Sara Marie **Mc Carthy**

PhD Candidate · Research Assistant

1367 W 37th Street, Los Angeles, California, 90007 USA

(323) 352-4132 | sara.m.mccarthy@gmail.com | www-scf.usc.edu/~saramarm/ | sara-marie-mccarthy

Interests: Artificial Intelligence, Optimization, Algorithmic and Computational Game Theory, Multi-Agent Systems, Machine Learning and Security.

Education

Doctor of Philosophy, Computer Science — 2014 - Present
University of Southern California, Los Angeles, CA, USA — GPA: 3.87/4

Bachelor of Science, Honours Physics — 2011 - 2014
Minor: Computer Science — *Graduated with First Class Honours*
McGill University, Montreal, Quebec, Canada — GPA: 3.71/4

Work Experience

Research Intern, Google LLC. — Summer 2018
Mountiain View, CA

- Research and Machine Intelligence Team. Mentors: Matthew Burgess, Natalya Noy.

Software Engineer Intern, Google LLC. — Summer 2017
Mountiain View, CA

- Worked with Video Ads Quality formulating long term value of showing ads to users. Built and designed online learning and optimization tool for automatic parameter tuning of user cost function used in auction scoring for ads in the Youtube ad auction.
- Developed proposal for how to do smart yield management for youtube ads in order to dynamically set reserve prices for different ads based on various ad features by using learned bid distributions for these ads.

Research Assistant, University of Southern California — 2014 - Present
Teamcore Research Group, Viterbi School of Engineering — Supervisor: Milind Tambe

- Research focuses on topics in artificial intelligence, addressing challenges in planning, learning, dealing with uncertainty and coordination for intelligent agents and teams in adversarial settings. Examples include:
- Optimizing resource investment and strategic deployment of multi-agent teams in network security games, with applications in forest and wildlife protection.
- POMDP planning for active sensing in uncertain cyber network environments, planning optimal strategies to protect against advanced persistent threats, and data exfiltration.
- Robust optimization for handling uncertainty in plan execution in large scale games.

Thesis Project, McGill University — 2013 - 2014
Quantum Defects Lab, Department of Physics — Supervisor: Lily Childress

- Creation and characterization of optical vortex beams to be used in a stimulated emission depletion sub-wavelength imaging system. Complete design of experimental setup needed for the creation of the beam and the optical profilometry for characterization of mode quality and resolution scaling. Characterization involved the study of near and far field diffraction of transverse electromagnetic radiation under the paraxial approximation.

Research Assistant, McGill University 2013
Quantum Defects Lab, Department of Physics Supervisor: Lily Childress

- Built quality control system for production of optical cavities used for control and measurement of quantum q-bit states. This involved the computation of optimal cavity parameters and development of an interferometry imaging system and image processing software in MATLAB used to analyze and benchmark nanoscale optical fibers.

Research Assistant, McGill University 2012
Reasoning and Learning Lab, School of Computer Science Supervisor: Doina Precup

- Provided a formal analysis of temporally extended actions and environment spaces in Markov Decision Processes, used in reinforcement learning to accelerate the process of learning good behaviors. Analysis involved the derivation of analytical expressions of absorption time of agent using shortcut actions on several manifold environments, showing increasing benefit with the dimensionality of the state space. Research resulted in a publication in Connection Science journal as well as the proceedings of ALA 2013 conference.

Publications

Conference and Journal Publications

- **Sara Mc Carthy**, Corine Laan, Kai Wang, Arunesh Sinha, Phebe Vayanos, Milind Tambe The Price of Usability: Designing Operationalizable Strategies for Security Games. *In Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI) 2018*
- Shahrzad Gholami, **Sara Mc Carthy**, Bistra Dilkina, Andrew Plumptre, Milind Tambe, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, Mustapha Nsubaga, Joshua Mabonga. Adversary models account for imperfect crime data: Forecasting and planning against real-world poachers. *In International Conference on Autonomous Agents and Multi-agent Systems (AAMAS 2018)*
- **Sara Mc Carthy**, Phebe Vayanos, Milind Tambe Staying Ahead of the Game: Adaptive Robust Optimization for Dynamic Allocation of Threat Screening Resources. *In Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI) 2017*
- **Sara Mc Carthy**, Arunesh Sinha, Milind Tambe, Pratyusa Manadhata. Data Exfiltration Detection and Prevention: Virtually Distributed POMDPs for Practically Safer Networks. *In Proceedings of the Conference on Decision and Game Theory for Security (GameSec) 2016*
- **Sara Mc Carthy**, Milind Tambe, Christopher Kiekintveld, Meredith L. Gore, Alex Killion, Preventing Illegal Logging: Simultaneous Optimization of Resource Teams and Tactics for Security *AAAI'16 Conference on Artificial Intelligence*
- **Sara Mc Carthy**, Doina Precup, Theoretical Results on the Effect of 'Shortcut' Actions in MDPs, *Connection Science* 26, 2 (April 2014), 179-193.

Book Chapters

- **Sara Mc Carthy**, Milind Tambe, Christopher Kiekintveld, Meredith L. Gore, Alex Killion. Simultaneous Optimization of Strategic and Tactical Planning for Environmental Sustainability and Security. *AI for Conservation. Cambridge University Press*
- **Sara Mc Carthy**, Arunesh Sinha, Milind Tambe, Pratyusa Manadhata. Decision Theory for Network Security: Active Sensing for Detection and Prevention of Data Exfiltration. *Applied Risk Analysis for Guiding Homeland Security Policy and Decisions. John Wiley & Sons Inc. 2017*
- **Sara Mc Carthy**, Arunesh Sinha, and Milind Tambe. Game Theoretic Defense for Maritime Security. *Book on Challenges in Maritime Security. (CCICADA Department of Homeland Security) 2017*

Workshop Papers and Symposia

- **Sara Mc Carthy**, Corine Laan, Phebe Vayanos, Milind Tambe. Robust Markov Decision Processes for Threat Screening Games in *AAAI Workshop on Imperfect Information Games 2018.*
- **Sara Mc Carthy** Phebe Vayanos, Milind Tambe. Adaptable Robust Optimization for Threat Screening *Institute for Operations Research and the Management Sciences (INFORMS) 2017.*
- **Sara Mc Carthy**, Milind Tambe, Christopher Kiekintveld, Meredith L. Gore, Alex Killion. An introduction to Green Security Games: A Mathematical Framework for Protecting our Natural Resources from Illegal Exploitation. *Society for Mathematical Biology: Ecology Crime. Utah 2017.*
- **Sara Mc Carthy,** Phebe Vayanos, Milind Tambe. Dynamic Decisions and Adaptive Allocations: Robust Planning for Physical and Cyber Threat Screening Games. *In International Workshop on A.I. in Security 2017*
- **Sara Mc Carthy**, Milind Tambe, Christopher Hallam, PAWS-LITE: Extending the Deployment of Game Theoretic Applications for Environmental Crime Prevention. *AAAI Spring Symposium 2017*
- **Sara Mc Carthy**, Milind Tambe, Christopher Kiekintveld, Meredith L. Gore, Alex Killion. Preventing Illegal Logging: Simultaneous Optimization of Resource Teams and Tactics for Security. In AAMAS Workshop on Security and Multi-agent Systems (SecMAS) 2016
- **Sara Mc Carthy**, Aaron Schlenker, Milind Tambe, Christopher Kiekintveld, Multi-Age Patrolling on a Budget: Finding the Best Team on a Budget *AAMAS'15 International Workshop on Optimization in Multi-Agent Systems*
- **Sara Mc Carthy** , Doina Precup, Theoretical Results on Variable-Length Actions in MDPs. *Adaptive Learning Agents - AAMAS 2013.* Minnesota, United States. May 6-10, 2013.

Media Coverage

- National Science Foundation. 2016. Outwitting poachers with artificial intelligence. *https://www.nsf.gov/news/news_summ.jsp?preview=y&cntn_id=138271*

Contribution to Deployed Software Systems

PAWS (Protection Assistant for Wildlife Security)

- PAWS is an anti-poaching software system that uses AI to predict and prevent poaching. I have developed novel planning algorithms for computing randomized patrols to optimize the protection of conservation areas. This is in collaboration with many conservation agencies, including Wildlife Conservation Society (WCS) and Panthera.

SMART (Spatial Monitoring and Reporting Tool)

- Smart is a free, open source software application that allows conservationists to collect, analyze and evaluate data on patrol efforts, patrol results, and threat levels. In collaboration with the World Wildlife Fund (WWF), Wildlife Conservation Society (WCS) and Panthera, my patrol planning prescriptive model are being integrated into the SMART software. This will allow conservation areas all around the world access to game theoretic and machine learning software which allow them to perform predictive analysis to better determine where attacks and signs of disturbance are likely to occur and to plan patrols in order to maximize their interdiction of these illegal activities and deterrent effect of the patrols.

Awards and Commendations

WiSE Top-Off Fellowship (USC Women in Science and Engineering (WiSE) Program)

Technical Skills

Languages: (proficient in) Java, Python, (familiar with) C/C++, JavaScript
Math and Statistical Packages: CPLEX, Gurobi,TensorFlow, Matlab