

# Ruoyang 'Alex' Xu

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## Education

### Carnegie Mellon University

Master of Science in Robotics

- {ROBOField} in {LabName} advised by Dr. {ProfName}.

Pittsburgh, PA

August 2020 - August 2020 (expected)

### Georgia Institute of Technology

Bachelor of Science in Computer Engineering, GPA 3.88/4.0

- Minor in Robotics, and Computing and Intelligence

Atlanta, GA

August 2016 - May 2020

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## Skills

**Concepts:** Motion Planning, Navigation, Computer Vision, Machine Learning, Computer Architecture

**Programming:** Wrote a lot: Python, C++, MATLAB; Knows: C, Julia; Coursework: VHDL, Java

**Frameworks:** Linux/Unix, Git, ROS, PyTorch, Keras, CMake, Eigen.

**Publication:** J. S. Smith, R. Xu, P. Vela., egoTEB: Ego-centric, Perception Space Navigation Using Timed-Elastic-Bands, 2019, ICRA 2020.

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## Experience

### Intelligent Vision and Automation Lab | Georgia Tech

Student Research Assistant | Vision-based navigation

Atlanta, GA

August 2018 - July 2020

- **Perception space navigation** to reduces planning time and computation complexity for mobile and computationally limited platforms.
- Develop **local planning** algorithm that **directly plans in RGB-D sensor inputs**, benchmarked and evaluated in simulated Gazebo environment with monte-carlo rollouts with randomly populated obstacles, start, and goals.
- Developed a framework for benchmarking planner timings including execution rate, time, and message delays to evaluate between stages of planning.
- Transformed existing optimal local planner *Timed Elastic Band* to use **perception space representation**.

### Lab of Automatic and Control Engineering | Technical University of Munich

Summer Research Intern | Optimization-based Motion Planning

Munich, Germany

May 2019 - August 2019

- Highway driving scenarios using stochastic model predictive control for **uncertain agent interactions**.
- Developed a framework for recursively update belief of interaction in agents and represented as chance-constraint.
- Wrote MATLAB script for simulation environment and controller design, average planning rate of ~5Hz.
- Rewrote to **JuliaLang** with Convex.jl and JuMP.jl for performance enhancement analysis.

### Georgia Tech Systems Research Lab | Georgia Tech

Senior Design | Visual Inertial Odometry

Atlanta, GA

Jan 2020 - May 2020

- Deployed monocular **visual inertial odometry** on lightweight aerial vehicles with limited sensor quality and highly nonlinear dynamics.
- Developed image denoising and partial rejection framework, and modified DSO to achieve stable performance.
- Assessed system robustness to handle significant drift-free rotation and noisy image on self-collected datasets.

### Intelligent Ground Vehicle Challenge

Electrical Team | RoboJackets - Competitive Robotics at Georgia Tech

Atlanta, GA

August 2016 - August 2020

- **Electrical hardware experience** in building an autonomous robot capable of navigating off-road obstacle course.
  - Designed and constructed custom sensor and control platform using ARM mbed, implemented motion control algorithms and communication firmware between onboard computer.
  - Led the design of a vehicle-wide diagnostic system of distributed network of sensors for runtime awareness.
  - Developed an electrical training curriculum for incoming freshman; Volunteered for FTC competitions.
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## Relevant Coursework

**Introduction to Automation and Robotics:** Fundamentals in robotics from representation through manipulator kinematics, and control; End-effector planning through jacobian.

**Machine Learning:** Introduction to ML that covers **randomized optimization, supervised, unsupervised, and reinforcement learning**. Open ended projects for each topic for comparative algorithmic performance analysis and characteristic evaluation.

**Intro to Computer Vision:** Foundation of **classical computer vision**, Harris feature detector, SIFT feature descriptor, bag of words classification; stereo pose estimation; deep learning for classification in computer vision.

**Perception and Robotics:** Mobile robots **navigation stack** from perception (label recognition and classification) to execution (probabilistic localization and planning)