

# Sara Marie **McCarthy**

PHD STUDENT · RESEARCH ASSISTANT

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*Interests: Artificial Intelligence, Optimization, Algorithmic and Computational Game Theory, Security and Cyber-Security, Multi-Agent Systems and Team-Formation, Machine Learning*

## Education

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*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

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**Software Engineer Intern, Google Inc.** Summer 2017  
Mountain 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.

- 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

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### Conference and Journal Publications

- **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**, 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

- **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**, Aaron Schlenker, Milind Tambe, Christopher Kiekintveld, **Heterogeneous Resources for Patrolling: 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.

## Awards and Commendations

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

## Technical Skills

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Languages: (proficient in) Java, (familiar with) Python, C/C++, JavaScript

Math and Statistical Packages: CPLEX, Gurobi, Matlab, TensorFlow, scikit-learn