# Yicheng Chen

Email : yicheng@buaa.edu.cn
Homepage : amos-chen98.github.io

## EDUCATION

- **Beihang University** — Sept. 2021 - Jun. 2024 (expected)
  *M. Sc. in Control Science and Engineering, GPA: 89.2/100* — Advisor: *Prof. Xiwang Dong*

- **Beihang University** — Sept. 2017 - Jun. 2021
  *B. Eng. of Automation with an outstanding graduate award, GPA: 88.5/100* — Advisor: *Prof. Honglun Wang*

**Main Courses**

**Mathematics**: Mathematical Analysis, Complex Functions, Optimization Methods, Numerical Analysis

**Control**: Principle of Control Theory, Intelligent Control Theory

**Robotics&Aerospace**: Autonomous Mobile Robots, Modeling and Simulation for Quadcopter, Aerospace Software Engineering

**Artificial Intelligence**: Pattern Recognition, Machine Learning

## RESEARCH INTERESTS

I am always enthusiastic about making robots smarter, safer, and more agile by leveraging methods from machine learning, control, and optimization.

## PUBLICATIONS

1. Yicheng Chen, Lingling Wang, "Adaptively Dynamic RRT*-Connect: Path Planning for UAVs Against Dynamic Obstacles", *2022 7th International Conference on Automation, Control and Robotics Engineering (CACRE)*, 2022. [slides, doi]

2. Huan Chang*, Yicheng Chen*, Baochang Zhang, David Doermann. "Multi-UAV Mobile Edge Computing and Path Planning Platform Based on Reinforcement Learning". *IEEE Transactions on Emerging Topics in Computational Intelligence*, 2021. [doi]

## RESEARCH EXPERIENCE

- **Cooperative Online Trajectory Planning for Autonomous Aerial Robotics Swarm** — Nov. 2022 - Present
  *Master's Thesis* — Advisor: *Prof. Xiwang Dong*
  - **Aim**: (1) Full autonomy: Fully onboard perception, self-positioning, planning, and control. (2) Online: Real-time flying in unknown environments. (3) Cooperation: Multiple drones to perform cooperative tasks, such as search and rescue.
  - **Method**: Parameterize trajectories in a spatial-temporal-decoupled form to achieve independent optimization on the spatial and temporal profile of the trajectory. Build an optimization framework to incorporate multiple constraints in a unified form. Use gradient-based solvers to solve the problem. Use multiple quadrotors equipped with depth cameras, Intel NUC, and Pixhawk to conduct real-world experiments.

- **Autonomous Navigation for Unmanned Ground Vehicles** — Mar. 2022 - May 2022
  *Personal project* — *Swarm Intelligence and Cooperative Control Lab, Beihang*
  - **Aim**: To navigate an unmanned ground vehicle in a cluttered environment.
  - **Method**: Use the gmapping algorithm to build an occupancy grid map. Use Timed Elastic Band (TEB) algorithm to achieve nonholonomic trajectory planning for the unmanned ground vehicle in the map.
  - **Achievement**: Achieved desirable mapping and motion planning on a car-like robot. [Real-world experiment videos]

- **RRT-based Efficient Path Re-planning for Aerial Robotics** — Dec. 2020 - Jun. 2021
  *Bachelor's Thesis* — Advisor: Prof. Lingling Wang
  - **Aim**: To explore how to reduce sampling times in RRT-based path re-planning to improve planning efficiency.
  - **Method**: To improve efficiency in sampling new nodes, proposed a strategy to automatically adjust the heuristic factor based on feedback from the sampling results. For avoiding collision with dynamic threats, introduced a pruning-reconnecting mechanism to repair the path when new obstacles emerge.
  - **Achievement**: Refer to Pub. 1: proposed a new algorithm called Adaptively Dynamic RRT*-Connect, which only requires 3.5% new samples to obtain a feasible path in re-planning compared with the existing benchmarks. I was awarded the *Best Presenter Award* for excellent oral presentation at the conference.

- **Path Planning in UAV-aided Mobile Edge Computing** — Jul. 2020 - May 2021
  *Researcher* — Advisor: *Prof. Baochang Zhang*
  - **Aim**: To address the path planning problem in a UAV-aided mobile edge computing mission to improve the quality of service for terminal users.
  - **Method**: Used a sigmoid-like function to depict the terminal users' demand to ensure a higher quality of service. Applied synthetic considerations of the terminal users' demand, risk, and geometric distance in reinforcement learning reward matrix to ensure the quality of service, risk avoidance, and cost-savings.

- ○ **Achievement**: Refer to Pub. 2: proposed a conceptual framework for path planning in mobile edge computing based on reinforcement learning.

- **Radiograph Classification for Diagnosing COVID-19** Mar. 2020 - May 2020
  *Team leader* *Course project for Pattern Recognition*
  - ○ **Aim**: Use machine learning approaches to help preliminary diagnosis of chest radiographs: classify radiographs into 3 classes – COVID, normal, and viral pneumonia with the highest possible accuracy.

  - ○ **Method**: Used transfer learning to train several models including ResNet, DenseNet, InceptionResNet, etc. on a labeled training set. Used stacking to ensemble these models to build a stronger model.

  - ○ **Achievement**: Achieved accuracy of more than 0.98. Especially, the model achieved almost 100% precision in the COVID class. Released the solution on Kaggle. This project got full marks in the course. [Codes]

- **Multifunctional Wheeled Robot Based on Arduino** Oct. 2018 - Dec. 2018
  *Team leader* *2018 Beihang Robot Competition*
  - ○ **Aim**: The project was for the 2018 Beihang Robot Competition. In the competition, participants were asked to build a robot that has the following functions: line tracking, obstacle avoidance, object grabbing with a robotic arm, and Bluetooth remote control. The robots were to perform a series of tasks and be rated accordingly.

  - ○ **Method**: Built a robot from scratch: used Arduino as the computer, incorporated infrared module and ultrasonic module for line-tracking and obstacle avoidance, built a tube with a paper bucket that can take in the objects, and achieved remote control via the Bluetooth module and an Android Application.

  - ○ **Achievement**: Completed the competition and ranked fourth place in the final. Got a lot of experience and more importantly, a great passion for robotics.

## International Learning Experience

- **Online Summer School by Peter the Great St. Petersburg Polytechnic University** Jul. 2020 - Aug. 2020
  *Team member* *2020 ECMI Modelling Week*
  - ○ **Activity**: Took part in the 2020 ECMI Modelling Week, worked with 4 Master students on a modeling problem of bolted assembly optimization in aircraft assembly.

  - ○ **Gain**: Finished a report through active teamwork, gave an oral presentation, and got 3 ECTS credits. [Report]

- **Summer School at Technical University of Denmark** Aug. 2019 - Sept. 2019
  *Visiting Student* *Department of Applied Mathematics and Computer Science*
  - ○ **Activity**: Studied in the Department of Applied Mathematics and Computer Science, finished the course *Introduction to Programming and Data Processing*.

  - ○ **Gain**: Accumulated some knowledge about data processing in MATLAB, got 5 ECTS credits, and a lot of beautiful photos.

## Skills Summary

- **English**: GRE (Verbal 152, Quantitive 170, AW 3.5), TOEFL iBT 105 (Reading 30, Listening 27, Speaking 22, Writing 26)

- **Programming**: Python, MATLAB, C/C++, LaTeX

- **Software**: ROS, Gazebo, AirSim, TensorFlow, PyTorch, Simulink, SolidWorks, AutoCAD

- **HardWare**: NVIDIA Jetson, Pixhawk, Motion Capture System

- **Hobbies**: Long-distance Running, Hiking, Cycling, Table Tennis, Snowboarding

## Honors and Awards

- Best Presenter of CACRE 2022

- Beihang Outstanding Graduate (2021)

- Merit Student Scholarship (2017, 2018, 2019)

- Fourth place in Beihang Robot Competition (2018)