

Alexander “Sasha” Gutfraind, Ph.D.

Contact

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Research

Complex Networks and Systems
Mathematical Models of Terrorism
Mathematical Models for Biology

Distinctions

Robust Network Interdiction Under Uncertainty
Successful \$1.5M DTRA grant
Research Team: A. Gutfraind, A. Hagberg and F. Pan.
Best Graduate Student Paper in Mathematical Sociology
2008 American Sociological Association Annual Meeting
Cornell Sage Fellowship
2006-2007, \$20k + full tuition
National Sciences and Engineering Research Council of Canada (NSERC)
Master’s Award (2004-2006), \$20k per annum + full tuition

Education

Ph.D. Applied Mathematics (8/2009), Cornell University
Thesis: *Mathematical Terrorism*
Minor in Computer Science
M.Math. Applied Mathematics (6/2006), University of Waterloo
Thesis: *Error-Tolerant Coding and the Genetic Code*
Certificate in University Teaching
B.Math. Applied Mathematics (5/2004), University of Waterloo
Minor in Physics

Publications

Refereed

- A. Gutfraind, “Terrorism as a Mathematical Problem,” *SIAM News*, vol. 42, p. 12, Oct 2009.
- A. Gutfraind, A. A. Hagberg, and F. Pan, “Optimal interdiction of unreactive Markovian evaders,” in *CPAIOR 2009* (J. Hooker and W.-J. van Hoeve, eds.), Lecture Notes in Computer Science, Springer, May 2009. <http://arxiv.org/abs/0903.0173>.
- A. Gutfraind, *Mathematical Methods in Counterterrorism*, ch. Understanding Terrorist Organizations with a Dynamic Model. Springer-Verlag, 2009.
- A. Gutfraind, “Understanding terrorist organizations with a dynamic model,” *Studies in Conflict and Terrorism*, vol. 32, pp. 45–59, Jan 2009.

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- A. Gutfraind, A. A. Hagberg, D. Izraelevitz, and F. Pan, “Interdicting a Markovian evader,” 2009. In resubmission for European J. of Operations Research. Preprint is to appear in arxiv.org.
- M. Genkin and A. Gutfraind, “How Do Terrorist Cells Self-Assemble? Insights from an Agent-Based Model,” *SSRN Working Paper*, no. 1031521, 2008. Winner: 2008 ASA Graduate Student Paper Award in Mathematical Sociology.
- A. Gutfraind and A. Kempf, “Error-reducing structure of the genetic code indicates code origin in non-thermophile organisms,” *Orig Life Evol Bios*, vol. 38, no. 1, pp. 75–85, 2008.

In Preparation

- A. Gutfraind, “Faster algorithms for betweenness centrality,” 2009. Manuscript available by request.
- A. Gutfraind, “Inferring Evolving Communities,” 2009. Manuscript available by request.

Technical Reports

- A. Gutfraind and K. Ahmadizadeh, “Markovian Network Interdiction and the Four Color Theorem,” 2009. <http://arxiv.org/abs/0911.4322>.
- F. Gilfeather(co-PI) and A. Gutfraind(co-PI), “Multi-objective multivariate analysis and optimization of cascade resilience in networks.” DTRA grant proposal, 2009.
- A. Gutfraind, “Constructing networks for cascade resilience,” 2009. <http://arxiv.org/abs/0906.0786>.
- F. Pan(co-PI), A. A. Hagberg(co-PI), and A. Gutfraind(contributor), “Robust network interdiction under uncertainty.” successful DTRA grant proposal (10% success rate), 2008.
- A. Gutfraind, “Error-tolerant coding and the genetic code,” Master’s thesis, University of Waterloo, Waterloo, Ontario, Canada, 2004.
- A. Gutfraind, “Preparing undergraduate students for success in graduate school.” Report towards Certificate in University Teaching. Manuscript is available by request., 2005.

Talks and Posters

- A. Gutfraind, F. Pan, A. A. Hagberg, and D. Izraelevitz, “Network Interdiction with a Markovian Adversary,” Oct. 2009 (expected). Contributed talk at INFORMS Annual Meeting, San Diego, CA.
- A. Gutfraind, “Constructing networks for cascade resilience,” July 2009. Poster - SIAM Annual meeting, Denver, CO.
- A. Gutfraind, “Constructing networks for cascade resilience,” June 2009. Talk at the International Workshop on Coping with Crises in Complex Socio-Economic Systems, Zurich.
- A. Gutfraind, “Understanding Terrorist Organizations with a Dynamic Model,” May 2009. Mini-symposium and introductory talk at SIAM Snowbird Conference on Applications of Dynamical Systems.
- A. Gutfraind, “Resilient complex networks,” April 2009. Talk at the Risk 2009 conference, Santa Fe, NM.
- A. Gutfraind, “Understanding Terrorist Organizations with a Dynamic Model,” Mar 2009. Invited talk at the 5th Conference on Mathematical Methods in Counterterrorism.
- A. Gutfraind, “Network interdiction of Markovian evaders,” 2008. Poster - DIMACS Workshop on Port Security, Piscataway, NJ.
- A. Gutfraind, F. Pan, and A. A. Hagberg, “Interdicting nuclear smuggling with imperfect information,” Oct. 2008. Contributed talk at INFORMS Annual Meeting, Washington, DC.

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- A. Gutfraind, “Optimal interdiction of constrained Markovian evaders,” 2008. Poster - SIAM Annual meeting, San Diego, CA.
- M. Genkin and A. Gutfraind, “How Do Terrorist Cells Self-Assemble? Insights from an Agent-Based Model,” Dec. 2007. Invited talk at the Society for Risk Analysis Annual Conference.
- A. Gutfraind, “A mathematical model of terrorist organizations,” 2007. Invited Poster - DHS University Network Summit.
- A. Gutfraind and A. Kempf, “Reverse-engineering the genetic code using information theory.” Poster and Workshop Presentation - Astrobiology and Origins of Life Conference, 2005.

Awards & Grants

- Best Graduate Student Paper in Mathematical Sociology.
- Travel Award (\$500): *SIAM Annual Meeting 2009* conference.
- Travel Award (\$500): *Risk 2009* conference.
- Workshop Travel Award (\$1300 + fees): IPAM “Beyond Internet MRA: Network of Networks”, 2008.
- Travel Award (\$1500 from Los Alamos Natl. Lab): SIAM Annual Meeting, 2008.
- Travel Award (\$500 from Cornell): Society of Risk Analysis Conference, 2007.
- DHS University Summit (\$1000), 2007 (invited student poster.)
- Workshop Travel Award (\$1000) MSRI Workshop in Computational Biology, 2006.
- NSERC Postgraduate Scholarship (\$20k + tuition), 2004-2006.
- Ontario Graduate Scholarship (\$7k - turned down when awarded NSERC).
- NSERC Undergraduate Student RAs (twice) (each \$10k), 2003-2004.
- Entrance Scholarship for academic performance (\$1000), 1999.
- JIAS National Scholarship (\$1000), 1999.

Employment

Research and Development

- 2007 - 2008
Research Intern, T division, Los Alamos National Lab
Developed and solved new mathematical models of network interdiction.
- 2004
Undergraduate Research Assistant, University of Waterloo
Mathematical Modeling of the Genetic Code
- 2002
Undergraduate Research Assistant, Audiolab, University of Waterloo
Mathematical Modeling in Nonlinear Acoustics
Investigated a novel mathematical model for co-axial loudspeakers.
- 2001 - 2002
Software Engineering Intern, Siebel Systems Canada Inc.
Integrated Content Management technology into Siebel Architecture.
Independently developed C++ integration objects and utilities.
Designed and implemented new tree reconstruction algorithm, improving indexing subsystem performance by over 20%.

Alexander “Sasha” Gutfraind, Ph.D.

- 2000
Software Engineering Intern, MDS SCIEX Inc.
Designed and developed utilities for automatic regression testing of the flagship “Analyst” product.
Developed several models using ATL/COM with VC++.

Service

Fellow, Consortium for Mathematical Methods in Counterterrorism

Organizer, Terrorism as a Dynamical System

a mini-symposium at SIAM DS2009, Snowbird, UT

Founder and chair of “Networks Journal Club” (2006-2009)

a biweekly interdisciplinary (Math,Sociology,CompSci) forum for discussing papers in theory and appls of networks, with a budget of \$800 and over 70 members.

Co-Founder and Treasurer, Cornell SIAM Student Chapter

Technical Skills

Java, Python, R, Matlab, Maple, C/C++ , Pascal, PHP, HTML, Linux

Extracurricular

Emergency Medical Technician (Basic)

Volunteer - Los Alamos Auxiliary Fire Brigade

Member - Toastmasters International

Alexander “Sasha” Gutfraind, Ph.D.

References

Prof. Richard T. Durrett

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Ph.D. Thesis Advisor

Prof. Achim Kempf

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Master’s Thesis Advisor

Dr. Aric A. Hagberg

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Supervisor and collaborator

Prof. Jon M. Kleinberg

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Prof. Michael W. Macy

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