Daniel Melcer

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Education

Northeastern University Boston, MA
Khoury College of Computer Sciences
PhD Student in Formal Methods and Reinforcement Learning | GPA: 4.0 *September 2021 - Present*
Advised by Christopher Amato and Stavros Tripakis, Expected Completion 2026
Bachelors of Science in Computer Science, Minor in Math | GPA: 4.0 *September 2017 - May 2021*

Publications

Incremental Quotient Language Recognition to Improve LLM Code Generation Quality
Daniel Melcer, Nathan Fulton, Sanjay Krishna Gouda, Haifeng Qian *Under Review*

Shield Decentralization for Safe Reinforcement Learning in General Partially Observable Multi-Agent Environments *Under Review*
Daniel Melcer, Christopher Amato, Stavros Tripakis

Shield Decentralization for Safe Multi-Agent Reinforcement Learning *NeurIPS 2022*
Daniel Melcer, Christopher Amato, Stavros Tripakis *Safe RL @ IJCAI 2022*

Multi-Agent Tree Search with Dynamic Reward Shaping *ICAPS 2022*
Alvaro Velasquez, Brett Bissey, Lior Barak, Andre Beckus, Ismail Alkhouri, Daniel Melcer, George Atia

Decentralized Shield Decomposition for Safe Multi-Agent Reinforcement Learning *RLDM 2022*
Daniel Melcer, Christopher Amato, Stavros Tripakis | Extended Abstract

ProofViz: An Interactive Visual Proof Explorer *Trends in Functional Programming 2021*
Daniel Melcer, Stephen Chang

Dynamic Automaton-Guided Reward Shaping for Monte Carlo Tree Search *AAAI 2021*
Alvaro Velasquez, Brett Bissey, Lior Barak, Andre Beckus, Ismail Alkhouri, Daniel Melcer, George Atia

Verification-Guided Tree Search *AAMAS 2020*
Alvaro Velasquez, Daniel Melcer | Extended Abstract

Experience

Amazon Web Services Applied Research Intern, New York, NY *May 2023 - August 2023*

- Researched incremental parsing and quotient language generation for context-sensitive programming languages, including those with complex lexing rules and whitespace sensitivity.
- Implemented constrained generation for a Python 3 fill-in-middle task, leading to a significant increase in generations which are accepted by a Python parser.

Griffiss Institute Research Intern for Air Force Research Laboratory, Rome, NY *June 2021 - August 2021*

- Extended work on automatically learning a high-level human-interpretable automaton representation of a complex reinforcement learning environment
- Experimented with discretized autoencoders in order to obtain a low-dimensional representation of an environment state space for use in downstream classification tasks
- Created a method which transfers knowledge between two agents through an automaton representation of a task, using a modified version of the traditional Q-learning loss function

Datto Software Development Intern, Norwalk, CT *January 2020 - May 2020*

- Migrated thousands of lines of Javascript to Typescript and formalized shared object types
- Wrote two new chapters for the internal style guide on Typescript type design and SQL best practices
- Designed and prototyped a mock server to simulate external dependencies during automated tests

Griffiss Institute Research Co-op for Air Force Research Laboratory, Rome, NY *January 2019 - June 2019*

- Used Pytorch to implement a formal specification based reinforcement learning mechanism to enable a 50% higher success rate in sparse-reward tasks, with the ability to transfer knowledge to similar tasks
- Researched an exploration method that combines intrinsic curiosity networks and tree search to explore new environments without manually specifying a reward function
- Experimented with the application of new sequence-modeling methods to predict results of an action

Forward Thinking Systems Software Development Intern, Jericho, NY *May 2018 - August 2018*

- Analyzed sensor data with Python and Keras to detect potential camera blockages and failures in thousands of commercial vehicle dashcams
- Developed an extensible Typescript Alexa skill for users to perform common administrative tasks

Brookhaven National Laboratory Summer Research Intern, Upton, NY *July 2016 - August 2017*

- Increased speed of search for mathematical constants by over 100x by parallelizing search with CUDA
- Wrote a Python desktop application to sort and search a database of over 1,000 ethernet ports
- Constructed a Django website to improve the efficiency of administering on-site network switches

Teaching

Logic and Computation *September 2022 - December 2022*
September 2023 - December 2023

Fundamentals of Computer Science 1—Accelerated *September 2018 - December 2018*
September 2019 - December 2019

Fundamentals of Computer Science 1 *January 2018 - April 2018*
September 2020 - December 2020