FACULTY MENTOR
Atanasov, Nikolay

PROJECT TITLE
Python Robotics

PROJECT DESCRIPTION
This project focuses on developing a python simulation of 3-D environments, mobile robots (e.g., autonomous car, quadrotor, etc.), and onboard sensors (camera, lidar, IMU, etc.). The project will also focus on the implementation of core robotics algorithms for localization, mapping, planning, and control in python. If time permits, additional objectives, such as connecting the simulation with OpenAI gym reinforcement learning algorithms to achieve navigation or manipulation, may be considered.
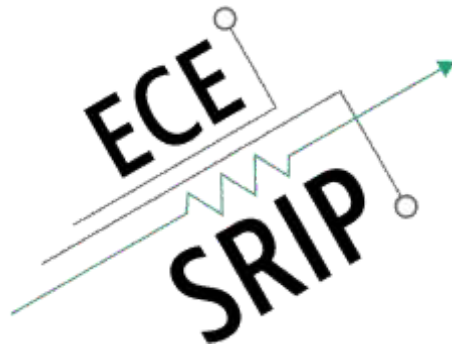
This project will be remote.

INTERNS NEEDED
2 Students

PREREQUISITES
Candidates are expected to be proficient in Python and to have taken a data structures and algorithms course, e.g., at the level of ECE141. Background in linear algebra and probability theory is required. Experience in robotics, e.g., at the level of Probabilistic Robotics by Thrun, Burgard & Fox is preferred but not required.

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PROJECT TITLE
Metric-Semantic Simultaneous Localization and Mapping

PROJECT DESCRIPTION
This project will focus on simultaneous localization and mapping (SLAM) in robotics using streaming visual and inertial data. The project will pursue novel research in sparse object-level or dense surface-level mapping. Depending on background and interests, aspects such as object pose estimation, object shape estimation, object-augmented visual-inertial odometry, or object-based loop closure will be considered. Alternatively, dense mapping, including geometric surfaces and semantic categories, may be considered for either indoor environments or outdoor terrain mapping. The objective is to achieve real-time metric-semantic mapping using real visual-inertial data.

This project will be remote.

INTERNS NEEDED
2 students

PREREQUISITES
Candidates are expected to be proficient in one programming language (e.g., C++ or python) and to have taken a data structures and algorithms course (e.g., at the level of ECE141). Strong background in linear algebra, probability, and estimation theory is expected. Experience with ROS (https://www.ros.org/) or machine learning is preferred but not required.
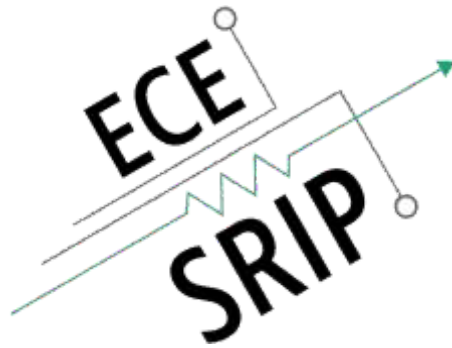
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PROJECT TITLE
Model-based Inverse Reinforcement Learning

PROJECT DESCRIPTION
This project focuses on teaching a robot from demonstration to navigate or pick objects up in an unknown environment. The objective is to implement an inverse reinforcement learning algorithm on a simulated robot in a pyBullet environment. Aspects such as modeling the robot environment or robot dynamics from onboard observations, designing robot motion primitives, and inferring motion costs will be considered.

This project will be remote.

INTERNS NEEDED
2 students

PREREQUISITES
Candidates are expected to have a background in machine learning and reinforcement learning. Proficiency with Python or C++ is expected. Experience with OpenAI Gym (https://gym.openai.com/) is preferred but not required.