ANDREW G. GILPIN
208 E. 51st St., #107, New York, NY 10022, andrew.gilpin@gmail.com

Curriculum Vitae
Last updated: August 3, 2009

Research interests

Artificial intelligence, computational game theory, computational finance, electronic markets, linear and integer programming, convex optimization, auctions, exchanges, mechanism design, electronic commerce, market-clearing algorithms

Education

Carnegie Mellon University — Pittsburgh, Pennsylvania
Ph.D., Computer Science — August 2002 – May 2009
Advisor: Tuomas Sandholm
Thesis: Algorithms for Abstracting and Solving Imperfect Information Games

Washington University in St. Louis — St. Louis, Missouri
B.S., Computer Science — August 1998 – May 2002
Minor: Mathematics; Elective concentration: Economics

Professional experience

Hg Analytics, LLC — New York, New York
Founding Partner — November 2008 – Present

CombineNet, Inc. — Pittsburgh, Pennsylvania
Research Engineer, Technical Consultant — May 2000 – March 2007

Center for Distributed Object Computing — St. Louis, Missouri
Washington University Computer Science Department — Summer 2000
Summer Undergraduate Researcher

Strictly Business Computer Systems, Inc. — Huntington, West Virginia
Software Developer Intern — Summer 1998, Summer 1999

Honors

- **Receipient**, Siebel Scholarship (2008)
- **First Place** in the heads-up limit bankroll competition at the 2008 AAAI Computer Poker Competition (with Tuomas Sandholm and Troels Bjerre Sørensen)
- **Second Place** in the No-limit Competition and **Third Place** in both Limit Competitions at the 2007 AAAI Computer Poker Competition (with Tuomas Sandholm and Troels Bjerre Sørensen)
- **Finalist**, Best Paper Award for the paper "Better automated abstraction techniques for imperfect information games, with application to Texas Hold'em poker" at the International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Honolulu, Hawaii, 2007 (with Tuomas Sandholm)
- **Third Place**, Series Competition at the 2006 AAAI Computer Poker Competition (with Tuomas Sandholm)
- **Invited** to join CMU SCS Speakers Club (September 2005)

- **Recipient**, student travel scholarships: AAMAS (Honolulu, Hawaii, May 2007), IJCAI (Hyderabad, India, January 2007), AAAI (Boston, Massachussetts, July 2006), AAMAS (Hakodate, Japan, May 2006), DIMACS Workshop on Computational Issues in Auction Design (Rutgers, October 2004)
- **Recipient**, Graduate Fellowship (2002 – Present)
- **Recipient**, Award for Professional Excellence, Computer Science Department, Washington University in St. Louis (2002)
- **Dean's List**, School of Engineering and Applied Science, Washington University in St. Louis (1998 – 2002, 6/7 semesters)
- **Recipient**, Dean's Honorary Merit Scholarship, School of Engineering and Applied Science, Washington University in St. Louis (1998 – 2002)
- **Recipient**, National Merit Finalist Scholarship (1998 – 2002)
- **Honorable Mention** for Best Paper Award, Technical Writing Competition, Washington University in St. Louis (2001)

Publications

Journal articles

1. Andrew Gilpin and Tuomas Sandholm. Lossless abstraction of imperfect information games. *Journal of the ACM* 54(5), 2007.
2. Tuomas Sandholm, Subhash Suri, Andrew Gilpin, and David Levine. CABOB: A Fast Optimal Algorithm for Winner Determination in Combinatorial Auctions. *Management Science* 51(3), 374–390, special issue on Electronic Markets, 2005.

Refereed conference and workshop papers

1. Andrew Gilpin, Javier Peña, and Tuomas Sandholm. First-order algorithm with $\mathcal{O}(\ln(1/\epsilon))$ convergence for ϵ-equilibrium in two-person zero-sum games. National Conference on Artificial Intelligence (AAAI-08), Chicago, Illinois, 2008.
2. Andrew Gilpin and Tuomas Sandholm. Expectation-based versus potential-aware automated abstraction in imperfect information games: An experimental comparison using poker. Short paper. National Conference on Artificial Intelligence (AAAI-08), Chicago, Illinois, 2008.
3. Andrew Gilpin and Tuomas Sandholm. Solving two-person zero-sum repeated games of incomplete information. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Estoril, Portugal, 2008.
4. Andrew Gilpin, Tuomas Sandholm, and Troels Bjerre Sørensen. A heads-up no-limit Texas Hold'em poker player: Discretized betting models and automatically generated equilibrium-finding programs. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Estoril, Portugal, 2008.
5. Andrew Gilpin, Samid Hoda, Javier Peña, and Tuomas Sandholm. Gradient-based algorithms for finding Nash equilibria in extensive form games. International Workshop on Internet and Network Economics (WINE), San Diego, California, 2007.
6. Andrew Gilpin, Tuomas Sandholm, and Troels Bjerre Sørensen. Potential-aware automated abstraction of sequential games, and holistic equilibrium analysis of Texas Hold'em poker. National Conference on Artificial Intelligence (AAAI-07), Vancouver, British Columbia, Canada, 2007.
7. Andrew Gilpin and Tuomas Sandholm. Better automated abstraction techniques for imperfect information games, with application to Texas Hold'em poker. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Honolulu, Hawaii, 2007. Finalist for Best Paper Award.

8. Andrew Gilpin and Tuomas Sandholm. Information-theoretic approaches to branching in search. International Joint Conference on Artificial Intelligence (IJCAI), Hyderabad, India, 2007. Short, early version appeared at the International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Hakodate, Japan, 2006.
9. Andrew Gilpin and Tuomas Sandholm. A competitive Texas Hold'em poker player via automated abstraction and real-time equilibrium computation. National Conference on Artificial Intelligence (AAAI-06), Boston, Massachussetts, 2006.
10. Andrew Gilpin and Tuomas Sandholm. 2006. Finding equilibria in large sequential games of imperfect information. ACM Conference on Electronic Commerce (EC'06), Ann Arbor, MI. Early version with proofs: Technical Report CMU-CS-05-158, Carnegie Mellon University, Pittsburgh, Pennsylvania, August 2005. Subsumed by JACM journal version.
11. Tuomas Sandholm and Andrew Gilpin. Sequences of Take-It-or-Leave-It Offers: Near-Optimal Auctions Without Full Valuation Revelation. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS), Hakodate, Japan, 2006. Early version appeared at the *AAMAS Workshop on Agent-Mediated Electronic Commerce (AMEC-V)*, Melbourne, Australia, 2003.
12. Tuomas Sandholm, Andrew Gilpin, and Vincent Conitzer. Mixed-integer programming methods for finding Nash equilibria. National Conference on Artificial Intelligence (AAAI), Pittsburgh, Pennsylvania, 2005.
13. Andrew Gilpin and Tuomas Sandholm. Arbitrage in Combinatorial Exchanges. AAMAS Workshop on Agent-Mediated Electronic Commerce (AMEC-VI), New York, New York, 2004.
14. Tuomas Sandholm, Subhash Suri, Andrew Gilpin, and David Levine. Winner determination in combinatorial auction generalizations. International Conference on Autonomous Agents and Multi-Agent Systems, pages 69–76, Bologna, Italy, July 2002. Early version appeared at the AGENTS-01 Workshop on Agent-Based Approaches to B2B, pages 35–41, Montreal, Quebec, Canada, May 2001.
15. Tuomas Sandholm, Subhash Suri, Andrew Gilpin, and David Levine. CABOB: A fast optimal algorithm for combinatorial auctions. International Joint Conference on Artificial Intelligence (IJCAI), pages 1102–1108, Seattle, Washington, 2001. Subsumed by Management Science journal version.

Reviewed system demonstrations appearing in published proceedings

1. Andrew Gilpin, Tuomas Sandholm, and Troels Bjerre Sørensen. GS3 and Tartanian: Game theory-based heads-up limit and no-limit Texas Hold'em poker-playing programs. In *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, Estoril, Portugal, May 2008.
2. Andrew Gilpin and Tuomas Sandholm. A Texas Hold'em poker player based on automated abstraction and real-time equilibrium computation. In *International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, pages 1453–1454, Hakodate, Japan, May 2006.
3. Andrew Gilpin and Tuomas Sandholm. Optimal Rhode Island Hold'em Poker. Intelligent Systems Demonstration. In *National Conference on Artifical Intelligence (AAAI)*, pages 1684–1685, Pittsburgh, Pennsylvania, July 12, 2005.

Refereed conferences and workshops without published proceedings

1. Andrew Gilpin, Tuomas Sandholm, Samid Hoda, Javier Peña, and Troels Bjerre Sørensen. Algorithmic Generation of Strategies for Huge Imperfect-Information Games–Applied to Texas Holdem. At the "Computational Game Theory" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Washington, DC, October 2008. (Talk given by Tuomas.)
2. Andrew Gilpin, Samid Hoda, Javier Peña, and Tuomas Sandholm. Smoothing Techniques for the Computation of Nash Equilibria of Sequential Games. At the "Computational Game Theory" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Washington, DC, October 2008. (Talk given by Javier.)

3. Andrew Gilpin, Javier Peña, and Tuomas Sandholm. First-Order Algorithm with $O(log1/\epsilon)$ Convergence for ϵ-Equilibrium in Zero-Sum Games. At the "Computational Game Theory" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Washington, DC, October 2008.
4. Andrew Gilpin and Tuomas Sandholm. Expectation-Based Versus Potential-Aware Automated Abstraction in Imperfect Information Games. At the "Equilibria in eBusiness" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Washington, DC, October 2008.
5. Andrew Gilpin, Tuomas Sandholm, Samid Hoda, Javier Peña, and Troels Bjerre Sørensen. Game-theory-based approaches to full-scale Heads-Up Texas Hold'em poker: Automated abstraction and scalable equilibrium-finding algorithms. Oral presentation at the *Second World Congress of the Game Theory Society*, Evanston, Illinois, July 2008. (Talk given by Tuomas.)
6. Andrew Gilpin, Samid Hoda, Javier Peña, and Tuomas Sandholm. Gradient-based algorithms for Nash equilibrium finding in huge sequential two-person zero-sum imperfect-information games. Oral presentation at the *Second World Congress of the Game Theory Society*, Evanston, Illinois, July 2008.
7. Andrew Gilpin, Tuomas Sandholm, and Troels Bjerre Sørensen. Potential-aware automated abstraction of sequential games, and holistic equilibrium analysis of Texas Hold'em poker. At the "Auctions from a Computational Perspective" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Seattle, Washington, November 2007. (Talk given by Tuomas.)
8. Andrew Gilpin, Samid Hoda, Javier Peña, and Tuomas Sandholm. Gradient-based Algorithms for Finding Nash Equilibria in Extensive Form Games. At the "Dynamic Variational Inequalities" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Seattle, Washington, November 2007.
9. Andrew Gilpin, Samid Hoda, Javier Peña, and Tuomas Sandholm. Gradient-based Algorithms for Finding Nash Equilibria in Extensive Form Games. 18th International Conference on Game Theory, Stony Brook, New York, July 2007.
10. Andrew Gilpin and Tuomas Sandholm. A Strong Texas Hold'em Poker Player via Automated Abstraction and Real-time equilibrium computation. At the "Artificial Intelligence" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Pittsburgh, Pennsylvania, November 2006.
11. Samid Hoda, Andrew Gilpin, Javier Peña, and Tuomas Sandholm. Computing equilibria arising from large sequential games. At the "Applications of Linear Programming" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, Pittsburgh, Pennsylvania, November 2006. (Talk given by Sam.)
12. Andrew Gilpin and Tuomas Sandholm. A competitive Texas Hold'em poker player via automated abstraction and real-time equilibrium computation. 17th International Conference on Game Theory, Stony Brook, New York, July 14, 2006.
13. Andrew Gilpin and Tuomas Sandholm. Information-theoretic approaches to branching in search. At the "Optimization and Heuristic" session at the INFORMS (Institute for Operations Research and the Management Sciences) Annual Meeting, San Francisco, California, November 2005. (Talk given by Tuomas.)
14. Andrew Gilpin and Tuomas Sandholm. Finding equilibria in large sequential games of incomplete information. Workshop on Game Theory and Computer Science at the 16th International Conference on Game Theory, Stony Brook, New York, July 20, 2005.
15. Tuomas Sandholm, Andrew Gilpin, and Vincent Conitzer. Mixed-integer programming methods for finding Nash equilibria. 16th International Conference on Game Theory, Stony Brook, New York, July 14, 2005.
16. Tuomas Sandholm, Bryan Bailey, Andrew Fuqua, Andrew Gilpin, Samid Hoda, Tom Kuhn, David Levine, David C. Parkes, Rob Shields, Yuri Smirnov, and Subhash Suri. Real-World Combinatorial Procurement Auctions. At the "Revenue Management and Dynamic Pricing" session at the INFORMS

(Institute for Operations Research and the Management Sciences) Annual Meeting, Denver, Colorado, October 2004. (Talk given by David Levine.)

17. Andrew Gilpin and Tuomas Sandholm. Arbitrage in Combinatorial Exchanges. Poster presentation at *DIMACS Workshop on Computational Issues in Auction Design*, Rutgers University, October 2004.
18. Andrew Gilpin and Tuomas Sandholm. Arbitrage in Combinatorial Exchanges. Oral presentation at the *Second World Congress of the Game Theory Society*, Marseilles, France, July 2004.
19. Tuomas Sandholm and Andrew Gilpin. Sequences of Take-It-or-Leave-It Offers: Near-Optimal Auctions Without Full Valuation Revelation. Oral presentation at the *Second World Congress of the Game Theory Society*, Marseilles, France, July 2004.
20. Tuomas Sandholm, Bryan Bailey, Andrew Fuqua, Andrew Gilpin, John Heitmann, Samid Hoda, Tom Kuhn, David Levine, Rob Shields, Yuri Smirnov, and Subhash Suri. Industrial Procurement Auctions with Expressive Competition. At the "Combinatorial Auctions" session at the INFORMS (Institute for Operations Research and the Management Sciences) conference, Atlanta, Georgia, 2003. (Talk given by David.)
21. Tuomas Sandholm, Subhash Suri, Andrew Gilpin, and David Levine. CABOB: A fast optimal algorithm for combinatorial auctions. INFORMS (Institute for Operations Research and the Management Sciences) conference, San Jose, California, November 2002. (Talk given by David.)

Manuscripts

1. Automated Design of Revenue-Maximizing Combinatorial Auctions. Tuomas Sandholm, Anton Likhodedov, and Andrew Gilpin. 2008. In submission.
2. A gradient-based approach for computing Nash equilibria of large sequential games. Samid Hoda, Andrew Gilpin, and Javier Peña. 2008. In submission.

Patent applications

1. Method and Apparatus for Forming Expressive Combinatorial Auctions and Exchanges. Tuomas Sandholm, Subhash Suri, David Levine, Andrew Gilpin, John Heitmann, and Robert Shields. Patent application submitted (US, Europe, Japan). Provisional application was submitted 4/10/02 as Side Constraints and Non-Price Attributes in Combinatorial Markets by Tuomas Sandholm and Subhash Suri.
2. Combinatorial Auction Branch on Bid Searching Method and Apparatus. Tuomas Sandholm, Subhash Suri, Andrew Gilpin, and David Levine. Provisional application submitted 4/2002, full application 4/2003.

Miscellaneous

1. Modern poker AI: Automated abstraction and equilibrium-finding algorithms. Andrew Gilpin and Tuomas Sandholm. *Intelligent Gambler*, 28, 7–8, 2007.
2. `gdb` Tutorial. A tutorial for using the GNU debugger. Andrew Gilpin. 2000. Integrated with the curriculum in upper-level undergraduate software engineering courses at several universities, including Washington University in St. Louis, University of Arizona, Wright State University, Monash University (Australia), The University of Sydney, Centre for Development of Advanced Computing (Mumbai, India), and Carleton College. Available at `http://www.cs.cmu.edu/~gilpin/tutorial/`.

External invited talks

1. Better Automated Abstraction Techniques for Imperfect Information Games. Institute of Informatics, British University in Dubai, UAE, January 18, 2007.

2. Sequences of Take-It-or-Leave-It Offers: Near-Optimal Auctions Without Full Valuation Revelation. Oral presentation at *Dagstuhl Seminar on Computing and Markets*, Schloss Dagstuhl, Germany, January 2005.
3. CABOB: A fast optimal algorithm for combinatorial auctions. Infonomics Workshop on Electronic Market Design, Maastricht, The Netherlands, July 2001.

Talks at Carnegie Mellon University

1. Ascending combinatorial auctions. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), November 6, 2007.
2. Incentive-compatible approximation. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), October 25, 2007.
3. Winner determination in combinatorial auctions and generalizations. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), October 23, 2007.
4. Multi-item auctions and exchanges. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), October 18, 2007.
5. Algorithms for abstracting and solving imperfect information games. Oral Thesis Proposal, April 23, 2007.
6. Nesterov's excessive gap technique and poker. Theory Lunch, February 28, 2007.
7. Ascending combinatorial auctions. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), November 15, 2005.
8. Finding equilibria in large sequential games of imperfect information. Theory Lunch, November 9, 2005.
9. Winner determination in combinatorial auction generalizations. Guest lecture for Foundations of Electronic Commerce 15-892 (Professor: Tuomas Sandholm), October 25, 2005.
10. Finding equilibria in large sequential games of imperfect information. Student Seminar Series, September 23, 2005. (Satisfied speaking skills requirement)
11. Computing equilibria for extensive form games. Guest lecture for Advanced Artificial Intelligence 15-780 / 16-731 (Professors: Michael Lewicki and Tuomas Sandholm), April 7, 2005.
12. Computing equilibria for extensive form games. Guest lecture for Mathemematical Games 15-859 / 21-801 (Professors: Alan Frieze and Daniel Sleator), March 29, 2005.

Professional service

Program committee

1. International Joint Conference on Artificial Intelligence (IJCAI) 2009.
2. Quantitative Risk Analysis for Security Applications (QRASA) Workshop 2009.
3. ACM Conference on Electronic Commerce (ACM-EC) 2008, 2009.
4. International Joint Conference on Autonomous Agents and Multiagent System (AAMAS) 2006, 2007, 2008, 2009.
5. National Conference on Artificial Intelligence (AAAI) 2006, 2008.
6. Workshop on Agent Mediated Electronic Commerce (AMEC) 2004, 2007.

Journal reviewing

1. Operations Research
2. Games and Economic Behavior
3. Autonomous Agents and Multi-Agent Systems
4. Artificial Intelligence
5. Journal of Artificial Intelligence Research
6. Neural Computation
7. Machine Learning
8. Computers & Operations Research
9. Adaptive Behavior
10. Journal of Heuristics

Conference and workshop reviewing

1. Symposium on Algorithmic Game Theory (SAGT) 2009.
2. Conference on Neural Information Processing Systems (NIPS) 2008, 2009.
3. Symposium on Discrete Algorithms (SODA) 2006, 2008.
4. Workshop on Internet and Network Economics (WINE) 2007.
5. National Conference on Artificial Intelligence (AAAI) 2005, 2007.
6. ACM Conference on Electronic Commerce (ACM-EC) 2003, 2004, 2006, 2007.
7. North East Student Colloquium on Artificial Intelligence (NESCAI) 2006.
8. International Joint Conference on Artificial Intelligence (IJCAI) 2005.
9. International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2004.
10. Conference on Uncertainty in Artificial Intelligence (UAI) 2004.
11. Hawaii International Conference on System Sciences (HICSS) 2004.

Departmental and group service at CMU

- Speakers Club, 2005 – 2009.
- Graduate PC selection committee (Survey chair), 2005.
- Organizer of Game Theory Discussion Group, 2004 – 2007.
- System administrator for various lab machines, including epsilon (AIX), nash (Linux), bellagio (Linux), venetian (Linux), ecommerce (Solaris), and a 9 machine cluster (Linux/Windows), 2004 – 2009.

Affiliations

- American Association for Artificial Intelligence (AAAI)
- Institute for Operations Research and Management Science (INFORMS)

Other

- Chair, AAAI Computer Poker Competition, 2008.

Teaching assistance

Carnegie Mellon University

1. Negotiation Task, Vertical Mentor, eBusiness Technology (graduate level), Spring 2008
2. Negotiation Task, Vertical Mentor, eBusiness Technology (graduate level), Spring 2007
3. Negotiation Task, Vertical Mentor, eBusiness Technology (graduate level), Summer 2006
4. Negotiation Task, Vertical Mentor, eBusiness Technology (graduate level), Summer 2005
5. Advanced Artificial Intelligence (graduate level), Spring 2005
6. Negotiation Task, Vertical Mentor, eBusiness Technology (graduate level), Summer 2004
7. Electronic Negotiation (graduate level), Summer 2004
8. Great Theoretical Ideas in Computer Science, Spring 2004

   In addition, I served as a volunteer grader for Foundations of Electronic Marketplaces (graduate level) in Fall 2003, Fall 2005, and Fall 2007.

Washington University in St. Louis

9. Introduction to Formal Languages and Automata (graduate level), Spring 2002 (Head TA)
10. Object-Oriented Software Development Laboratory, Fall 2001
11. Object-Oriented Software Development Laboratory, Spring 2000
12. Formal Foundations of Computer Science, Fall 1999 (Head TA)
13. Formal Foundations of Computer Science, Spring 1999 (Head TA)

Selected media appearances (excluding press releases)

1. *Timeout Dubai.* Hot seat interview. UAE, February 1–8, 2007.
2. *Khaleej Times.* US expert to speak on computers and artificial intelligence. UAE, January 18, 2007.
3. *Pittsburgh Post-Gazette.* CMU deals a winning hand for Texas Hold 'em. July 19, 2006. `http://www.post-gazette.com/pg/06200/706689-96.stm`
4. *Dr. Dobbs.* Computer Poker: AI Contest is a Big Deal. July 7, 2006.

References

Available upon request.