, J.R. and Danforth, C.M., 2017. Simon's fundamental rich-get-richer model entails a dominant first-mover advantage. Physical Review E, 95(5), p.052301.

Contributed talks

4. **Dewhurst, D.R.** (July, 2020). Evolving *ab initio* trading strategies in heterogeneous environments. Presented at the Genetic and Evolutionary Computational Conference (GECCO 2020), Remote.
3. **Dewhurst, D.R.** (January, 2020). The shocklet transform and STAR algorithm: A decomposition method for the identification of local, mechanism-driven dynamics in sociotechnical time series. Presented at Dynamics Days 2020, Hartford, CT, USA.
2. **Dewhurst, D.R.** (July, 2019). Selection mechanisms affect volatility in a market of evolving agents. Presented at the Genetic and Evolutionary Computation Conference (GECCO 2019), Prague, Czech Republic.
1. **Dewhurst, D.R.** (May, 2019). Fragmentation and inefficiencies in US equities markets: A network perspective. Presented at the 4th workshop on Statistical Physics for Financial and Economic Networks at NetSci 2019, Burlington, VT, USA.

Technical skills

I design complex research programs that leverage massive datasets subject to flexible project requirements in dynamic solution spaces.

- **Analytical:** ordinary and partial differential equations; real, complex, and functional analysis; continuous and global optimization; nonparametric and Bayesian statistics; probability theory and stochastic processes; noncooperative and evolutionary game theory; panel data econometrics
- **Computational:** Object-oriented and functional programming; petabyte-scale data analysis using distributed computing techniques and resources (e.g., MapReduce, Spark, Dask); agent-based modeling (financial and other domains); Monte Carlo methods for options pricing, simulation, search, and optimization; machine learning, deep learning, and reinforcement learning methods; complex network analysis; linear and nonlinear time series analysis; signal processing algorithm design; numerical PDE solver design
- **Programming languages and software:** Python (expert), C (intermediate), Stan (intermediate), R (intermediate), MATLAB/Octave (intermediate), *T_EX (T_EXnician), Bash (working), RHEL, Torque/PBS, Git

Academic service

- **Journal reviewer:** Cognitive Science, The Computer Journal (Section C)
- **Conference reviewer:** International Conference on Computational Social Science (2020)
- **M.S. advisor:**
 - Nathaniel Shenton, University of Vermont, M.S. Complex Systems and Data Science (2020). Project title: “Two essays on celebrities’ influence on Twitter: Characterizing fame and modeling exogenous events after death”

Professional service

- **UMass Center for Data Science:** Industry advisor, Data Science for the Common Good