Peter Mitrano - Curriculum Vitae/Resume

EDUCATION

PhD. Robotics
University of Michigan, expected December 2023

MS. Robotics
University of Michigan, May 2020

BS. Computer Science, *BS.* Robotics Engineering
Worcester Polytechnic Institute, May 2018
3.95 GPA

PUBLICATIONS

P. Mitrano, D. Berenson. (2024). The Grasp Loop Signature: A Topological Representation for Manipulation Planning with Ropes and Cables. (UNDER REVIEW for ICRA 2024).

P. Mitrano, A. LaGrassa, O. Kroemer, D. Berenson. (2023). Focused Adaptation of Dynamics Models for Deformable Object Manipulation. ICRA 2023.

P. Mitrano, D. Berenson. (2022). Data Augmentation for Manipulation. Robotics Science and Systems (RSS)

P. Mitrano, D. M^{c}Conachie, D. Berenson. (2020). Learning Where to Trust Unreliable Models in an Unstructured World for Deformable Object Manipulation. Science Robotics.

D. M^{c}Conachie, T. Power, P. Mitrano, D. Berenson. (2020). Learning When to Trust a Dynamics Model for Planning in Reduced State Spaces. ICRA/RA-L 2020.

P. Mitrano, J. Burklund, M. Giancola, C. Pinciroli (2019). A Minimalistic Approach to Segregation in Robot Swarms. The 2nd IEEE International Symposium on Multi-Robot and Multi-Agent Systems.

P. Mitrano, A. Lockman, J. Honicker, S. Barton. (2017). Using Recurrent Neural Networks to Judge Fitness in Musical Genetic Algorithms. The 5th International Workshop on Musical Metacreation (MUME).

PRESENTATIONS

Presented "Learning Where to Trust a Dynamics Model for..." for IAM Lab and Carnegie Mellon University in April 2022.

Presented "Using Recurrent Neural Networks to Judge Fitness in Musical Genetic Algorithms" at the MuMe 2017 Workshop.

Blog post on perception for manipulation with a Spot robot, featured on RoboFlow

WORKSHOP PAPERS

P. Mitrano, D. Berenson. (2022). Data Augmentation for Online Learning of Rope Manipulation. 2nd Workshop on Representing and Manipulating Deformable Objects @ ICRA2022

P. Mitrano, D. M°Conachie, D. Berenson. (2020). Learning When to Trust a Dynamics Model When Planning With Physical Constraints. Accepted for the ICRA 2020 Workshop MLPC

EMPLOYMENT

PickNik Robotics Jan-April 2023

Integrated instance segmentation into a manipulation planning pipeline, enabling the first autonomous perception-driven behaviors in the MoveIt Studio beta product. See this blog post about my internship.

Uber ATG Pittsburgh Summer 2017, Summer 2018

My team worked on predicting the future paths of actors seen by the autonomous vehicle. I made both software engineering and algorithmic contributions.

Robot Autonomy and Interactive Learning Lab (Georgia Tech) Summer 2016

I conducted research on applying Learning from Demonstration techniques to the ROS Navigation stack. I developed several plugins for the ROS navigation stack, and studied basic machine learning and LfD techniques. My approach consisted of learning to adjust the cost map of the environment using demonstrated trajectories. These demonstrations came from a remote human operator when the robot planner failed. This work was funded by an NSF grant, and completed under the advisement of Professor Sonia Chernova.

Open Robotics (Open Source Robotics Foundation) Summer 2015

The aim of my project was to allow FIRST Robotics Teams to use the Gazebo robot simulator to simulate their robots and practice programming. This project involved cross-architecture and cross-platform C++/Java development.

Robot Autonomy and Interactive Learning Lab (WPI) 2013-14

Developed 3D models and an online interface to allow online crowd-control of our robot for user studies. The goal was to learn whether online crowd-learning can be used to learn tasks in unstructured robot domains like the home. This was completed under PhD student Russell Toris, under the advisement of Professor Sonia Chernova.

PROJECTS

Grasp Loop Signature: A Topological Representation for Manipulation Planning with Ropes and Cables 2023

We propose a topological representation that captures how ropes or cables loop in and around obstacles in the environment. The novelty is that we consider the robot arms that may be grasping the object, and points on the object that are fixed to the environment. We demonstrate using this representation in grasp planning, and show that it is more successful and significantly faster than altnernative planning methods.

Focused Adaptation of Dynamics Models 2022

In order to efficiently learn a dynamics model for a task in a new environment, one can adapt a model learned in a similar source environment. However, existing adaptation methods can fail when the target dataset contains transitions where the dynamics are very different from the source environment. Our key insight is to improve data efficiency by focusing model adaptation on only the regions where the source and target dynamics are similar. We propose a new method for adaptation that is effective in adapting to regions of similar dynamics. Additionally, we combine this adaptation method with prior work on planning with unreliable dynamics to make a method for data-efficient online adaptation, called FOCUS.

Data Augmentation for Manipulation 2021
Data augmentation has played a key role in the success of deep learning for computer vision, but has so far not been applied to other tasks or types of data. We are exploring what data augmentation for robotics manipulation could look like, and reframing data augmentation as a constraint satisfaction problem.

Learning and Planning with Unreliable Models for Deformable Object Manipulation 2020
Deformable objects are challenging to model, and having poor models makes perception, planning, and control more difficult. I have explored using deep learning to model only partial dynamics of these objects and developed planning methods for this setting. I have also studied adaptation and online learning in this setting.

A Minimalistic Approach to Segregation in Robot Swarms 2018
Submitted to ICRA 2019. We present a decentralized algorithm to achieve segregation into an arbitrary number of groups with swarms of autonomous robots. The structure of the control system is purely reactive, and it maps directly the sensor readings to the wheel speeds with a simple if statement. We present a thorough analysis of the parameter space that enables this behavior to emerge, along with conditions for guaranteed convergence and a study of non-ideal aspects in the robot design

Perceptual Grouping in Music 2017
The goal of this research is to produce a computational model for how humans perceive groupings of sonic events in music. This work consists of both psychological experiments and machine learning. We expect to publish later this year both on the ability of our model to accurately predict perceptual grouping and on the results of our psychological studies.

Position Hallucination and Indoor Localization (PHIL) 2017
Senior capstone project. The goal of this project is to develop a flexible system for localization of robots for the FIRST Robotics Competition. We intend to support various sensor suites and provide precise location of the robot independent of the geometry of the available space.

WPI Smartmouse 2014-2018
Smartmouse is a project organized by the WPI CollabLab to design, fabricate, and program a small maze solving robot. Our robot is capable of reaching the center of the maze in under 50 seconds, which requires precise planning and controls to be carried out at 500Hz.

HONORS

Outstanding Senior Award, Robotics. Worcester Polytechnic Institute, 2018.
Dean's List. Worcester Polytechnic Institute, 2014-2018.

VOLUNTEERING & OUTREACH

Rackham Professional Development Diversity, Equity, and Inclusion Certificate 2023
Completed 10 workshops on a variety of DEI topics and completed the Intercultural Development Inventory.

Robotics Graduate Student Outreach 2019-Present
I have served as President, Social chair and Colloquium chair. I participated in several outreach events for local girl scout troops and middle schools, including hand-on engineering activities and lab tours. I have also organized colloquiums for UM Robotics students to share and discuss their research.

Rho Beta Epsilon Honor Society 2016-2018
Provided tutoring to undergraduate Robotics Engineering majors as a part of Rho Beta Epsilon Robotics Engineering Honor Society.

WPILib & FRCSim 2014-15
WPILib is a set of libraries, toolchains, and development tools that allows students in FRC to program their robots. Over 40,000 students use this software every year.