# Jiahe Xu

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## Education:

- **Johns Hopkins University** *08/2020 – 05/2022*
  Whiting School of Engineering, Robotics MSE ***Cumulative GPA: 3.9/4***
- **Jilin University** *09/2016 - 07/2020*
  Tang Ao-qing Honors Program in Computer Science ***Cumulative GPA: 89/100 3.6/4***
- **Massachusetts Institute of Technology** *08/2019*
  2019MIT Machine Learning & Artificial Intelligence Short Course ***Course Grade: 91.5/100***

**Core courses:**
JHU: Nonlinear Control and Planning in Robotics, Applied Optimal Control, Computer Vision, Deep Learning, Nonlinear Optimization I & II, Machine Learning: Advanced Topics, Deep Reinforcement Learning.
JLU: Operating Systems Principles, Computer Network, Compiler Principles, and Implementation, Data Structure, Discrete Mathematics, Advanced Mathematics, Principles of Embedded System.

## Work Experiences:

**Research on Unmanned Aerial Vehicle: Pick-and-Place task with UAV**
*Research Intern Dept. of ME, JHU ASCO Lab Director: Prof. Marin Kobilarov 06/2021-05/2022*
- Created an interactive visualization framework of debugging, optimizing, and state-checking. Implemented a GUI to represent the state of *UAV* with Qt and QcustomPlot.
- Took part in constructing the simulation environment in Gazebo.
- Implemented pick-and-place test routines and calibrations (camera & position estimator) in Gazebo.
- Deployed CNN to predict waypoints (mimic the decision of a local trajectory planner) and used MPC for local trajectory planning (Learning-based navigation).

**Research on Intelligent Pressure Control Ventilator**
*Research Intern Dept. of AMS Director: Prof. Antwan D Clark 06/2021-05/2022*
- Implemented a mathematical lung model and Pressure Control Ventilator in Simulink
- Designed an evaluation metric for the Reinforcement Learning agent's behavior (reward function)
- Applied DQN to train a professional controller for the intelligent ventilator machine.
- Designing new methods of measuring the ventilator controller's action.

**Research on Data Augmentation (DA) in CNN for ADAS tasks**
*Research Intern Dept. of CS, Jilin University Director: Prof. Lan Huang 06/2020-12/2020*
- Implemented different types of DA methods (geometric and photometric) in CNN major tasks.
- Applied Camera imaging Characteristics-based DA methods in different tasks and different datasets (KITTI COCO CIFAR-10 CIFAR-100 etc.)
- Used multi-thread programming to accelerate the DA procedure.
- Compared the combination of DA methods on imbalanced datasets and simple CNN models.
- Participated in visualizing the result of CNN (show bounding boxes and the environment) in Rviz.

## Professional Skills:

- Programming Languages: C/C++, Java, Python, Matlab, Simulink.
- Familiar with Linux, and Windows systems.
- Proficient with ROS/ROS2 RTOS, MySQL, Pytorch & Tensorflow.
- Worked with UR5, Jackal, TurtleBot, Pixhawk2 and RaspberryPi.
- Familiar with RRT, RRT*, PRM, A*, D*, hybrid A*, JPS, Dijkstra, MPC, iLQR, DDP algorithms.
- Github: https://github.com/JiaheXu

## Awards:

- The ACM-ICPC Asia Regional Contest Shenyang Site2016 Bronze Medal.
- The ACM-ICPC Asia Regional Contest Xi'an Site2017 Silver Medal.

## Course Projects:

**UAV trajectory planning in a haze**

- Used voxel to represent obstacles in a known maze.
- Applied shortest path algorithms to find an initial path.
- Took corner points (points that change direction) as initial settings for the CEM algorithm.
- After getting a converged solution from the CEM algorithm, used the T-spline curve to generate a segmented smooth path between two nearby points.
- To avoid obstacle collision near the corner, more waypoints are randomly generated around the corner to force the trajectories around corners to be straight lines.

**Autonomous car parking in a T-shape narrow alleyway**

- Designed methods to generate obstacle-avoiding paths with quadratic cost.
- Represent obstacles as circles and add a large cost when the car model is too close.
- Took different planners: DDP, iLQR, MPPI, and CEM for MPC and compared their efficiency.
- Manually added waypoints for DDP and iLQR methods to improve their performances.

**Human detection in indoor environments**

- Used Turtlebot robot to navigate in a known environment and update the map with lidar in real-time
- Applied self-developed localization package for locating.
- Added an infrared camera to the robot for human detection and record the location of each person to count how many people are inside the room.

**UR5 pick-and-place task**

- Completed the forward kinematic and inverse kinematic of UR5 in ROS.
- Planned a trajectory for UR5's current position to object's position with LQR.
- Applied PID control to make UR5 track the planned trajectory to reach the goal.

**Jackal object following task**

- Completed the forward kinematic and inverse kinematic of UR5 in ROS.
- Planned a trajectory for UR5's current position to object's position with LQR.
- Applied PID control to make UR5 track the planned trajectory to reach the goal.

**Intelligent Energy Saving Lamp System**

- Use CNN to detect if there is any user in the room.
- Connect the lamp system and some states of the room to an online server.
- Design a website page to log in to the server and check the lamp systems on a building.