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Research Interests

Autonomous Agents, Multi-Agent Systems, Distributed Constraint Optimization, Privacy in Collaborative Environments, Graphical Models for Artificial Intelligence, Game Theory, Reasoning under Uncertainty, Coalition Formation.

Education

University of Southern California, Los Angeles, CA
Ph.D., Computer Science (expected) 09/03–06/07
Thesis: "Local Optimization in Agent Networks in Cooperative and Noncooperative Settings"
Committee: Milind Tambe (chair), Sven Koenig, Bhaskar Krishnamachari, Victor Lesser, Fernando Ordóñez

Massachusetts Institute of Technology, Cambridge, MA
M.Eng., Electrical Engineering and Computer Science 09/00–06/01
Thesis: "Qualitative Behavior Prediction for Simple Mechanical Systems"
Advisor: Randall Davis

Massachusetts Institute of Technology, Cambridge, MA
S.B., Management Science (Sloan School of Management) 09/96–06/01
S.B., Computer Science and Engineering 09/96–06/00
Minor in Economics

Research Funding Granted

Optimizing Team Composition Using Modeling and Multiagent Systems, 12/01/06–12/01/07 (funded: $70k), wrote USC portion of proposal (part of US Army Research Institute SBIR Phase I)

Rapid Formation of Virtual Organizations Using Modeling and Multiagent Systems, 10/01/06–10/01/07 (funded: $100k), wrote USC portion of proposal (part of DARPA STTR Phase I)

Automated Mission Scheduling and Collaboration Support By Distributed Constraint Optimization for Shared Control of Unmanned Vehicles (in submission), wrote USC portion of proposal (part of DARPA SBIR Phase I)

Computational Models for Effects Based Operations in Special Forces Teams (in submission), wrote USC portion of proposal (part of DARPA SBIR Phase I)

Reconfigurable Robot Teams for Surface Operations, 2005 (unfunded), assisted with proposal writing (NASA)

Awards

Best Paper Award, Eighth International Workshop on Distributed Constraint Reasoning (DCR–07), Hyderabad, India (at IJCAI–07), for J. P. Pearce and M. Tambe, "Lower Bounds on k-Optimal Solutions for Distributed Constraint Optimization Problems," 1/8/07.

Outstanding Research Assistant award, Computer Science Department, USC. Awarded annually to two Ph.D. students for excellence in research (out of over 240 Ph.D. students), 12/4/06.

Chosen as one of three USC graduate students university-wide to present research to US Secretary of Homeland Security Tom Ridge, 1/15/04.

Eta Kappa Nu (Electrical engineering and computer science honor society), 2000.

David A. Chanen Writing Prize, for best-written undergraduate term paper in computer science at MIT (out of over 200 papers), 1998.

Research Experience

Graduate Research Assistant, USC Computer Science Department 8/03–present
Supervisor: Milind Tambe
Developed novel algorithms and theoretical results for multiagent distributed constraint optimization. Applied algorithms to a working system of personal-assistant software agents as part of a multi-institution effort called CALO (Cognitive Agent that Learns and Organizes). Presented results at DARPA PI meetings.

Graduate Research Assistant, MIT AI Lab 9/00–6/01
Undergraduate Research Assistant, MIT AI Lab 1/00–5/00
Supervisor: Randall Davis
Developed a theoretical framework and software engine for qualitative analysis of mechanical diagrams.

Summer Research Associate, Charles River Analytics, Cambridge, MA 6/98–8/98
Supervisor: Magnus Snorrason
Created a terrain-based guidance algorithm for an unmanned aircraft searching for targets. Developed a software tool for testing this algorithm on a variety of scenarios. Presented work to funders at Eglin Air Force Base, Florida. This work was the deliverable in a Phase I proposal which was subsequently approved for Phase II funding.

Undergraduate Research Assistant, MIT AI Lab 1/98–5/98
Supervisor: Dave Cliff
Created an interactive tool for visualizing the results and editing parameters of automated bidding agents in auctions.

Publications

Journal Articles in Submission

J. P. Pearce, M. Tambe and R.T. Maheswaran, "Properties of k-Optimal Solutions in Distributed Constraint Optimization," in submission, *Journal of Artificial Intelligence Research*, 33 pages.

Rigorously Refereed Journal Articles and Conference Papers (Full-Length)

P. Paruchuri, J. P. Pearce, F. Ordóñez, S. Kraus and M. Tambe, "An Efficient Heuristic Approach for Security Against Multiple Adversaries," to appear in *Proceedings of the Sixth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–07)*, 8 pages. (acceptance rate 22%)

J. P. Pearce and M. Tambe, "Quality Guarantees on k-Optimal Solutions for Distributed Constraint Optimization Problems," to appear in *Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI–07)*, Hyderabad, India, January 6–12, 2007, 6 pages. (acceptance rate 34%)

R. Greenstadt, J. P. Pearce and M. Tambe, "Analysis of Privacy Loss in DCOP Algorithms," in *Proceedings of the 21st National Conference on Artificial Intelligence (AAAI–06)*, Boston, Massachusetts, July 16–20, 2006, pp. 647–653. (selected for oral presentation, acceptance rate 23%)

J. P. Pearce, R. T. Maheswaran, and M. Tambe, "Solution Sets for DCOPs and Graphical Games," in *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi–Agent Systems (AAMAS–06)*, Hakodate, Japan, May 8–12, 2006, pp. 577–584. (selected for oral presentation, acceptance rate 11%)

R. T. Maheswaran, J. P. Pearce, P. Varakantham, E. Bowring and M. Tambe, "Privacy Loss in Distributed Constraint Reasoning: A Quantitative Framework for Analysis and its Applications." *Journal of Autonomous Agents and Multi Agent Systems (JAAMAS)*, 13:27–60, 2006.

R. T. Maheswaran, J. P. Pearce, P. Varakantham, E. Bowring and M. Tambe, "Valuation of Possible States: A Unifying Quantitative Framework for Evaluating Privacy in Collaboration," in *Proceedings of the Fourth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–05)*, Utrecht, The Netherlands, July 25–29, 2005, pp. 1030–1037. (acceptance rate 24%)

R. T. Maheswaran, J. P. Pearce and M. Tambe, "Distributed Algorithms for DCOP: A Graphical-Game-Based Approach," in *Proceedings of the 17th International Conference on Parallel and Distributed Computing Systems (PDCS–04)*, San Francisco, CA, September 15–17, 2004, pp. 432–439.

R. T. Maheswaran, M. Tambe, E. Bowring, J. P. Pearce and P. Varakantham, Taking DCOP to the Real World: Efficient Complete Solutions for Distributed Multi-Event Scheduling," in *Proceedings of the Third International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–04)*, New York, NY, July 19–13, 2004, pp. 310–317. (acceptance rate 24%)

Rigorously Refereed Conferences: Short Papers

J. P. Pearce, "Locally Optimal Algorithms and Solutions for Distributed Constraint Optimization," in Member Abstracts and Posters Track, *Proceedings of the 21st National Conference on Artificial Intelligence (AAAI–06)*, Boston, Massachusetts, July 16–20, 2006., 2 pages.

P. M. Berry, C. Albright, E. Bowring, K. Conley, K. Nitz, J. P. Pearce, B. Peintner, S. Saadati, M. Tambe, T. Uribe, and N. Yorke-Smith, "CALO Conflict Negotiation: PTIME and DCOP," demo paper in *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–06)*, Hakodate, Japan, May 8–12, 2006, pp. 1467–8.

J. P. Pearce, "Locally Optimal Algorithms and Solutions for Distributed Constraint Optimization," in Doctoral Consortium, *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–06)*, Hakodate, Japan, May 8–12, 2006, 2 pages.

R. Greenstadt, J. P. Pearce, E. Bowring and M. Tambe "Experimental analysis of privacy loss in DCOP algorithms," short paper in *Proceedings of the Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–06)*, Hakodate, Japan, May 8–12, 2006, pp. 1424–26.

J. P. Pearce, R. T. Maheswaran and M. Tambe, "How Local Is That Optimum? k-optimality for DCOP," short paper in *Proceedings of the Fourth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS–05)*, Utrecht, The Netherlands, July 25–29, 2005, pp. 1303–1304.

Refereed Technical Magazine Articles

M. Tambe, E. Bowring, J. P. Pearce, P. Varakantham, P. Scerri, D. V. Pynadath, "Electric Elves: What Went Wrong and Why," in AAAI Spring Symposium on What Went Wrong and Why: Lessons from AI Research and Applications, to appear, *AI Magazine*, 2007.

Book Chapters

R. T. Maheswaran, J. P. Pearce and M. Tambe, "A Family of Graphical-Game-Based Algorithms for Distributed Constraint Optimization Problems," in P. Scerri, R. Mailler and R. Vincent editors, *Coordination of Large-Scale Multiagent Systems*, Springer, 2005, pp. 127–146.

Invited Papers

P. Paruchuri, E. Bowring, R. Nair, J. P. Pearce, M. Tambe, N. Schurr and P. Varakantham, "Multi-agent Teamwork: Hybrid Approaches," *Communications of the Computer Society of India*, 30(6):19–24, 2006.

M. Tambe, E. Bowring, J. P. Pearce, P. Varakantham, P. Scerri, D. V. Pynadath, "Electric Elves: What Went Wrong and Why," in AAAI Spring Symposium on What Went Wrong and Why: Lessons from AI Research and Applications, Stanford, CA, March 27–29, 2006.

M. Tambe, E. Bowring, H. Jung, G. Kaminka, R. T. Maheswaran, J. Marecki, P. J. Modi, R. Nair, J. P. Pearce, P. Paruchuri, D. Pynadath, P. Scerri, N. Schurr and P. Varakantham, "Conflicts in

Teamwork: Hybrids to the Rescue," in *Proceedings of the Fourth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*, Utrecht, The Netherlands, July 25–29, 2005, pp. 3–10.

Refereed Symposium and Workshop Papers

P. Paruchuri, J. P. Pearce, F. Ordóñez , S. Kraus and M. Tambe, "An Efficient Heuristic for Security Against Multiple Adversaries in Stackelberg Games," to appear in AAAI Spring Symposium on Game Theoretic and Decision Theoretic Agents (GTDT), Stanford, CA, March 26-28, 2007.

J. P. Pearce and M. Tambe, "Lower Bounds on k-Optimal Solutions for Distributed Constraint Optimization Problems," in The Eighth International Workshop on Distributed Constraint Reasoning (DCR), Hyderabad, India, January 8, 2007 (at IJCAI–07). **(Winner of Best Paper Award)**

R. Greenstadt, J. P. Pearce and M. Tambe, "An Experimental Analysis of Privacy Loss in DCOP Algorithms," in The Seventh International Workshop on Distributed Constraint Reasoning (DCR), Hakodate, Japan, May 8, 2006 (at AAMAS–06).

J. P. Pearce and M. Tambe, "Quality Guarantees on Locally Optimal Solutions for Distributed Constraint Optimization Problems," in The Seventh International Workshop on Distributed Constraint Reasoning (DCR), Hakodate, Japan, May 8, 2006 (at AAMAS–06).

J. P. Pearce, R. T. Maheswaran, and M. Tambe, "Solution Sets for DCOPs and Graphical Games: Metrics and Bounds," in Ninth International Symposium on Artificial Intelligence and Mathematics, Ft. Lauderdale, FL, January 4–6, 2006.

J. P. Pearce, R. T. Maheswaran and M. Tambe, "Local Algorithms for Distributed Constraint Optimization in Dynamic, Anytime Environments," in Workshop on Ambient Intelligence - Agents for Ubiquitous Environments, Utrecht, The Netherlands, July 26, 2005 (at AAMAS–05).

J. P. Pearce, R. T. Maheswaran and M. Tambe, "Graph-Based Bounds on k-Optimal Joint-Action Sets for Multiple Agents," in Workshop on Declarative Agent Languages and Technologies (DALT), Utrecht, the Netherlands, July 25, 2005 (at AAMAS–05).

R. T. Maheswaran, J. P. Pearce, P. Varakantham, E. Bowring and M. Tambe, "Valuations of Possible States (VPS): A Quantitative Framework for Analysis of Privacy Loss Among Collaborative Personal Assistant Agents," in AAAI Spring Symposium on Persistent Assistants: Living and Working with AI, Menlo Park, CA, March 21–23, 2005.

J. P. Pearce, R. T. Maheswaran and M. Tambe, "DCOP Games for Multi-Agent Coordination," in The Fifth International Workshop on Distributed Constraint Reasoning (DCR), Toronto, Canada, September 27, 2004 (at CP–04).

R. T. Maheswaran, J. P. Pearce and M. Tambe, "Distributed Algorithms for DCOP: A Graphical Game-Based Approach," (longer version) in Workshop on Challenges in the Coordination of Large-Scale Multi-Agent Systems, New York, NY, July 20, 2004 (at AAMAS–04).

Presentations at Conferences and Workshops

"Lower Bounds on k-Optimal Solutions for Distributed Constraint Optimization Problems," in Eighth International Workshop on Distributed Constraint Reasoning (DCR), Hyderabad, India, January 8, 2007 (at IJCAI–07).

"Solution Sets for DCOPs and Graphical Games," in Fifth International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), Hakodate, Japan, May 11, 2006.

"Distributed Algorithms for DCOP: A Graphical-Game-Based Approach," in 17th International Conference on Parallel and Distributed Computing Systems (PDCS), San Francisco, CA, September 15, 2004. Also given at AAMAS Workshop on Challenges in the Coordination of Large-Scale Multi-Agent Systems, New York, NY, July 20, 2004.

"Quality Guarantees on Locally Optimal Solutions for Distributed Constraint Optimization Problems," in AAMAS 2006 Workshop on Distributed Constraint Reasoning (DCR), Hakodate, Japan, May 8, 2006.

"Locally Optimal Algorithms and Solutions for Distributed Constraint Optimization," in Doctoral Consortium, 5th International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), Hakodate, Japan, May 8, 2006.

"Solution Sets for DCOPs and Graphical Games: Metrics and Bounds," in Ninth International Symposium on Artificial Intelligence and Mathematics, Ft. Lauderdale, FL, January 4-6, 2006.

"Local Algorithms for Distributed Constraint Optimization in Dynamic, Anytime Environments," in AAMAS Workshop on Ambient Intelligence - Agents for Ubiquitous Environments, Utrecht, The Netherlands, July 26, 2005.

"Graph-Based Bounds on k-Optimal Joint-Action Sets for Multiple Agents," in AAMAS Workshop on Declarative Agent Languages and Technologies (DALT), Utrecht, the Netherlands, July 25, 2005.

Teaching

Course Design Experience

Contributor, Intelligent Agents and Science Fiction (CSCI 499), USC, Fall 2006. Assisted with conceptual design and creation of syllabus for completely new undergraduate class on AI and multi-agent systems, using science fiction movies and literature as inspiration for topics covered. Instructor: Milind Tambe.

Teaching Experience

Teaching Assistant, Software Multi-Agent Systems (CSCI 543), USC, Spring 2005. Instructor: Milind Tambe. Graduate-level course of 50 students. Duties included choosing topics and papers for the course syllabus, preparing lecture slides and assignments, teaching several lectures, mentoring students on final projects, holding regular office hours. Topics included game theory, constraint reasoning, partially observable Markov decision processes, belief-desire-intentions-based

agent models, multiagent learning, market-based systems, and coalition formation.

Guest Lecturer, Advanced Artificial Intelligence (CECS 551), California State University, Long Beach, Spring 2006 (4/3/06). Instructor: Colleen Van Lent.

Guest Lecturer, Software Multi-Agent Systems (CSCI 543), USC, Spring 2006 (1/31/06, 2/2/06). Instructor: Milind Tambe.

Guest Lecturer, Advanced Artificial Intelligence (CSCI 573), USC, Spring 2005 (4/11/05). Instructor: Sven Koenig.

Guest Lecturer, Advanced Artificial Intelligence (CSCI 573), USC, Fall 2005 (8/22/05). Instructor: Milind Tambe.

Professional Service

Conferences

Organizer, Ninth International Workshop on Distributed Constraint Reasoning (DCR), 2008
Program Committee, National Conference on Artificial Intelligence (AAAI), 2007
Reviewer, International Joint Conference on Artificial Intelligence (IJCAI), 2007
Reviewer, International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), 2006
Reviewer, Seventh International Workshop on Distributed Constraint Reasoning (DCR), 2006
Reviewer, International Symposium on Artificial Intelligence and Mathematics, 2006
Reviewer, International Joint Conference on Artificial Intelligence (IJCAI), 2005
Reviewer, Florida Artificial Intelligence Research Society Conference (FLAIRS), 2005
Reviewer, 17th Brazilian Symposium on Artificial Intelligence, 2004

Journals

Reviewer, IEEE Transactions on System, Man, and Cybernetics, 2006–present
Reviewer, IEEE/ACM Transactions on Networking, 2006–present
Reviewer, Journal of Autonomous Agents and Multi-Agent Systems (JAAMAS), 2005–present
Reviewer, ACM Computing Surveys, 2004–present

Other Service

Organizing Committee, USC Computer Science Colloquium Series, 2005–present
Organizer, Distributed Constraint Optimization (DCOP) repository website, where several researchers have made their programs and data sets available for testing and further research. *http://teamcore.usc.edu/dcop*

Industry Experience

Applications Engineer, Oracle Corporation, Redwood Shores, CA 8/01–5/03
Advanced Supply Chain Planning and Scheduling Group

Developed and implemented novel constraint-based algorithms for supply-chain scheduling in Oracle Advanced Supply Chain Planning software. Also worked directly with corporate clients including Sony, Agilent, and Intersil Semiconductor.

Software Engineering Intern, Hewlett-Packard, Cupertino, CA 6/00–8/00
Internet Security and Solutions Group

Intern, Ernst & Young Consulting, New York, NY 6/99–8/99

Citizenship

United States

References

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