Matthew Wilson

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Education

University of British Columbia
Vancouver, BC, CA

M.S. in Computer Science
Sep. 2019 - May 2021 (2 years)

University of Utah
Salt Lake City, UT, USA

B.S. in Computer Engineering
Aug. 2015 - May 2019 (4 years)

Experience

Graduate Student Researcher
MOCCA Lab

University of British Columbia, Vancouver, BC
Sep 2019 - May 2021 (2 years)

- Advisor: Michiel van de Panne

Undergraduate Researcher
LL4MA Lab

University of Utah, Salt Lake City, UT
Jan 2018 - Aug 2019 (1.5 years)

- Advisor: Tucker Hermans

Robotics Institute Summer Scholar (REU)
MSL Lab

Carnegie Mellon University, Pittsburgh, PA
Jun 2017 - Aug 2017 (3 months)

- Advisors: Ralph Hollis, Jean Oh

University Robotics Club Member
Utah Student Robotics

University of Utah, Salt Lake City, UT
Jan 2016 - Aug 2018 (2.5 years)

- Advisor: Jon Davies

Projects and Publications

boxLCD: A Testbed for Learned Simulator and World Model Research
GitHub

Matthew Wilson
Feb 2021 - Current

- Developing a small-scale testbed for research in unsupervised learning / generative models for robot learning and training models to solve it.

Learning to Manipulate Object Collections Using Grounded State Representations
CoRL 2019 (Oral, Best System Paper)

Matthew Wilson, Tucker Hermans
Nov 2018 - Jun 2019 (7 months)

- Led sim2real deep reinforcement learning project, training manipulation policy in simulation and deploying on real Baxter Robot
- See project page for summary video and slides: `https://matwilso.github.io/projects/object_collections`

Go, Look, and Tell: Natural Language Communication with a Ballbot
Preprint | Poster

Matthew Wilson, Jean Oh, Ralph Hollis
Jun 2017 - Aug 2017 (3 months)

- Developed system for a user to give natural language commands and ask questions of dynamically balancing mobile robot (Ballbot)
- Integrated vision system, natural language processing via Amazon Echo, world model (database), and mobile robot navigation system

NASA Robotic Mining Competition
Competition Website

Utah Student Robotics (Mechanical member, Electrical member, and Software Lead)
Nov 2015 - Aug 2018 (2 years 8 months)

- Helped design, build, and program robots to compete in NASA Robotic Mining Competitiong for 3 years of competition
- Started on the mechanical subteam, but contributed most to electrical and software
- Helped design, spec, and assemble (solder, wire up) electrical system components
- Developed simulation of robot for testing, using Gazebo and ROS
- Was software team lead in 2017-18 year and developed low-level motor controller code and autonomy components such as vision system, position controllers for actuators, and finite state machine
- Wrote technical paper on Systems Engineering for NASA competition, getting 3rd place in 2017
- Attended outreach events for K-12 students. Talked to kids about robotics and space exploration

Open Source Implementations

Generative Models

https://github.com/matwilso/generative_models

ALGORITHM IMPLEMENTATION *Feb 2018*

- Implemented fundamental generative model algorithms in PyTorch, including Autoregressive models, GANs, VAEs, and Diffusion Models

Domain Randomization for Transferring from Simulation to the Real World

https://github.com/matwilso/domrand

REPRODUCING *Jun 2018*

- Developed a simulation environment, collected a dataset of images and labels, and trained a VGG model to localize objects
- Reproduced domain randomization results from Tobin et. al 2017 and verified predictions on a physical system

Model-Agnostic Meta-Learning (MAML)

https://github.com/matwilso/maml_numpy

ALGORITHM IMPLEMENTATION *Jun 2018*

- Derived forward and backward passes of MAML (meta-learning algorithm) and implemented them in raw numpy

REINFORCE

https://github.com/matwilso/reinforce

ALGORITHM IMPLEMENTATION *Spring 2018*

- Implemented REINFORCE deep reinforcement learning algorithms in both TensorFlow and raw numpy

Writing

Blog posts on Robot Learning

https://matwilso.github.io/blog/

Personal Blog *Jul 2020 - current*

- [Feb 22, 2021] The Future of Robot Learning. Discussion of the role unsupervised learning is going to play in the future of robot learning. From two perspectives of model-based RL (world models) and sim2real (learned simulators).
- [Feb 22, 2021] Learned Simulators. Specific thoughts on the idea of a learned simulator and the framing they provide on robot learning progress.
- [Jul 20, 2020] GPT Physics Sim. Some of my earlier thoughts on extrapolating technologies like GPT to video and physics simulation.

Explanation of Proximal Policy Optimization (PPO) on Stack Overflow

https://stackoverflow.com/questions/46422845

Stack Overflow *Jun 2018*

- Wrote explanation of a popular reinforcement learning algorithm, Proximal Policy Optimization (PPO)
- Top answer on Stack Overflow, with 125+ upvotes. Cited by popular blog post and used in popular YouTube video with 75k+ views

Honors & Awards

Best System Paper Award, CoRL 2019	*Osaka, Japan*	Oct 2019
Presidential Scholarship	*University of Utah*	2015-2019
Dean's List	*College of Engineering*	2015-2018
UROP Undergraduate Research Award	*University of Utah*	Summer 2018
3rd Place / 50, NASA RMC	*NASA Kennedy Space Center*	May 2017, 2018
Judges' Innovation Award, NASA RMC	*NASA Kennedy Space Center*	May 2016

Skills

Languages Python (PyTorch, TensorFlow, Jax), C/C++, Java, basic HTML+JS (some d3)

Other Git, Linux/Unix, Mujoco, ROS, Gazebo, Solidworks, LaTeX, some machine shop experience (basic, mill)