Peter Mitrano - Curriculum Vitae/Resume

https://users.wpi.edu/~pdmitrano
https://github.com/petermitrano/
mitranopeter@gmail.com
(609) 433-5864

OBJECTIVE

I am looking for summer internships in the intersection of robotics and machine learning. I have extensive engineering experience, and my background includes controls theory, machine learning, and simulation. I will be persuing a PhD in Robotics at the University of Michigan in the fall of 2018.

EDUCATION

BS. Computer Science, *BS.* Robotics Engineering
Worcester Polytechnic Institute, expected May 2018
3.94 GPA
Relevant Coursework includes *Unified Robotics, Intro to AI, Deep Neural Networks, Software Engineering, Controls, Probability, Linear Algebra, Numerical Methods*

PUBLICATIONS

P. Mitrano, A. Lockman, J. Honicker, S. Barton. (2017). Using Recurrent Neural Networks to Judge Fitness in Musical Genetic Algorithms. Proceedings of MuMe 2017

PROJECTS

Perceptual Grouping in Music 2017-present
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-present
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.

Sutton & Barto RL Fall 2017
I am reading and completing exercises from Sutton & Barto's canonical text, Reinforcement Learning: An Introduction (1996).

WPI Smartmouse 2013-present
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, and requires precise planning and controls to be carried out within several milliseconds.

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.

EMPLOYMENT

Uber ATG Pittsburgh Summer 2017

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. Through this work, I know the ROS navigation stack in great detail. 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.

OSRF (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. I also lead the ongoing process of getting Gazebo to run on Windows.

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.

HONORS

Dean's List 2013-present

Rho Beta Epsilon Honor Society 2016-present

Provide help and tutoring to undergraduate Robotics Engineering majors as a part of Rho Beta Epsilon Robotics Engineering Honor Society.

APPENDIX of Project Details

Using Recurrent Neural Networks to Judge Fitness in Musical Genetic Algorithms

In this paper, we contribute a new architecture for composing music. In this architecture, we use a genetic algorithm with the same design as GenJam by Al Biles, a famous genetic algorithm for generating jazz solos. GenJam is trained by human feedback, and is very slow and tedious to train. We instead used a LSTM with attention functions designed for music to provide fitness feedback. The networks we used are from the Google Magenta project, and were trained on generating music from a large corpus. We feed into the network the samples produced by the genetic algorithm, and use the log-likelihood of the output as our measure of fitness. In other words, we are asking this network how likely it is that the samples produced by our genetic algorithm were drawn from the distribution of the network's training data. Since the network was trained on a huge musical corpus, we claim that this is close to asking the network if the sample sounds like "real music". You can hear examples of the output of our machine here: http://petermitrano.github.io/plonky.

Perceptual Grouping in Music

I am working on this project with Professor Scott Barton. Our current research builds on previous work on beat tracking, event detection, as well as Gestalt theory. Ultimately, we aim to be able to predict where people will perceive groups of notes in unheard musical sequences given a dataset of music sequences labeled with groupings. Computational and psychological studies agree that the way humans perceive onsets of notes is broadly described by a few simple rules, but these rules are often in competition. As such, it is difficult to manually describe a procedure for this task. Recent successes with RNNs at composing and synthesizing music indicate that they may be able well suited to other sequential audio tasks like defining groupings. For this project, I am using Tensorflow, and we are collecting data through a user study which asks people to label groups in short snippets of solo acoustic guitar music.

Position Hallucination and Indoor Localization (PHIL)

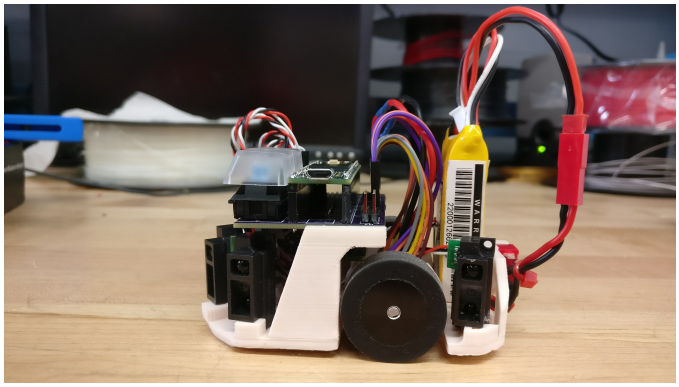
This project is my MQP (Major Qualifying Project). Localization in the FRC environment is difficult because there are 6 robots moving at speeds up to 5 m/s with many obstacles. Our approach is to combine traditional localization methods using odometry from wheel encoders and IMUs with visual fiducial markers placed around the field. We are exploring how to better optimize fiducial markers like April and ArUco tags for occlusion and accuracy at the cost of information density. Time permitting, we will also use ultrasonic beacons and optical flow as additional inputs to position estimation. Our premise for this approach is that each sensing techniques makes up for the failures of the other techniques, and therefore fusion of each unoptimized system will perform better than any one system when optimized. This system is designed for use by teams with limited or cluttered test space to develop with localization, and then deploy their code confidently on the official competition field without changing any of their code.
https://github.com/phil-mqp

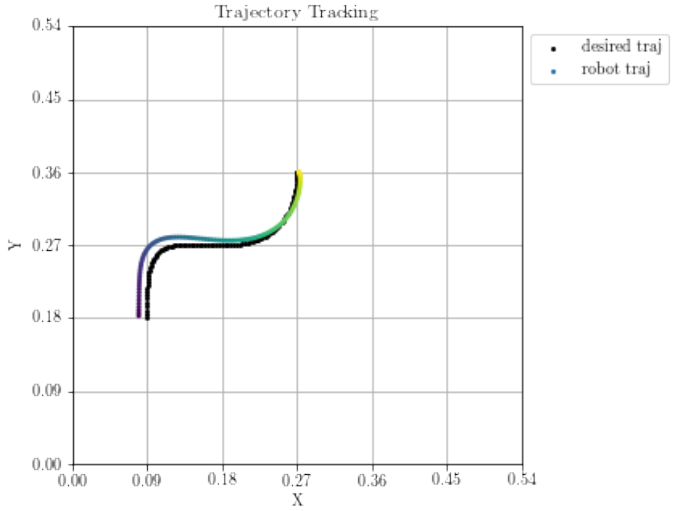
Sutton & Barto RL

The motivation for this project was to help me learn more about reinforcement learning and implementing environments and simulators for reinforcement learning. I also treated this like it were a research project by practicing scientific documentation of my code and reproducible experiments. I have been annotating the text as I read, and implementing various algorithms from scratch in python. I have successfully reproduced various graphs and proofs from the text to demonstrate my understanding of the material.
https://github.com/petermitrano/sutton_and_barto_rl

WPI Smartmouse

I have been working on this project for four years. Each year, we compete in the Brown IEEE Robotics Olympiad, and last year we won the competition. Currently, I am working on both extensive simulation of our robot and a time optimal controller. I have so far created a time optimal controller for computing the forward velocity component when driving straight. I have also written a simulator from scratch, which uses forward kinematics and a simple DC Motor model. I am using modern C++, Qt, and CMake for this project.
https://github.com/wpismartmouse/



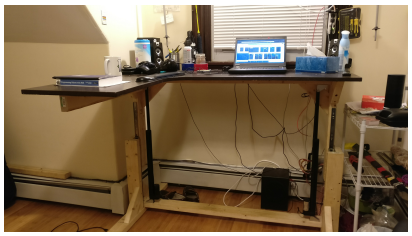


WPILib & FRCSim

I developed a series of software tools for simulating FRC robots using the Gazebo simulator. This work was done in conjunction with the Open Source Robotics Foundation. I have also contributed small patches to the core libraries used by FRC teams around the world.
https://github.com/wpilibsuite/

Electric Sit-Stand desk

I built an powered sit-stand desk from scratch, and have connected it to the internet with an ESP8266 so I can control it from anywhere. Additionally, I made an alexa skill that allows me to raise and lower my desk by saying "Alexa, tell my desk to go up/down".
https://github.com/my_desk
https://github.com/desk



OpenAI Gym

As a part of my self study of reinforcement learning, I have made two of my own controls environments for the OpenAI Gym. I have made a pull request to the OpenAI repository for one of these environments.

https://github.com/openai/gym/pull/698