Muye **Jia**

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Education

Northwestern University	*Evanston, IL, U.S*
M.S. IN ROBOTICS	*Sep. 2022 - Now*

University of Michigan, Ann Arbor	*Ann Arbor, Michigan, U.S*
B.S. IN MECHANICAL ENGINEERING	*Sep. 2019 - May. 2022*

Work Experience

Isuzu Technical Center of America — *Ann Arbor, U.S*

AUTONOMOUS VEHICLE CONTROL INTERN — *June 2023 - December 2023*
- Literature review for using deep reinforcement learning (DRL) to improve the performance of Model Predictive Control (MPC), DRL's application in autonomous vehicles, and researching for practical ways that alleviate the sim2real problem.
- Created a training framework for RL algorithm that dynamically tunes the objective function for the model predictive controller (MPC).
- Deployed the trained RL-MPC on a full-scale Lincoln MKZ vehicle and obtained superior performance to hand-tuned MPC.
- Implemented the vehicle dynamics simulator using Python and ROS that can be coupled with the offline RL training.
- Constructing parallel training framework (running multiple simulations in parallel) with asynchronous PPO and TD3 algorithms using PyTorch multi-processing library to boost training efficiency. Implementing RL algorithms (DDPG, TD3, PPO) using PyTorch and TensorFlow

Country Garden - Bright Dream Robotics — *Guangdong, China*

MECHANICAL DESIGN INTERN — *June 2021 - August 2021*
- Improved the energy efficiency and vibration conduction of the construction used vibrator on the company's floor-leveling robot.
- The improved vibrator design is patented by the company.
- Modelled, analyzed, and made geometric dimensioning and tolerancing (GDT) drawings for parts using Solidworks.

University of Michigan Transportation Research Institute (UMTRI) — *Ann Arbor, MI, U.S*

STUDENT RESEARCHER — *Jan. 2021 - Dec. 2021*
- Set up and run automobile frontal crash computer simulation using finite element human body models (LS-DYNA is used)
- Automated the simulation set-up process using MATLAB for frontal crash condition to run large numbers (100+) of simulations in parallel.
- Tuned the simulation parameters such as impact position, seat-belt stiffness to simulate different car crash scenarios.
- Analyzed the possibility of passenger injury under certain car crash conditions from numerical results.

Projects

Learning Quadrupedal Locomotion with Multi-modal Transformer — *Northwestern University*

ROBOT LEARNING — *April 2023 - December 2023*
- Literature review for recent advances in the field of robot learning, particularly the application of reinforcement learning in robotics.
- Deployed the learned walking policy on the Unitree Go1 quadruped by direct low-level control of the robot joints.
- Created a command publishing and subscribing pipeline using Lightweight Communication and Marshalling (LCM) that allows commands to be published on local host and received on arbitrary remote hosts within the same network.
- Creating Python wrapper for the Unitree Go1 legged SDK using pybind11 so it can be integrated to the PyTorch neural network policy.
- Implemented image streaming and processing pipeline for Intel Realsense camera as front-end for the learned control policy.

Adversarial Reinforcement Learning for Robot Soccer — *Northwestern University*

REINFORCEMENT LEARNING PROJECT — *Jan. 2023 - Present*
- Implemented Deep Deterministic Policy Gradient (DDPG) reinforcement learning algorithm composed of an actor-critic network to train differential drive robot attack and defensive players that have a continuous action spaces.
- Made a custom ROS2 simulation environment for the robot players where the simulated soccer matches can be monitored real-time in Rviz.
- Applied transfer learning to train successful policies against each other to produce more sophisticated attacker and defender behaviors.

Monocular Visual Odometry with Bundle Adjustment for DJI Tello Drone — *Northwestern University*

COMPUTER VISION — *May 2022 - June 2022*
- Implemented feature-based monocular visual odometry pipeline with feature extraction, frame-to-frame feature tracking, camera poses solving, and constructing the camera trajectory using openCV library; the real-drone performance is acceptable in <30m range
- Utilized the G2O graph-optimization library to construct and solve the bundle adjustment problem to significantly increase the odometry accuracy.
- Performed RGB camera calibration for the DJI Tello drone to get the camera intrinsic parameters.

Simultaneous Localization and Mapping (SLAM) with Data Association using Turtlebot — *Northwestern University*

SLAM PROJECT — *Jan. 15 - March. 15*
- Implemented extended Kalman filter and wheel odometry for differential drive mobile robot (turtlebot) using ROS2 framework in C++.
- Constructed data association scheme that takes in LiDAR information and infers the positions of obstacles.
- Wrote a C++ library of 2D rigid transformation that calculates forward and inverse kinematics for differential drive mobile robots (Wheel velocity to body twists and vice versa, etc.)

Robot Playing *Don't Let the balloon touch the ground* with Human — *Northwestern University*

ROBOT MANIPULATION PROJECT — *Nov. 2022 - Dec. 2022*
- Developed a balloon trajectory prediction algorithm in Python using Euler integration method and object tracking with computer vision techniques.
- The balloon trajectory prediction can be done and sent to the robot arm in under 0.8 second.
- Implemented a control algorithm in Python that causes the robot arm to move to the predicted balloon position in time and tap the balloon upward repeatably when the balloon is within the robot's task space.
- Constructed a ROS2 node that sends MoveIt2 motion request messages to cause the arm to move in screw or Cartesian trajectory.

Skills

Programming	Python, C++, ROS/ROS2, Git, Unit Testing, Linux, Machine Learning, Deep Learning, Reinforcement Learning, PyTorch, OpenCV
Software	Solidworks, Ign Gazebo, MoveIt2, CoppeliaSim, MATLAB, LS-Dyna, Fluent, ICEM CFD