Joseph McCalmon

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EDUCATION

Wake Forest University, Winston-Salem, NC
Computer Science, B.S. • Mathematics, B.A.
GPA: 3.99/4.00 Dean's List: Fall 2018 - Spring 2021
August 2018 – May 2022

PROFESSIONAL EXPERIENCE

Wake Forest University Computer Science Department
Undergraduate Researcher
Spring 2020 – Present

- Led multiple projects focused on deep learning, security, robotics, and explainable machine learning
- Collaborated with professors from numerous universities and departments

Pennsylvania State University Computer Science Department
Undergraduate Researcher
Summer 2021 – Present • NSF Research Experience for Undergraduates

- Led a project on explainable reinforcement learning
- Continued summer work throughout the 2021 academic year

Wake Forest University Learning Assistance Center
Peer Tutor
Fall 2019 – Fall 2020

- Tutor freshmen, sophomores, and juniors weekly
- Reinforce topics from Introduction to Economics, Intermediate Microeconomics, and Intermediate Macroeconomics for struggling students

RESEARCH EXPERIENCE

CAPS: Comprehensible Abstract Policy Summaries for Explaining Reinforcement Learning Agents
Collaboration with Dr. Dongwon Lee, Penn State University
Spring 2021 – Present • REU project continuing into 2021-2022 academic year

- Created a novel algorithm to explain the decision making of reinforcement learning agents
- Work accepted at AAMAS 2022 as a full paper and oral presentation

COMPUTER SKILLS & PLATFORMS

Tensorflow 1.X, 2.X (Keras), & PyTorch

Python, C, C++, Java, JavaScript, HTML, & CSS languages

LaTex

Embedded Systems and Robotics

AWARDS

Follett Scholarship
Wake Forest University – Fall 2021
Awarded for academic excellence

Goldwater Scholar
Barry Goldwater Scholarship and Excellence Foundation – Spring 2021
Awarded for promise in research and academics

Thomas E. and Ruth Mullen Scholar
Wake Forest University – Fall 2020
Awarded for exceptional leadership and academics to under 20 undergraduates each year

Finalist, CRA Outstanding Undergraduate Researcher Award
Computing Research Association – Fall 2021
This award program recognizes undergraduate students in North American colleges and universities who show outstanding research potential in an area of computing research

CONFERENCES AND PRESENTATIONS

Advancement of Artificial Intelligence Conference
Poster Presenter – Spring 2021

International Conference on Tools with Artificial Intelligence
Keynote Presenter – Fall 2020

Observation Agnostic Reinforcement Learning

Collaboration with Dr. Sarra Alqahtani, Wake Forest University

Spring 2021 – Present

- Developing a defense against large-scale adversarial perturbations to reinforcement learning agents
- Leading two undergraduates as the main investigator

Detecting & Predicting Dark Mining with Remote Sensing Imagery

Mentored by Dr. Sarra Alqahtani & Dr. Paúl Pauca, Wake Forest University

Winter 2020 – Spring 2021

- Primary researcher on this project involving Intelligent Remote Sensing in Conservation & Discovery Group (IRSC) & CINCIA
- Used image recognition techniques, transfer learning, and change detection to identify hardly visible dark mining in varying resolutions of images in the Peruvian department of Madre De Dios
- Collaborated with professors and graduate students in remote sensing from Dartmouth University and Florida University

Defending Against Security Attacks in Multi-Agent Reinforcement Learning Systems

Mentored by Dr. Sarra Alqahtani, Wake Forest University

Fall 2020 – Fall 2021

- Developed security attacks against current multi-agent reinforcement learning systems, and created detection models to defend against such attacks
- Part of continuing research to improve the robustness of reinforcement learning agents
- Formed mathematical models and theories based on literature reviews
- Led two undergraduates and one graduate student in all phases of the project
- Work under submission at AAMAS 2022

Deep Reinforcement Learning for Adaptive Exploration of Unknown Environments

Mentored by Dr. Sarra Alqahtani, Dr. Paúl Pauca, & Dr. Miles Silman, Wake Forest University

Summer 2020 – Present • Presented at IEEE SSRR, AAAI-21 Undergraduate Consortium, and ICARA-21

- Developed algorithms to autonomously fly a drone using deep reinforcement learning and image thresholding to detect, trace, and observe illegal gold mining in South America over Amazonian Forests
- Conducted extensive experiments and testing in a simulated environment before deploying the refined algorithm into a drone

International Symposium on Safety, Security, Rescue, and Robotics (SSRR)

Undergraduate Presenter – Fall 2020

EXTRACURRICULAR ACTIVITES

Wake Forest Robotics Club

Founder & President – Fall 2020 - Present

- Led a four-person team to build a robotics club from scratch, teaching over twenty undergraduates programming, robotics, and machine learning
- Developed a website with handcrafted modules for self-guided learning
- Received grants to purchase inventory and send teams to international conferences

PUBLICATIONS

McCalmon, J., Liu, T., Lischke, C., Rahman, A., Alqahtani, S.M. (2021). Advanced Persistent Threat in Multi-Agent Reinforcement Learning [Manuscript Submitted for Publication]. Computer Science Department, Wake Forest University.

McCalmon, J., Le, T., Alqahtani, S.M., Lee, D. (2021). CAPS: Comprehensible Abstract Policy Summaries for Explaining Reinforcement Learning Agents. Manuscript accepted at the International Conference on Autonomous Agents and Multi-Agent Systems 2022.

Zhang, Y., **McCalmon, J.**, Peake, A., Alqahtani, S.M., & Pauca, V.P. (2021). A Symbolic-AI Approach for UAV Exploration Tasks. 2021 7th International Conference on Automation, Robotics and Applications (ICARA), 101-105.

Peake, A., **McCalmon, J.**, Zhang, Y., Myers, D., Alqahtani, S.M., & Pauca, V.P. (2021). Deep Reinforcement Learning for Adaptive Exploration of Unknown Environments. 2021 International

- Analyzed the results and wrote the initial manuscript draft presenting the algorithm

Black-Box Breaker: Crafting Adversarial Examples for Deep Neural Networks without Training

Primary researcher with Dr. Sarra Alqahtani, Wake Forest University and Dr. Charles Walter, University of Mississippi

Summer 2020 • Submitted at 16th ACM ASIA Conference on Computer and Communications Security, 2021

- Created a tool to customize the training phase of deep reinforcement learning models built with convolutional neural networks using the approximated parameters by genetic algorithms

Multi-Agent Reinforcement Learning for Cooperative Adaptive Cruise Control

Primary researcher with Dr. Sarra Alqahtani, Wake Forest University

Spring 2020 • Presented at The International Conference on Tools for Artificial Intelligence ICTAI, 2020

- Adapted a multi-agent deep reinforcement learning algorithm for an environment which simulated multiple autonomous cars driving on a highway, avoiding collisions, and coordinating in one unit called platoon

Conference on Unmanned Aircraft Systems (ICUAS), 265-274.

McCalmon, J., Peake, A., Zhang, Y., Raiford, B., & Alqahtani, S.M. (2020). Wilderness Search and Rescue Missions using Deep Reinforcement Learning. 2020 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR), 102-107.

McCalmon, J., Peake, A., Raiford, B., Liu, T., & Alqahtani, S.M. (2020). Multi-Agent Reinforcement Learning for Cooperative Adaptive Cruise Control. 2020 IEEE 32nd International Conference on Tools with Artificial Intelligence (ICTAI), 15-22.

RELEVANT COURSEWORK

Statistical Models

Real Analysis

Cryptography

Computer Systems I & II

Data Structures

Algorithm Design & Analysis

Security in Deep Learning

Data Mining