

Fei Fang

Assistant Professor

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EDUCATION

- **University of Southern California**, Los Angeles, California. August 2011 – June 2016.
Ph.D., Department of Computer Science.
Advisor: Prof. Milind Tambe
Thesis: Towards Addressing Spatio-Temporal Aspects in Security Games
- **Tsinghua University**, Beijing, China. August 2007 – July 2011.
B. Eng., Department of Electronic Engineering.

EMPLOYMENT

- **Carnegie Mellon University, Pittsburgh, Pennsylvania.** August 2017 – Present.
Assistant Professor in the Institute for Software Research in the School of Computer Science.
- **Carnegie Mellon University, Pittsburgh, Pennsylvania.** June 2016 – June 2017.
Adjunct Assistant Professor in the Institute for Software Research in the School of Computer Science.
- **Harvard University, Cambridge, Massachusetts.** June 2016 – June 2017.
Postdoctoral Fellow in the Center for Research on Computation and Society at the School of Engineering and Applied Sciences, working with Prof. David Parkes and Prof. Barbara Grosz.
- **University of Southern California, Los Angeles, California.** August 2011 – June 2016.
Research Assistant in the Department of Computer Science, working with Prof. Milind Tambe.
- **IBM Thomas J. Watson Research Center, Yorktown Heights, New York.** May 2013 -- August 2013.
Research Intern in Mathematical Sciences Department with Dr. Dharmashankar (Shankar) Subramanian and Dr. Janusz Marecki.
- **Microsoft Research Asia, Beijing, China.** December 2010 -- March 2011.
Research Intern in Hardware Computing Group with Dr. Chunshui Zhao.

AWARDS

- **Distinguished Paper, International Joint Conference on Artificial Intelligence and European Conference on Artificial Intelligence (IJCAI-ECAI). 2018.** Our paper titled “What game are we playing? End-to-end learning in normal and extensive form games” (authors: Chun Kai Ling, **Fei Fang**, J. Zico Kolter) was selected as distinguished paper. 7 papers was selected out of 3470 submissions and 710 accepted papers.

- **The William F. Ballhaus, Jr. Prize for Excellence in Graduate Engineering Research. 2017.**
- **Best Dissertation Award in Computer Science at the University of Southern California. 2017.** Dissertation title: Towards Addressing Spatio-Temporal Aspects in Security Games. Advisor: Prof. Milind Tambe.
- **Best Paper in the First International Workshop on Teams in Multiagent Systems (TEAMAS) held at AAMAS 2017.** Zheyuan Shi, **Fei Fang**. Optimizing Peer Teaching to Enhance Team Performance.
- **Runner-up for IFAAMAS-16 Victor Lesser Distinguished Dissertation Award.** Dissertation title: Towards Addressing Spatio-Temporal Aspects in Security Games. Advisor: Prof. Milind Tambe.
- **Best Research Assistant, 2016, Computer Science Department, University of Southern California.**
- **Best Application of AI, Video Competition at AAI Conference on Artificial Intelligence (AAAI), 2016.** Video title: “PAWS: Protection Assistant for Wildlife Security”. Authors: **Fei Fang**, Debarun Kar, Dana Thomas, Nicole Sintov, Milind Tambe.
- **Best Student Video Award Finalist, Video Competition at AAI Conference on Artificial Intelligence (AAAI), 2016.** Video title: “PAWS: Protection Assistant for Wildlife Security”. Authors: **Fei Fang**, Debarun Kar, Dana Thomas, Nicole Sintov, Milind Tambe.
- **Innovative Application Award, Innovative Applications of Artificial Intelligence (IAAI), 2016.** The award is presented to **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Gopaldasamy R. Clements, Bo An, Amandeep Singh, Milind Tambe and Andrew Lemieux for the deployed application paper titled “Deploying PAWS: Field Optimization of the Protection Assistant for Wildlife Security”.
- **Outstanding Paper Award, International Joint Conferences on Artificial Intelligence (IJCAI), Computational Sustainability Track. 2015.** The award is presented to **Fei Fang**, Peter Stone and Milind Tambe for the paper titled “When Security Games Go Green: Designing Defender Strategies to Prevent Poaching and Illegal Fishing”. Only one paper is selected.
- **Selected Participant for Rising Stars in EECS: An Academic Career Workshop for Women. 2015.** This workshop brings together roughly 60 top EECS graduate and postdoctoral women for scientific interactions.
- **WiSE Merit Fellowship. 2014.** The Merit Fellowship is offered to Ph.D. students at University of Southern California who demonstrate exceptional work in their field. Two candidates will be chosen from the Viterbi School of Engineering every year.
- **Meritorious Team Commendation from Commandant of the US Coast Guard. 2013.** The commendation was awarded for “an innovative approach to optimize patrol schedules and actions for the Coast Guard Ports, Waterways and Coast Security missions” while serving the Coast Guard Port Resilience for Operational/Tactical Enforcement to Combat Terrorism (PROTECT) Team.
- **Flag Letter of Appreciation from Vice Admiral R.C. Parker, US Coast Guard. 2013.** The flag letter of appreciation was awarded for research work “during the development and implementation of the Port Resilience Operational/Tactical Enforcement to Combat Terrorism (PROTECT) Model.”
- **Poster Competition Finalist, First Conference on Validating Models of Adversary Behaviors. 2013.** Our poster on “Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources” was selected to be a finalist in the poster competition.

LIST OF PUBLICATIONS

BOOKS

[B1] **Fei Fang**, Milind Tambe, Bistra Dilkina, Andrew Plumptre (Editors). Artificial Intelligence for Conservation (under review). Cambridge, 2018.

CHAPTERS IN BOOKS

[BC2] **Fei Fang**, Benjamin Ford, Rong Yang, Milind Tambe, Andrew Lemieux. PAWS: Game-Theory Based Protection Assistant for Wildlife Security. In *Conservation Criminology*. Edited by Meredith Gore. Chapter 10. Wiley, 2017.

[BC1] Debarun Kar, Thanh H. Nguyen, **Fei Fang**, Matthew Brown, Arunesh Sinha, Milind Tambe, Albert Xin Jiang. Trends and Applications in Stackelberg Security Games. In *Handbook on Dynamic Game Theory*. Edited by Tamar Basar and Georges Zaccour. Springer, 2017.

REFEREED JOURNAL PAPERS

[J2] Debarun Kar, **Fei Fang**, Francesco M. Delle Fave, Nicole Sintov, Milind Tambe, Arnaud Lyet. Comparing Human Behavior Models in Repeated Stackelberg Security Games: An Extended Study. In *Artificial Intelligence (AIJ)*, 240:65-103, 2016.

[J1] **Fei Fang**, Albert X. Jiang, Milind Tambe. Protecting Moving Targets with Multiple Mobile Resources. In *Journal of Artificial Intelligence Research (JAIR)*, 48:583-634, 2013.

RIGOROUSLY REFEREED CONFERENCE/WORKSHOP PAPERS

Full Papers

[C20] Chun Kai Ling, J. Zico Kolter, **Fei Fang** What game are we playing? End-to-end learning in normal and extensive form games. In *the 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI)*, **Distinguished Paper Award**, July 2018. [20.5% acceptance rate]

[C19] Zheyuan Ryan Shi, Ziyi Tang, Long Tran-Thanh, Rohit Singh, **Fei Fang** Designing the Game to Play: Optimizing Payoff Structure in Security Games. In *the 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI)*, July 2018. [20.5% acceptance rate]

[C18] Elizabeth Bondi, Debadeepta Dey, Ashish Kapoor, Jim Piavis, Shital Shah, **Fei Fang**, Bistra Dilkina, Robert Hannaford, Arvind Iyer, Lucas Joppa, Milind Tambe AirSim-W: A Simulation Environment for Wildlife Conservation with UAVs. In *First Conference on Computing and Sustainable Societies (ACM COMPASS)*, June 2018. [34.3% acceptance rate]

[C17] Swaminathan Gurusurthy, Lantao Yu, Chenyan Zhang, Yongchao Jin, Weiping Li, Xiaodong Zhang, **Fei Fang** Exploiting Real-World Data and Human Knowledge for Predicting Wildlife Poaching. In *First Conference on Computing and Sustainable Societies (ACM COMPASS)*, June 2018. [34.3% acceptance rate]

[C16] Aaron Schlenker, Milind Tambe, Long Tran-Thanh, Phebe Vayanos, Yevgeniy Vorobeychik, Omkar Thakoor, Haifeng Xu, **Fei Fang** Deceiving Cyber Adversaries: A Game Theoretic Approach. In *the 17th International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, July 2018. [25.3% acceptance rate]

[C15] Nitin Kamra, Umang Gupta, **Fei Fang**, Yan Liu, Milind Tambe Policy Learning for Continuous Space Security Games using Neural Networks. In *the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI)*, February 2018. [24.6% acceptance rate]

- [C14] Elizabeth Bondi, **Fei Fang**, Mark Hamilton, Debarun Kar, Donnabell Dmello, Jongmoo Choi, Robert Hannaford, Arvind Iyer, Lucas Joppa, Milind Tambe, Ram Nevatia. SPOT Poachers in Action: Augmenting Conservation Drones with Automatic Detection in Near Real Time. In *the Thirtieth Conference on Innovative Applications of Artificial Intelligence*, February 2018.
- [C13] Haifeng Xu, Benjamin Ford, **Fei Fang**, Bistra Dilkina, Andrew Plumptre, Milind Tambe, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, Mustapha Nsubaga, Joshua Mabonga. Optimal Patrol Planning for Green Security Games with Black-Box Attackers. In *the 8th Conference on Decision and Game Theory for Security (GameSec), Special Track on Data-Centric Models and Applications*, September 2017. [39.4% acceptance rate]
- [C12] Elizabeth Bondi, **Fei Fang**, Debarun Kar, Venil Noronha, Donnabell Dmello, Milind Tambe, Arvind Iyer, Robert Hannaford. VIOLA: Video Labeling Application for Security Domains. In *the 8th Conference on Decision and Game Theory for Security (GameSec), Special Track on Data-Centric Models and Applications*, September 2017. [39.4% acceptance rate]
- [C11] Shahrzad Gholami, Benjamin Ford, **Fei Fang**, Andrew Plumptre, Milind Tambe, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, Mustapha Nsubaga, Joshua Mabonga. Taking it for a Test Drive: A Hybrid Spatio-temporal Model for Wildlife Poaching Prediction Evaluated through a Controlled Field Test. In *Proceedings of the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, September 2017
- [C10] Debarun Kar, Benjamin Ford, Shahrzad Gholami, **Fei Fang**, Andrew Plumptre, Milind Tambe, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba. Cloudy with a Chance of Poaching: Adversary Behavior Modeling and Forecasting with Real-World Poaching Data. In *Proceedings of the 16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2017. [26.1% acceptance rate]
- [C9] Anjon Basak, **Fei Fang**, Thanh Nguyen and Christopher Kiekintveld. Combining Graph Contraction and Strategy Generation for Green Security Games. In *Proceedings of the 7th International Conference on Decision and Game Theory for Security (GameSec)*, November 2016. [45.0% acceptance rate]
- [C8] Nika Haghtalab, **Fei Fang**, Thanh H. Nguyen, Arunesh Sinha, Ariel Procaccia, Milind Tambe. Three Strategies to Success: Learning Adversary Models in Security Games. In *Proceedings of the 25th International Joint Conference on Artificial Intelligence (IJCAI)*, July 2016. [24% acceptance rate]
- [C7] **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Gopalasamy R. Clements, Bo An, Amandeep Singh, Milind Tambe, Andrew Lemieux. Deploying PAWS: Field Optimization of the Protection Assistant for Wildlife Security. In *Proceedings of the Innovative Applications of Artificial Intelligence (IAAI), Innovative Application Award*, February 2016 (Deployed Application track).
- [C6] **Fei Fang**, Peter Stone, Milind Tambe. When Security Games Go Green: Designing Defender Strategies to Prevent Poaching and Illegal Fishing. In *Proceedings of the 24th International Joint Conference on Artificial Intelligence (IJCAI), Outstanding Paper Award in Computational Sustainability Track*, July 2015 (Computational Sustainability Track). [28.7% acceptance rate]
- [C5] Debarun Kar, **Fei Fang**, Francesco M. Delle Fave, Nicole Sintov, Milind Tambe. “A Game of Thrones”: When Human Behavior Models Compete in Repeated Stackelberg Security Games. In *Proceedings of the Fourteenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015. [27% acceptance rate]
- [C4] Haifeng Xu, **Fei Fang**, Albert X. Jiang, Vincent Conitzer, Shaddin Dughmi, Milind Tambe. Solving Zero-Sum Security Games in Discretized Spatio-Temporal Domains. In *Proceedings of the Twenty-Eighth Conference on Artificial Intelligence (AAAI), July 2014*. [28% acceptance rate]

- [C3] William Haskell, Debarun Kar, **Fei Fang**, Milind Tambe, Sam Cheung, Elizabeth Denicola. Robust protection of fisheries with COMPASS. In *Proceedings of the Twenty-Sixth Annual Conference on Innovative Applications of Artificial Intelligence (IAAI)*, July 2014. [28% acceptance rate]
- [C2] **Fei Fang**, Albert X. Jiang, Milind Tambe. Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources. In *Proceedings of the Twelfth International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2013. [23% acceptance rate]
- [C1] Matthew P. Johnson, **Fei Fang**, Milind Tambe, Heidi J. Albers. Patrol Strategies to Maximize Pristine Forest Area. In *Proceedings of the Twenty-Sixth Conference on Artificial Intelligence (AAAI)*, July 2012 (Computational Sustainability Track). [26% acceptance rate]

Short Papers

- [SP3] Qingyu Guo, Jiarui Gan, **Fei Fang**, Long Tran-Thanh, Milind Tambe, Bo An. Inducible Equilibrium for Security Games. In *Proceedings of the Seventeenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, July 2018. (*Extended Abstract*)
- [SP2] **Fei Fang**, Peter Stone, Milind Tambe. Planning Defender Strategies Against Attackers In Domains Involving Frequent Adversary Interaction. In *Proceedings of the Fourteenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015. (*Extended Abstract*)
- [SP1] Rong Yang, Albert X. Jiang, **Fei Fang**, Rajiv Maheswaran, Milind Tambe. Designing Better Strategies against Human Adversaries in Graph-Based Security Games. In *Proceedings of the Eleventh International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, June 2012. (*Short Paper*)

OTHER CONFERENCE/WORKSHOP PAPERS

Refereed Symposium Papers

- [S4] Chun Kai Ling, J. Zico Kolter, **Fei Fang**. What game are we playing? Differentiably learning games from incomplete observations. In *Deep Reinforcement Learning Symposium held at the Conference on Neural Information Processing Systems (NIPS), December 2017*.
- [S3] Nicole Sintov, Debarun Kar, Thanh H. Nguyen, **Fei Fang**, Kevin Hoffman, Arnaud Lyet, Milind Tambe. From the Lab to the Classroom and Beyond: Extending a Game-Based Research Platform for Teaching AI to Diverse Audiences. In *The Sixth Symposium on Educational Advances in Artificial Intelligence (EAAI), February 2016*.
- [S2] **Fei Fang**, Peter Stone, Milind Tambe. Defender Strategies In Domains Involving Frequent Adversary Interaction. In *AAAI Spring Symposium on Applied Computational Game Theory, March 2015*.
- [S1] Matthew P. Johnson, **Fei Fang**, Rong Yang, Milind Tambe, Heidi J. Albers. Challenges in Patrolling to Maximize Pristine Forest Area. In *AAAI Spring Symposium on Game Theory for Security, Sustainability and Health, March 2012*.

Refereed Workshop Papers

- [W15] Lantao Yu, Yi Wu, Rohit Singh, Lucas Joppa, **Fei Fang**. Deep Reinforcement Learning for Green Security Game with Online Information. In *AAAI-18 Workshop on AI for Imperfect-Information Games (AIII)*, February, 2018.
- [W14] Nitin Kamra, **Fei Fang**, Debarun Kar, Yan Liu, Milind Tambe. Handling Continuous Space Security Games with Neural Networks. In *1st International Workshop on A.I. in Security held at the International Joint Conference on Artificial Intelligence (IJCAI-17)*, August 2017.

- [W13] Zheyuan Shi, **Fei Fang**. Optimizing Peer Teaching to Enhance Team Performance. In *First International Workshop on Teams in Multiagent Systems held at AAMAS 2017.*, May 2017. In *AAMAS 2017 Workshops Best Papers volume*, Springer.
- [W12] **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Gopalasamy R. Clements, Bo An, Amandeep Singh, Milind Tambe, Andrew Lemieux. Deploying PAWS in the Field: Designing Efficient Patrols to Combat Poaching. In *Workshop on Computer Poker and Imperfect Information Games held at the Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16)*, February 2016.
- [W11] **Fei Fang**, Thanh H. Nguyen, Benjamin Ford, Nicole Sintov, Milind Tambe. Introduction to green security games (extended abstract). In *Workshop on Cognitive Knowledge Acquisition and Applications held at International Joint Conferences on Artificial Intelligence (IJCAI)*, July 2015.
- [W10] **Fei Fang**, Thanh H. Nguyen, Bo An, Milind Tambe, Rob Pickles, Wai Y. Lam, Gopalasamy R. Clements. Towards Addressing Challenges in Green Security Games in the Wild (extended abstract). In *Workshop of Behavioral, Economic and Computational Intelligence for Security (BECIS) held at International Joint Conferences on Artificial Intelligence (IJCAI)*, July 2015.
- [W9] Debarun Kar, **Fei Fang**, Francesco M. Delle Fave, Nicole Sintov, Arunesh Sinha, Aram Galstyan, Bo An, Milind Tambe. Learning Bounded Rationality Models of the Adversary in Repeated Stackelberg Security Games. In *ALA Adaptive and Learning Agents Workshop held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015.
- [W8] Debarun Kar, **Fei Fang**, Francesco M. Delle Fave, Nicole Sintov, Milind Tambe. Conducting Longitudinal Experiments with Behavioral Models in Repeated Stackelberg Security Games on Amazon Mechanical Turk. In *Fourth International Workshop on Human-Agent Interaction Design and Models (HAIDM) held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015.
- [W7] **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Milind Tambe. Challenges of Green Security Games in the Wild. In *International Workshop on Issues with Deployment of Emerging Agent-based Systems (IDEAS) held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015.
- [W6] **Fei Fang**, Peter Stone, Milind Tambe. Designing Defender Strategies Against Frequent Adversary Interaction. In *International Workshop on Optimisation in Multi-Agent Systems (OPTMAS) held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015.
- [W5] Debarun Kar, **Fei Fang**, Francesco M. Delle Fave, Nicole Sintov, Milind Tambe, Arlette van Wissen. Effectiveness of Probability Perception Modeling and Defender Strategy Generation Algorithms in Repeated Stackelberg Games. In *Workshop on Computational Sustainability held at the Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI-15)*, January 2015.
- [W4] Haifeng Xu, **Fei Fang**, Albert X. Jiang, Vincent Conitzer, Shaddin Dughmi, Milind Tambe. Computing Minimax Strategy for Discretized Spatio-Temporal Zero-Sum Security Games. In *International Joint Workshop on Optimisation in Multi-Agent Systems and Distributed Constraint Reasoning (OPTMAS-DCR) held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2014.
- [W3] **Fei Fang**, Albert X. Jiang, Milind Tambe. Designing Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources. In *Workshop on Optimisation in Multi-Agent Systems (OPTMAS) held at International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2013.

- [W2] Matthew P. Johnson, **Fei Fang**, Milind Tambe, Heidi J. Albers. Designing Patrol Strategies to Maximize Pristine Forest Area. In *Workshop on Optimisation in Multi-Agent Systems (OPTMAS)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, June 2012.
- [W1] Rong Yang, **Fei Fang**, Albert X. Jiang, Karthik Rajagopal, Milind Tambe, Rajiv Maheswaran. Modeling Human Bounded Rationality to Improve Defender Strategies in Network Security Games. In *Workshop on Human-Agent Interaction Design and Models (HAIDM)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, June 2012.

OTHER PUBLICATIONS

Refereed Technical Magazine Articles

- [M3] **Fei Fang**, Thanh H. Nguyen, Arunesh Sinha, Shahrzad Gholami, Andrew Plumptre, Lucas Joppa, Milind Tambe, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, Rob Critchlow, Colin Beale. Predicting Poaching for Wildlife Protection. In *IBM Journal of Research and Development*.
- [M2] Nicole Sintov, Debarun Kar, Thanh Nguyen, **Fei Fang**, Kevin Hoffman, Arnaud Lyet, Milind Tambe. Keeping it Real: Using Real-World Problems to Teach AI to Diverse Audiences. In *AI Magazine*, 38(2):35-47, 2017.
- [M1] **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Gopalasamy R. Clements, Bo An, Amandeep Singh, Brian C. Schwedock, Milind Tambe, Andrew Lemieux. PAWS – A Deployed Game-Theoretic Application to Combat Poaching. In *AI Magazine*, 38 (1):23-36, 2017.

Newsletter Publications

- [N1] **Fei Fang**, Thanh H. Nguyen. Green Security Games: Apply Game Theory to Addressing Green Security Challenges. In *ACM SIGecom exchanges: 15.1*, Pages 78-83, July 2016.

Demos

- [D1] **Fei Fang**, Thanh H. Nguyen, Rob Pickles, Wai Y. Lam, Gopalasamy R. Clements, Bo An, Milind Tambe. Deploying PAWS to Combat Poaching: Game-theoretic Patrolling in Areas with Complex Terrain. In *Proceedings of the AAI Conference on Artificial Intelligence (AAAI)*, February 2016.

Videos

- [V1] **Fei Fang**, Debarun Kar, Dana Thomas, Nicole Sintov, Milind Tambe. PAWS: Protection Assistant for Wildlife Security. In *AAAI Conference on Artificial Intelligence (AAAI)*, February 2016.

Posters

- [P2] **Fei Fang**, Albert X. Jiang, Milind Tambe. Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources. In *the 9th Conference on Web and Internet Economics (WINE)*, December 2013.
- [P1] **Fei Fang**. Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources (Poster Competition Finalist). In *the First Conference on Validating Models of Adversary Behaviors*, June 2013.

FIELDDED AND DEPLOYED RESEARCH

- **PROTECT-Ferry**. This work designs optimal patrol strategy for protecting ferry system. My algorithms have been in continued use by the US Coast Guard to schedule the escort boats to protect Staten Island Ferry since April 2013.

- **PAWS (Protection Assistant for Wildlife Security)**. This work focuses on learning poacher behavior, predicting poaching activities, and generating randomized patrols to combat poaching. The work has been tested or deployed in the field for protecting wildlife Uganda, Malaysia, China and South Africa.

PATENTS FILED

- Patent “Optimal Patrol Strategy for Protecting Moving Targets with Multiple Mobile Resources” (co-inventors: Fei Fang, Albert Jiang, Milind Tambe), 2014 (US Patent Application No. 20150273341)

INVITED TALKS AND COLLOQUIA

Invited Talks

- October 2018. Integrating Learning with Game Theory for Societal Challenges. AI Seminar at the University of Alberta.
- September 2018. Integrating Learning with Game Theory for Societal Challenges. EconCS Seminar at Harvard University.
- September 2018. AI for Societal Challenges. EmTech 2018 at Massachusetts Institute of Technology.
- June 2018. Integrating Learning with Game Theory for Societal Challenges. Seminar at Google Pittsburgh Campus.
- May 2018. Integrating Learning with Game Theory for Societal Challenges. Departmental seminar in the Department of Mathematics at the University of Pittsburgh.
- April 2018. Machine Learning and Game Theory for Biodiversity Conservation. Featured presentation at 2018 Center for Genome Research and Biocomputing Spring Conference at Oregon State University.
- March 2018. Integrating Learning with Game Theory for Societal Challenges. Seminar in Heinz College of Information Systems and Public Policy at Carnegie Mellon University.
- March 2018. Integrating Machine Learning with Game Theory for Societal Challenges. Machine Learning Seminar at Carnegie Mellon University.
- February 2018. Integrating Machine Learning with Game Theory for Security. CyLab Distinguished Seminar at Carnegie Mellon University.
- February 2018. Integrating Machine Learning with Game Theory for Security. Army Research Lab, Adelphi.
- December 2017. Integrating Machine Learning with Game Theory and Mechanism Design for Security, Sustainability, and Mobility. Departmental seminar series in the Department of Industrial and Systems Engineering in the State University of New York at Buffalo.
- November 2017. Data-Aware Game Theory for Security. Privacy Seminar at Carnegie Mellon University.
- October 2017. Data-Aware Game Theory and Mechanism Design for Security, Sustainability, and Mobility. Peking University, China.
- October 2017. Data-Aware Game Theory and Mechanism Design for Security, Sustainability, and Mobility. Tsinghua University, China.

- May 2017. Game-Theoretic Approaches for Sustainability Challenges. Computational Sustainability Virtual Seminar Series.
- April 2017. Game-Theoretic Approaches for Real-World Security and Sustainability Challenges. University of New Hampshire.
- February 2017. Win a Game to Build a Better World. Women Engineers Code (WECode) Conference.
- December 2016. Game-Theoretic Approaches for Real-World Security and Sustainability Challenges. EconCS Seminar at Harvard University.
- September 2016. Empower the Defender with Unpredictability: Game-Theoretic Approaches for Real-World Security and Sustainability Challenges. Center for Research on Computation and Society (CRCS) Seminar Series at Harvard University.
- June 2016. Win a Game to Build a Safer World: Towards a Science of Security Games. The USA Computing Olympiad Summer Camp.
- April 2016. Empower the Defender with Unpredictability: Game-Theoretic Approaches for Real-World Security and Sustainability Challenges. Multiagent Systems Professional Group (MSPG) Online Seminar Series.
- October 2015. Towards Addressing Spatio-Temporal Aspects in Security Games. Computer Science Colloquium Lecture Series at the University of Southern California.
- July 2013. Dealing With Spatio-Temporal Continuity in Stackelberg Games. IBM Thomas J. Watson Research Center.
- December 2012. Patrol Strategies to Maximize Pristine Forest Area (jointly with Prof. Milind Tambe). World Bank.

Other Talks

- October 2018. Integrating Machine Learning with Game Theory for Security. CMU CyLab conference.
- August 2018. Integrating Machine Learning with Game Theory for Security. Cyber Deception Workshop at the University of Maryland.
- July 2018. Designing the Game to Play: Optimizing Payoff Structure in Security Games. International Colloquium on Automata, Languages and Programming (ICALP) workshop Game Solving: Theory and Practice.
- July 2018. Designing the Game to Play: Optimizing Payoff Structure in Security Games. International Symposium on Mathematical Programming (ISMP), 2018.
- February 2018. CMU-Portugal workshop on Machine Learning and Natural Language Processing: Machine Learning for Sustainability.
- October 2017. Game Theoretic Approaches for Wildlife Conservation. World Wild Fund for Nature (WWF) Law Enforcement and Research Workshop, Cambodia.
- November 2015. When Security Games Go Green: Designing Defender Strategies to Prevent Poaching and Illegal Fishing. INFORMS Annual Meeting 2015.

CONFERENCE AND WORKSHOP COMMITTEES

- **PC member** of the *Conference on Neural Information Processing Systems (NIPS)*, December 2018.
- **PC member** of the *35th International Conference on Machine Learning (ICML)*, July 2018.
- **PC member** of the *17th International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, July 2018.
- **Organizing committee member** of the *AI for Wildlife Conservation (AIWC) Workshop at the Federated Artificial Intelligence Meeting (FAIM)*, July 2018.
- **PC member** of the *27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence (IJCAI-ECAI)*, July 2018.
- **PC member** of the *First Conference on Computing and Sustainable Societies (ACM COMPASS)*, June 2018.
- **PC member** of the *Thirty-Second AAAI Conference on Artificial Intelligence (AAAI)*, February 2018.
- **Chair** of *Special Track on “Data-Centric Models and Approaches at the 8th Conference on Decision and Game Theory for Security (GameSec 2017)*, October 2017.
- **PC member** of the *18th ACM Conference on Economics and Computation (EC)*, June 2017.
- **Reviewer** of the *49th ACM Symposium on Theory of Computing (STOC)*, June 2017.
- **Reviewer** of *Artificial Intelligence (AIJ)*, May 2017.
- **Co-chair** of the *AAAI 2017 Spring Symposium on AI for Social Good (AISOC)*, March 2017.
- **Reviewer** of *Journal of Artificial Intelligence Research (JAIR)*, March 2017.
- **PC member** of the *Sixteenth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS) Doctoral Consortium Program*, May 2017.
- **PC member** of the *Sixteenth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2017.
- **PC member** of the *Thirty-First AAAI Conference on Artificial Intelligence (AAAI) - Computational Sustainability (CompSust) Track*, February 2017.
- **PC member** of the *Thirty-First AAAI Conference on Artificial Intelligence (AAAI)*, February 2017.
- **Reviewer** of *Autonomous Agents and Multi-Agent Systems (JAAMAS)*, December 2016.
- **Coach** of *Hour of Code at the Meadowbrook School, teaching students in 6–8 grades*, December 2016.
- **Reviewer** of *Journal of Artificial Intelligence Research (JAIR)*, November 2016.
- **PC member** of *IEEE International Conference on Agents (IEEE ICA 2016)*, September 2016.
- **Co-organizer** of *4th International Conference on Computational Sustainability (CompSust)*, July 2016.
- **Reviewer** of *The Conference on Uncertainty in Artificial Intelligence (UAI)*, June 2016.

- **Coach** of the *USA Computing Olympiad Summer Camp*, June 2016.
- **Reviewer** of the *Conference on Conservation, Computation, & Criminology (C4)*, June 2016.
- **PC member** of the *25th International Joint Conference on Artificial Intelligence (IJCAI)*, July 2016.
- **PC member** of the *Workshop on Security and Multi-agent Systems (SecMAS)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2016.
- **PC member** of the *International Workshop on Optimisation in Multi-Agent Systems (OPTMAS)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2016.
- **PC member** of the *2015 IEEE/WIC/ACM International Conference on Intelligent Agent Technology (IAT)*, December 2015.
- **PC member** of the *24th International Joint Conference on Artificial Intelligence (IJCAI) - Computational Sustainability (CompSust) Track*, July 2015.
- **PC member** of the *24th International Joint Conference on Artificial Intelligence (IJCAI)*, July 2015.
- **PC member** of *Workshop of Behavioral, Economic and Computational Intelligence for Security (BECIS)* held at *International Joint Conferences on Artificial Intelligence (IJCAI)*, July 2015.
- **Co-organizer** of *USC Conference on Conservation, Computation, & Criminology (C4)*, June 2015.
- **PC member** of *2015 International Workshop on Optimisation in Multi-Agent Systems (OPTMAS)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2015.
- **Chair** of *AAAI 2015 Spring Symposium on Applied Computational Game Theory*, March 2015.
- **Reviewer** of *Simulation: Transactions of the Society for Modeling and Simulation International*, February, 2015.
- **Reviewer** of the *Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI)*, January 2015.
- **PC member** of *2014 International Joint Workshop on Optimisation in Multi-Agent Systems and Distributed Constraint Reasoning (OPTMAS-DCR)* held at *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2014.
- **Reviewer** of the *13th International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, May 2014.
- **Reviewer** of the *9th Conference on Web and Internet Economics (WINE)*, December 2013.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

- ACM
- AAAI
- AAAS

EDITORIAL BOARD MEMBERSHIPS

- **Editor** of *AGNT (Autonomous Agents and Multi-Agent Systems journal) Special Issue on “Agents and Multiagent Systems for Social Good”*. October 2018.

- **Subject-matter editor** of *Emerging Technologies track in Ecosphere Journal*. April 2017-present.

COURSES TAUGHT AT CARNEGIE MELLON

Courses

- Fall 2019. 15-381 / 15-681: Artificial Intelligence: Representation and Problem Solving
- Spring 2018. 08-537 / 08-737: Artificial Intelligence Methods for Social Good

Guest Lectures and Project Advising

- Fall 2018. AI, Society and Humanity (94878). Guest lecture on “Practice to Theory to Practice: AI for Social Good”.
- Spring 2018. Societal Computing Practicum (08998). Guest lecture on “The Evolution of PAWS”.
- Fall 2017. Special Topics in HCI – Computing for Good (05499-E). Advising a project titled “Identifying mining sites in conservation areas from satellite imagery and analyzing their dynamics”. Project team members: Wen Li, Abigail McManus.
- Fall 2017. Systems Synthesis I (90-739). Serve on advisory board for a project titled “Mapping Illegal Wildlife Trafficking”. Project advisor: Prof. Jon Caulkins. Project team members: James Duguid, Anhvinh Doanvo, Gursmeep Hundal, Vicky Mei, Benjamin Simmons, Theresa Froehlich.

Reading Groups

- Fall 2017. Multi-agent Reinforcement Learning (MARL) Reading Group

COURSES TAUGHT OUTSIDE CARNEGIE MELLON

Tutorial Talks

- September 2018. A Tutorial on Game Theory. At DHS Center of Excellence and Center for Accelerating Operational Efficiency.
- July 2018. Game Theory and Machine Learning for Security. At Federated AI Meeting (AA-MAS+IJCAI+ICML) 2018.
- July 2018. AI for Social Good: A multiagent systems perspective (with Milind Tambe, Bryan Wilder, and Eugene Vorobeychik). At
- International Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2018.
- July 2017. Game Theory for Protecting Natural Resources. At 2017 Doctoral Consortium on Computational Sustainability
- June 2017. Advances in Game Theory for Security and Privacy (with Bo An, Yevgeniy Vorobeychik). At the Eighteenth ACM Conference on Economics and Computation (ACM EC’17).

Guest Lectures

- April 2017. Harvard University, Advanced Topics in AI (CS280r). Guest lecture on “Security Games: Theory and Applications”.
- March 2016 - April 2016. University of Southern California, Security and Game Theory (ISE 599). Guest lectures on “Security Games and Applications”.

- April 2015. University of Southern California, Foundations of Artificial Intelligence (CSCI 561). Guest lecture on “Win a Game to Build a Safer World: Towards a Science of Security Games”.

STUDENTS

Current PHD Students

- Zheyuan (Ryan) Shi
 - Entered 2018
 - Research focus on game theory for security.
- Mihir Mongia
 - Entered 2018
 - Research focus on deep learning.
- Hoon Oh
 - Entered 2017
 - Research focus on mechanism design in ridesharing systems.
- Chun Kai Ling
 - Entered 2017
 - Research focus on end-to-end learning in games.

Undergraduate Senior Theses and Research Projects

- Tianyu Gu. B.S., Carnegie Mellon University. Spring 2018, Fall 2018. Research focus is machine learning for wildlife conservation.
- Justin Jia. B.S., Carnegie Mellon University. Fall 2017, Spring 2018. Research focus is machine learning for wildlife conservation.
- Lingyu Liu. B.S., Carnegie Mellon University. Fall 2017, Spring 2018, Fall 2018. Research focus is detecting mining sites from satellite imagery.
- Taoan Huang. B.S., Tsinghua University. Spring 2018, Summer 2018. Research focus is efficient dispatching in ridesharing and security games.
- Bohui Fang. B.S., Shanghai Jiaotong University. Summer 2018, Fall 2018. Research focus is efficient dispatching in ridesharing.
- Yufei Wang. B.S., Peking University. Summer 2018. Research focus is multi-agent reinforcement learning.
- Lantao Yu. B.S., Shanghai Jiaotong University. Fall 2017, Spring 2018. Research focus is multi-agent reinforcement learning.
- Zheyuan (Ryan) Shi. B.S., Swarthmore College. Fall 2016, Spring 2017, Fall 2017, Spring 2018. Research focus is peer-teaching, attacker collusion and payoff design in security games.
- Dana Thomas. B.S., University of Southern California. Fall 2014, Spring 2015, Fall 2015. Research focus is identifying potential patrol post locations in wildlife conservation domain.

- Brian Schwedock. B.S., University of Southern California. Fall 2015, Spring 2016. Research focus is exploration and exploitation in patrol route design in security games.
- Matthew Burke. B.S., University of Southern California. Fall 2015. Research focus is analyzing the impact of potential patrol post locations in security games.
- David Liao. B.S., University of Southern California. Spring 2015. Research focus is analyzing patrol observation data in wildlife conservation domain.

M.S. or PH.D. Thesis Committee Service

- Pinchao Zhang
 - Serve as Ph.D. thesis committee member
 - Thesis topic: Traffic management.
- Thomas J. Glazier
 - Serve as Ph.D. thesis committee member
 - Thesis topic: Meta-Management of Autonomic Systems.

Other

- Swaminathan Gurusurthy. M.S., Carnegie Mellon University. Fall 2017, Spring 2018. Research focus is adversarial machine learning.
- Amandeep Singh. M.S., Columbia University. Summer 2015. Research focus is speeding up patrol route design in wildlife conservation domain.
- Kevin Hoffman. Teacher from Alliance Health Services Academy High School (*now a Blended Learning Analyst in Aspire Public Schools*). NSF Research Experience for Teachers (RET) program. Summer 2014.
- Jewels Kovach. Teacher from Ellen Ochoa Middle School. NSF Research Experience for Teachers (RET) program. Summer 2014.

SELECTED MEDIA COVERAGE

- How AI could help solve some of society's toughest problems. MIT Technology Review. October 2018.
- AI Helps Humans Bring Poachers To Justice. Qatar. September 2018.
- Researcher Fei Fang shows why AI doesn't have to be inherently evil. SiliconRepublic. February 2018.
- Don't be fooled by dystopian sci-fi stories: A.I. is becoming a force for good. Digital Trends. Release also appeared in Yahoo! Finance. January 2018.
- This AI Hunts Poachers. IEEE Spectrum. January 2018.
- 'Predator' Vision Drones Get AI to Spot Poachers. Discover Blog. December 2017.
- Preventing Poaching with Science. Cheddar TV. November 2017.

- HUNT THE HUNTER: A combination of machine learning and game theory is being used to fight elephant poaching in Uganda. Quartz. October 2016.
- Rangers Try Gaming Technology to Protect African Wildlife. Reuters. September 2016.
- AI springs into action in surprising places. Elsevier Connect. July 2016.
- Putting Artificial Intelligence On The Hunt For Poachers. Fast Company. June 2016
- Rangers Use Artificial Intelligence to Fight Poachers. National Geographic. June 2016.
- More than boots and bullets: This app could help turn the tide on poaching, Los Angeles Times. June 2016.
- Advanced Game Theory Goes to Work for Homeland Security. Government Computer News. June 2016. Release also appeared in the following and others:
 - Advanced Game Theory Goes to Work for Homeland Security. ACM TECHNEWS.
- Outwitting poachers with artificial intelligence. National Science Foundation Press. April 2016. Release also appeared in the following and others:
 - Artificial Intelligence Fights Wildlife Poaching: The National Science Foundation unleashes A.I. against criminals. Popular Science.
 - Artificial intelligence used to combat poaching. Times of India.
 - Artificial intelligence used to combat poaching. Economic Times.
 - Artificial intelligence being used to stop wildlife poaching in Africa. International Business Times.
 - Forest rangers now turning to advanced AI and mathematical models to help curb poaching. Daily News and Analysis.
 - How Game Theory and Artificial Intelligence Help Wildlife Conservation by Outwitting Poachers. Nature World News.
 - Scientists Outwit Poachers With The Help of Artificial Intelligence. Science World Report.
- US Coast guard Testimony at House Committee on Transportation and Infrastructure, Subcommittee on Coast Guard and Maritime Transportation mentions our research on game theory for security. Federal News Radio. July 2013.
- How the US Coast Guard uses game theory to protect New York city. Business Insider. May 2013.