John P Dickerson

Curriculum Vitae

October 2015

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Education

2016	Ph.D.	Carnegie Mellon University	Computer Science (expected)
2014	M.Sc.	Carnegie Mellon University	Computer Science
2008	B.Sc.	University of Maryland	Computer Science
2008	B.Sc.	University of Maryland	Mathematics

Areas of Expertise

Artificial intelligence, stochastic optimization, applied computational economics, market design, mechanism design, machine learning, kidney exchange, healthcare policy & information technology
I am especially interested in optimal decision making and optimization in healthcare and the social sciences.

Work Experience

2010–*Present*	CMU	Research Assistant, Electronic Marketplaces Lab
2010–*Present*	OPTN/UNOS	Algorithms consultant for national kidney exchange
2012–*Present*	Optimized Markets	Algorithms & optimization consultant
2008–2012	UMD	Researcher, Lab for Computational Cultural Dynamics (LCCD)
2005	IBM	Global Contract Preparation System (GCPS)
2003–2004	NSA	Bioinformatics and security R&D, *cleared TS/SCI*

Awards & Grants

2015–2017	Facebook Fellowship	Full tuition, fees, & stipend for 2 years	$159,606
2015–2016	Siebel Scholarship	93 top students from leading graduate schools worldwide	$35,000
2012–2015	NDSEG Fellowship	Full tuition, fees, & stipend for 3 years	$218,410
2014		FutureMatch, our framework for dynamic matching, won HPCWire's "Best Data-Intensive Application" award (joint with Pittsburgh Supercomputing Center)	
2014	NSF SBIR Phase I	Principal Investigator, Award #1345567	$150,000
2014		"Price of Fairness in Kidney Exchange" ranked among best 10% of accepted papers at AAMAS	
2013		"Throwing Darts: Random Sampling Helps Tree Search when the Number of Short Certificates is Moderate" ranked among best 15% of accepted papers at SoCS	
Ongoing	Travel Funds	AAAI, AAMAS, SoCS, CMU	$3,860

Selected Projects

2010+: Kidney Exchange

The Electronic Marketplaces Lab at CMU (headed by my Ph.D. advisor, Tuomas Sandholm) develops the algorithms and software that run the UNOS national kidney exchange, a massive donation program where needy patients can swap incompatible donors to receive life-saving kidneys. As of late 2015, we have over 140 participating transplant centers in the exchange, and perform matches twice per week. I am the lead graduate student on this project.

Kidney exchange is a type of barter exchange, and presents many interesting problems in optimization and mechanism design. I am particularly interested in bridging the gap between kidney exchange theory and practice, with an emphasis on *dynamic* kidney exchange, where the matching algorithm must take into account possible futures when matching in the now. I developed a framework that automatically strikes a balance between equitable and efficient matching in a dynamic model (while necessarily keeping human policymakers "in the loop"). I have also shown that incorporating the possibility of post-algorithmic match failures into the optimization problem itself both increases the number of transplants in expectation and makes the clearing problem—implemented

via a custom branch-and-price integer program solver—easier to solve. I am currently exploring the effect on global welfare and participants' incentives of multiple competing exchanges in a dynamic model, as well as multi-organ exchange.

Media Coverage: The first nationwide kidney exchange took place in Nov. 2010, and was covered by the *International Business Times*. See the CMU press releases in November and December. Future-Match, our data-driven framework that learns to match in dynamic environments, won HPCWire's 2014 Award for Best Data-Intensive Application (joint with the Pittsburgh Supercomputing Center; we tied with IBM Watson). The announcement is available here, with a CMU press release here.

Relevant Publications: [6, 7, 8, 9, 12, 13, 15, 18, 19, 32, 34, 48, 49, 50, 51, 58, 59, 60, 61]

2011+: Dynamic Clearing & Automated Abstraction in TV Advertising

Can we use automated abstraction to deal with channel explosion in online and television advertising markets? In the case where bidders bid asynchronously and bids (possibly in the form of complex campaigns) can be accepted or rejected in an online fashion, can we tractably look to the future to yield better expected revenue for the seller or fairness for the bidder(s)? I'm exploring trade-offs between optimality and tractability in the context of dynamic market clearing of campaigns and abstraction of concrete channels.

Toward this end, I'm building an optimization engine and cloud-based combinatorial market system for selling television advertising campaigns. Our system is in the proof-of-concept stage with one of the world's largest cable operators (MSOs). The technology applies to cable operators (MSOs), broadcast networks, cable networks, TV over Internet, and cross-media advertising.
This research is being performed in part with Optimized Markets, Inc.

2007+: National Security & Counterterrorism

Science, *Scientific American*, *The Register*, *R&D Magazine*, and many others covered my work on how virtual worlds can be used to help policy and defense analysts. See my paper in *Science* (link), my interview in *Scientific American* (link), or coverage in the satirical magazine *The Register* (link). My more recent work in this area uses data mining and machine learning techniques to predict group behavior, with an extensive case study focusing on Lashkar-e-Taiba, a well-known South Asian terror group responsible for (among other attacks) the 2008 bombings in Mumbai.

Relevant Publications: [5, 11, 17, 20, 28, 29, 36, 37, 38, 39]

2009–2012: IED Cache Detection

The Spatial-Cultural Abductive Reasoning Engine (SCARE) is a project I helped develop that analyzes patterns of improvised explosive device (IED) attacks in a war zone. The final product was tested in Afghanistan and deployed elsewhere.

Media Coverage *Nature*, *Popular Science*, *The Baltimore Sun*, and many others covered SCARE. See the articles in *Popular Science* (link) and *The Baltimore Sun* (link). The *Nature* article is here.

Relevant Publications: [27, 40]

Publications

Working papers

1. Dickerson, JP, AD Procaccia, and T Sandholm (2015). "Failure-Aware Kidney Exchange". Under review.
2. Dickerson, JP, AD Procaccia, and T Sandholm (2015). "Price of Fairness in Kidney Exchange". Invited submission to Artificial Intelligence.
3. Dickerson, JP and T Sandholm (2015). "Multi-Organ Exchange: The Whole is Greater than the Sum of its Parts". Under review.
4. Plaut, B, JP Dickerson, and T Sandholm (2015). "Fast Optimal Clearing of Capped-Chain Barter Exchanges". Working paper.

Books

5. Subrahmanian, V, A Mannes, A Sliva, J Shakarian, and JP Dickerson (2012). *Computational Analysis of Terrorist Groups: Lashkar-e-Taiba*. New York: Springer. ISBN: 978-1-4614-4768-9.

Highly-refereed conference papers

6. Blum, A, JP Dickerson, N Haghtalab, AD Procaccia, T Sandholm, and A Sharma (2015). Ignorance is Almost Bliss: Near-Optimal Stochastic Matching With Few Queries. In: *Conference on Economics and Computation (EC)*.

7. Das, S, JP Dickerson, Z Li, and T Sandholm (2015). Competing Dynamic Matching Markets. In: *Conference on Auctions, Market Mechanisms, and Their Applications (AMMA)*.

8. Dickerson, JP and T Sandholm (2015). FutureMatch: Combining Human Value Judgments and Machine Learning to Match in Dynamic Environments. In: *Conference on Artificial Intelligence (AAAI)*.

9. Hajaj, C, JP Dickerson, A Hassidim, T Sandholm, and D Sarne (2015). Strategy-Proof and Efficient Kidney Exchange Using a Credit Mechanism. In: *Conference on Artificial Intelligence (AAAI)*.

10. Dickerson, JP, J Goldman, J Karp, AD Procaccia, and T Sandholm (2014). The Computational Rise and Fall of Fairness. In: *Conference on Artificial Intelligence (AAAI)*.

11. Dickerson, JP, V Kagan, and V Subrahmanian (2014). Using Sentiment to Detect Bots on Twitter: Are Humans more Opinionated than Bots? In: *International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*.

12. Dickerson, JP, AD Procaccia, and T Sandholm (2014). Price of Fairness in Kidney Exchange. In: *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*.

13. Dickerson, JP and T Sandholm (2014). Multi-Organ Exchange: The Whole is Greater than the Sum of its Parts. In: *Conference on Artificial Intelligence (AAAI)*.

14. Erickson, LC, ED Thiessen, KE Godwin, JP Dickerson, and AV Fisher (2014). Endogenously- but not Exogenously-driven Selective Sustained Attention is Related to Learning in a Classroom-like Setting in Kindergarten Children. In: *Conference of the Cognitive Science Society (CogSci)*.

15. Dickerson, JP, AD Procaccia, and T Sandholm (2013). Failure-Aware Kidney Exchange. In: *Conference on Economics and Computation (EC)*.

16. Dickerson, JP and T Sandholm (2013). Throwing darts: Random sampling helps tree search when the number of short certificates is moderate. In: *Conference on Artificial Intelligence (AAAI)*. Late-breaking paper.

17. Dickerson, JP, A Sawant, M Hajiaghayi, and V Subrahmanian (2013). PREVE: A Policy Recommendation Engine based on Vector Equilibria Applied to Reducing LeT's Attacks. In: *International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*.

18. Dickerson, JP, AD Procaccia, and T Sandholm (2012). Dynamic Matching via Weighted Myopia with Application to Kidney Exchange. In: *Conference on Artificial Intelligence (AAAI)*.

19. Dickerson, JP, AD Procaccia, and T Sandholm (2012). Optimizing Kidney Exchange with Transplant Chains: Theory and Reality. In: *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*.

20. Dickerson, JP, GI Simari, V Subrahmanian, and S Kraus (2010). A Graph-Theoretic Approach to Protect Static and Moving Targets from Adversaries. In: *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*.

21. Simari, GI, JP Dickerson, and V Subrahmanian (2010). Cost-based Query Answering in Action Probabilistic Logic Programs. In: *International Conference on Scalable Uncertainty Management (SUM)*.

Journal papers

22. Erickson, LC, ED Thiessen, KE Godwin, JP Dickerson, and AV Fisher (2015). Endogenously- and Exogenously-driven Selective Sustained Attention: Contributions to Learning in Kindergarten Children. *Journal of Experimental Child Psychology*.

23. Sawant, A, JP Dickerson, MT Hajiaghayi, and V Subrahmanian (2015). Automated Generation of Counter-Terrorism Policies using Multi-Expert Input. *ACM Transactions on Intelligent Systems and Technology (TIST)*.

24. Fisher, A, E Thiessen, K Godwin, H Kloos, and JP Dickerson (2013). Assessing selective sustained attention in 3- to 5-year-old children: Evidence from a new paradigm. *Journal of Experimental Child Psychology* **113**.

25. Simari, GI, JP Dickerson, A Sliva, and V Subrahmanian (2013). Parallel Abductive Query Answering in Probabilistic Logic Programs. *ACM Transactions on Computational Logic (TOCL)*.

26. Patro, R, JP Dickerson, S Bista, SK Gupta, and A Varshney (2012). Speeding Up Particle Trajectory Simulations under Moving Force Fields using GPUs. *ASME Journal of Computing and Information Science in Engineering (JCISE)* **12**(2), 021006:1–021006:8.

27. Shakarian, P, JP Dickerson, and V Subrahmanian (2012). Adversarial Geospatial Abduction Problems. *ACM Transactions on Intelligent Systems and Technology (TIST)* **3**(2), 34:1–34:35.

28. Subrahmanian, V and JP Dickerson (2009). What Can Virtual Worlds and Games Do for National Security? *Science* **326**(5957), 1201–1202.

Workshop and smaller conference papers

29. Banaszak, S, E Bowman, JP Dickerson, and V Subrahmanian (2014). Forecasting Country Stability in North Africa. In: *Joint Intelligence & Security Informatics Conference (JISIC)*.

30. Dickerson, JP (2014). Robust Dynamic Optimization with Application to Kidney Exchange. In: *Doctoral Consortium at AAMAS-2014*.

31. Dickerson, JP, J Goldman, J Karp, AD Procaccia, and T Sandholm (2014). The Computational Rise and Fall of Fairness. In: *Exploring Beyond the Worst Cast in Computational Social Choice (EXPLORE) workshop at AAMAS-2014*.

32. Dickerson, JP, AD Procaccia, and T Sandholm (2014). Empirical Price of Fairness in Failure-Aware Kidney Exchange. In: *Towards Better and more Affordable Healthcare: Incentives, Game Theory, and Artificial Intelligence (HCAGT) workshop at AAMAS-2014*.

33. Dickerson, JP and T Sandholm (2014). Balancing Efficiency and Fairness in Dynamic Kidney Exchange. In: *Modern Artificial Intelligence for Health Analytics (MAIHA) workshop at AAAI-2014*.

34. Dickerson, JP and T Sandholm (2013). Liver and Multi-Organ Exchange. In: *IJCAI-2013 Workshop on Constraint Reasoning, Planning and Scheduling Problems for a Sustainable Future (COPLAS)*.

35. Dickerson, JP and T Sandholm (2013). Throwing darts: Random sampling helps tree search when the number of short certificates is moderate. In: *International Symposium on Combinatorial Search (SoCS)*.

36. Dickerson, JP, A Mannes, and V Subrahmanian (2011). Dealing with Lashkar-e-Taiba: A Multi-Player Game-Theoretic Perspective. In: *International Symposium on Open Source Intelligence and Web Mining*.

37. Dickerson, JP, MV Martinez, D Reforgiato, and V Subrahmanian (2008). CIG: Cultural Islands and Games. In: *International Conference on Computational Cultural Dynamics*.

Book chapters

38. Dickerson, JP, GI Simari, and V Subrahmanian (2013). "Using Temporal Probabilistic Rules to Learn Group Behavior". In: *Handbook of Computational Approaches to Counterterrorism*. Ed. by V Subrahmanian. Springer New York.

39. Simari, GI, JP Dickerson, A Sliva, and V Subrahmanian (2013). "Policy Analytics Generation using Action Probabilistic Logic Programs". In: *Handbook of Computational Approaches to Counterterrorism*. Ed. by V Subrahmanian. Springer New York.

40. Shakarian, P, JP Dickerson, and V Subrahmanian (2012). "Geospatial Abduction with Adaptive Adversaries". In: *Geospatial Abduction: Principles and Practice*. Ed. by P Shakarian and V Subrahmanian. Springer. Chap. 4.

Invited talks

41. Das, S, JP Dickerson, Z Li, and T Sandholm (2015). Competing Dynamic Matching Markets. In: *INFORMS Annual Conference*. Invited talk, Auctions cluster.

42. Dickerson, JP (2015). Combining Human Value Judgments and Machine Learning to Match in Dynamic Environments. In: *International Symposium on Mathematical Programming (ISMP)*. Invited talk, Life Sciences and Healthcare cluster.

43. Dickerson, JP (2015). Combining Human Value Judgments and Machine Learning to Match in Dynamic Environments. In: *INFORMS Healthcare Conference*. Invited talk, Health Operations & Logistics cluster.

44. Dickerson, JP (2015). Near-optimal Stochastic Matching With Few Queries. In: *INFORMS Annual Conference*. Invited talk, Auctions cluster.

45. Dickerson, JP (2015). The Dynamics of Kidney Exchange. In: *Production and Operations Management Society (POMS) Annual Conference*. Invited talk, Healthcare Operations Management track.

46. Dickerson, JP (Dec. 2014). *FutureMatch: Combining Human Value Judgments and Machine Learning to Match in Dynamic Environments*. DB Seminar, Carnegie Mellon University, Pittsburgh, PA.

47. Dickerson, JP and T Sandholm (2014). FutureMatch: Combining Human Value Judgments and Machine Learning to Match in Dynamic Environments. In: *INFORMS Annual Conference*. Invited talk, Auctions cluster.

48. Dickerson, JP (Aug. 2013). *Failure-Aware Kidney Exchange*. Tsinghua University, Beijing, China.

49. Dickerson, JP, AD Procaccia, and T Sandholm (2013). Failure-Aware Kidney Exchange. In: *INFORMS Annual Conference*. Invited talk, Auctions cluster.

50. Dickerson, JP, AD Procaccia, and T Sandholm (2012). Dynamic Matching via Weighted Myopia with Application to Kidney Exchange. In: *INFORMS Annual Conference*. Invited talk, Computational Stochastic Optimization cluster.

51. Dickerson, JP, AD Procaccia, and T Sandholm (2012). Optimizing Kidney Exchange with Transplant Chains: Theory and Reality. In: *INFORMS Annual Conference*. Invited talk, Market Mechanisms and their Applications session.

Other publications and presentations

52. Das, S, JP Dickerson, Z Li, and T Sandholm (2015). Competing Dynamic Matching Markets. In: *Conference on Economics and Computation (EC)*. Abstract of poster.

53. Erickson, LC, K Godwin, JP Dickerson, ED Thiessen, and AV Fisher (2015). Different mechanisms for regulating sustained attention and learning in children. In: *Biennial Meeting of the Society for Research in Child Development (SRCD)*.

54. Dickerson, JP, AD Procaccia, and T Sandholm (2014). Price of Fairness in Kidney Exchange. In: *World Transplant Congress (WTC)*. Abstract of poster.

55. Dickerson, JP and T Sandholm (2014). FutureMatch: Learning to Match in Dynamic Environments. In: *World Transplant Congress (WTC)*. Abstract of poster.

56. Dickerson, JP and T Sandholm (2014). FutureMatch: Learning to Match in Dynamic Environments. In: *Conference on Economics and Computation (EC)*. Abstract of poster.

57. Dickerson, JP and T Sandholm (2014). Toward Multi-Organ Exchange. In: *World Transplant Congress (WTC)*. Abstract of poster.

58. Dickerson, JP, AD Procaccia, and T Sandholm (2013). Optimizing Kidney Exchange with Transplant Chains: Theory and Reality. In: *American Transplant Congress (ATC)*. Abstract of poster.

59. Dickerson, JP, AD Procaccia, and T Sandholm (2013). Results About, and Algorithms For, Robust Probabilistic Kidney Exchange Matching. In: *American Transplant Congress (ATC)*. Abstract of poster.

60. Dickerson, JP and T Sandholm (2013). Liver and Multi-Organ Exchange. In: *INFORMS Annual Conference*. Contributed presentations.

61. Dickerson, JP and T Sandholm (2013). Liver and Multi-Organ Exchange. In: *American Transplant Congress (ATC)*. Abstract of poster.

62. Fisher, AV, ED Thiessen, JP Dickerson, and LC Erickson (2013). Development of Selective Sustained Attention: Conceptual and Measurement Issues. In: *Biennial Meeting of the Cognitive Development Society (CDS)*.

63. Thiessen, ED, JP Dickerson, LC Erickson, and AV Fisher (2012). Eyes as the windows of cognition: The Track-It paradigm and selective attention. In: *SRCD Themed Meeting on Developmental Methodology*.

64. Vargas-Baron, E, JP Dickerson, and V Subrahmanian (2009). *Country Profiles on Early Childhood Development: Sub-Saharan Africa*. Booklet for the 4th International Conference on Early Childhood Development.

65. Blusewicz, K, K de Souza, JP Dickerson, B Feldman, A Gaddam, G Ganesan, C Hatch, C Hilseberg, L Kawa, K LaCurts, K Nealon, C Yu, and J Zytnick (2008). *Classification of Perceived Emotion in Music using a Computational Model of the Auditory Cortex*. University of Maryland Gemstone Interdisciplinary Research Program Thesis.

Teaching

2015	Lecturer	CMU	15-892	Foundations of Electronic Marketplaces	*with Sandholm*
2013	Vertical Mentor	CMU	—	Negotiation, eBusiness Technology	Sandholm
2013	Teaching Asst.	CMU	15-780	Graduate Artificial Intelligence	Sandholm & Veloso
2012	Vertical Mentor	CMU	—	Negotiation, eBusiness Technology	Sandholm
2012	Teaching Asst.	CMU	15-780	Graduate Artificial Intelligence	Hebert & Procaccia
2008	Teaching Asst.	UMD	CMSC311	Computer Organization	Hugue
2007	Teaching Asst.	UMD	CMSC311	Computer Organization	Hugue
2007	Teaching Asst.	UMD	CMSC330	Organization of Prog. Languages	Herman
2006	Teaching Asst.	UMD	CMSC212	Intro to Low-Level Programming	Herman

In 2007, I was Undergraduate TA of the Year at UMD's Computer Science Department.

Community

Conferences

PC Member	EXPLORE (2014, 2015), AAAI (2013), IJCAI (2013), TinyToCS (2012)
Reviewer	IJCAI (2015), ADT (2015), AAAI (2014), CPAIOR (2013), EC (2012), AAMAS (2012)
Session Chair	INFORMS (2014, 2015), AAAI (2013)
Travel Grant	AAMAS (2012, 2014), AAAI (2013, 2015), SoCS (2013)

Journals

Reviewer	Operations Research (OR)
	European Journal of Operations Research (EJOR)
	International Journal of Production Research (IJPR)
	Annals of Mathematics and Artificial Intelligence (AMAI)

Service

2013, 2014	CMU	Admissions Committee
2012	CMU	Visit Weekend planning committee
2012	CMU	President of Dec/5 (SCS graduate student organization)
2011, 2012	CMU	Artificial Intelligence Reading Group (AIRG) planning

Graduate Coursework

CMU	F2015	15-889 (Au)	Reinforcement Learning	Brunskill
CMU	F2013	15-781 (Au)	Machine Learning	G. Gordon & A. Smola
CMU	S2013	15-750	Graduate Algorithms	M. Blum
CMU	F2012	10-725 (Au)	Optimization	G. Gordon & R. Tibshirani
CMU	F2012	15-740	Computer Architecture	T. Mowry
CMU	S2012	15-812	Semantics of Programming Languages	S. Brookes
CMU	F2011	15-744	Computer Networks	P. Steenkiste
CMU	F2011	15-892	Foundations of Electronic Marketplaces	T. Sandholm
CMU	S2011	15-780	Graduate Artificial Intelligence	G. Gordon & T. Sandholm
CMU	S2011	15-859	Mathematical Games	D. Sleator & A. Frieze
CMU	F2010	15-887	Planning, Execution, and Learning	M. Veloso & R. Simmons
CMU	F2010	15-853	Algorithms in the Real World	G. Blelloch & J. Fineman
UMD	S2009	CMSC828E	Scientific Computing on GPUs	R. Duraiswami
UMD	F2008	CMSC740	Advanced Computer Graphics	A. Varshney

Programming & Technology

Languages – Fluent

Java, Python, C++

Languages – Experienced

Ruby, C, JavaScript, Matlab, LATEX2e, ActionScript, Flex, HTML4+, CSS2+, XML, HAML, YAML, JSON

Frameworks

Sinatra, Flask, Rails, Play, Java EE (Servlets on Tomcat or GlassFish), Git, SVN, CVS, TORQUE, MPI
I've also extensively used Blacklight, a 4096-core NUMA supercomputer at the Pittsburgh Supercomputing Center, as well as a 1404-core, 116-node cluster at UMD, a 21-node Nvidia Tesla cluster at UMD, and a variety of Amazon AWS services through my work at Optimized Markets and Kidney Match.

Environments & Software Suites

Emacs, Eclipse, NetBeans, Visual Studio, 3d Studio Max, Adobe Creative Suite, Gimp, RubyMine

References

Tuomas Sandholm, Ph.D.	V.S. Subrahmanian, Ph.D.
Professor, Computer Science	Professor, Computer Science
Carnegie Mellon University	University of Maryland
Pittsburgh, PA 15213	College Park, MD 20742
Alvin Roth, Ph.D.	Ariel Procaccia, Ph.D.
Professor, Economics	Asst. Professor, Computer Science
Stanford University	Carnegie Mellon University
Stanford, CA 94305	Pittsburgh, PA 15213

Extra academic and personal references available upon request!