

# Sara Marie **McCarthy**

PHD STUDENT · RESEARCH ASSISTANT

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

☎ (323) 352-4132 | ✉ [sara.m.mccarthy@gmail.com](mailto:sara.m.mccarthy@gmail.com) | 🏠 [www-scf.usc.edu/~saramarm/](http://www-scf.usc.edu/~saramarm/) | 📺 [sara-marie-mccarthy](https://www.youtube.com/channel/UCsara-marie-mccarthy)

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

## Publications

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### Conference and Journal Publications

- **Sara McCarthy**, 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 Marie McCarthy**, Milind Tambe, Christopher Kiekintveld, Meredith L. Gore, Alex Killion, **Preventing Illegal Logging: Simultaneous Optimization of Resource Teams and Tactics for Security** *AAAI conference on Artificial Intelligence (AAAI) 2016*
- **Sara Marie McCarthy**, Doina Precup, **Theoretical Results on the Effect of 'Shortcut' Actions in MDPs,** *Connection Science* 26, 2 (April 2014), 179-193.

### Book Chapters

- **Sara McCarthy**, 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 McCarthy**, 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 Marie McCarthy**, Milind Tambe, Christopher Hallam, **PAWS-LITE: Extending the Deployment of Game Theoretic Applications for Environmental Crime Prevention.** *AAAI Spring Symposium 2017*
- **Sara Marie McCarthy**, 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 Marie McCarthy**, Doina Precup, **Theoretical Results on Variable-Length Actions in MDPs.** *Adaptive Learning Agents - AAMAS 2013.* Minnesota, United States. May 6-10, 2013.

## Research Experience

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### 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:
- Simultaneous optimizing tactical decision making, resource investment and strategic deployment of multi-agent teams in network security games, with applications in forest and wildlife protection.
- Novel decision theoretic framework addressing challenges in cyber security, active sensing in uncertain network environments, planning optimal strategies to protect against advanced persistent threats, and data exfiltration.
- Robust optimization and dealing with uncertainty in plan execution in Bayesian Threat Screening Games.
- Using AI to address social welfare problems such as drug abuse and homelessness.

### Thesis Project, McGill University

2013 - 2014

Quantum Defects Lab, Department of Physics

Supervisor: Lily Childress

- Research involved the 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 a quality control system for the production of optical cavities used for control and measurement of quantum q-bit states. This involved the computation of optimal cavity parameters as well as the 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.

## 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