

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

MassMutual

Boston, MA

Lead data scientist

February 2020 - present

Serve as knowledge leader in nonparametric and Bayesian time series analysis and modeling

- Collaborate with enterprise risk management as a senior member of investments and finance data science team
- Interface with academic researchers, publish and review scholarly work, and mentor junior data scientists

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.

- Represent UVM in finance working group focusing on algorithmic trading of FX assets
- Conduct research on financial markets, social media dynamics, and game theory

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 comprehensive studies of U.S. equities markets leading to press coverage in the Wall Street Journal, studies were subsets of DARPA project deliverables that ultimately lead to creation of new program
- Facilitate DARPA strategy exercises as member of white-cell team, generate and summarize insights for DARPA program managers

Publications

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

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., 2019. Evolving ab initio trading strategies in heterogeneous environments. arXiv preprint arXiv:1912.09524. (Accepted for publication, GECCO 2020.)
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

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
- **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 simulation, search, and optimization; machine and deep learning methods, network analysis; linear and nonlinear time series analysis
- **Programming languages and software:** Python (expert), MATLAB/Octave (intermediate), C (working), R (working), * \TeX (\TeX nician), Bash (working), RHEL, Torque/PBS, Git