FACULTY MENTOR

Nikolay Atanasov

PROJECT TITLE

Motion Planning and Reinforcement Learning for Robot Manipulation

PROJECT DESCRIPTION

This project focuses on motion planning and reinforcement learning techniques for robot manipulation. The objective is to develop algorithms that compress visual or tactile observations into an environment representation and plan or learn robot arm and end-effector motions to achieve a desired task. The project involves learning manipulation policies in a physics simulator, such as MuJoCo, and the transfer of the learned policies to a real robot arm.

This project will be in person.

INTERNS NEEDED

- 2

PREREQUISITES

- Experience with motion planning (e.g., A*, RRT*) or reinforcement learning (e.g., Q-learning or policy gradient) as well as proficiency in Python or C++ are required.

FACULTY MENTOR

Nikolay Atanasov

PROJECT TITLE

Quadrotor Robot Design and Autonomous Flight

PROJECT DESCRIPTION

This project focuses on building a fully functioning quadrotor robot, including sensors (cameras, inertial measurement unit, lidar), a flight controller, a computer, motors, and battery. The project requires experience with 3D printing, electrical design, and CAD modeling to connect and power all robot components. Besides hardware design, the project focuses on sensor calibration and synchronization and using the robot operating system (ROS) to provide drivers for the sensors and flight controller. Once the hardware and software components are in place, the project will consider autonomous flight using visual-inertial odometry and geometric control techniques both in simulation and on the physical robot platform.

This project will be in person.

INTERNS NEEDED

- 2

PREREQUISITES

- Candidates are expected to have experience with CAD software, soldering, 3D printing, and C++ programming. Experience with the robot operating system (ROS) is preferred.

FACULTY MENTOR

Nikolay Atanasov

PROJECT TITLE

Robot Motion Planning for Mobile Target Tracking

PROJECT DESCRIPTION

This project focuses on designing algorithms for planning the viewpoint trajectory of a robot team to track the motion of mobile targets in an environment which may contain obstacles and occlusions. The objectives include developing (1) learning and inference algorithms for estimating dynamic target motion and intent, handling multi-modal (non-Gaussian) target probability distribution and sensing occlusions, (2) planning and control algorithms for environment exploration and target uncertainty minimization, (3) techniques for adversarial information acquisition where target information is maximized, while leaked information minimized.

This project will be in person.

INTERNS NEEDED

- 2

PREREQUISITES

- Candidates are expected to have knowledge of Bayesian estimation algorithms (e.g., Kalman filtering), control theory (e.g., linear quadratic regulator), and data structures and algorithms.