

Resume – Jinze Liu

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EDUCATION

University of Michigan

Ann Arbor, MI, U.S.A.

Master of Science, Electrical and Computer Engineering

Sep. 2021 - Current

- GPA: 4.0/4.0
- Subjects: Motion Planning / Algorithmic Robotics / Robotic System / Mobile Robotics / Deep Learning for Robot Perception / Machine Learning / Probability and Random Processing / Matrix Methods for Signal Processing / Mathematics for Robotics

University of Michigan

Ann Arbor, MI, U.S.A.

Bachelor of Science, Computer Engineering

Sep. 2017 - Apr. 2021

- GPA: 3.9/4.0
- Subjects: Autonomous Robotics / Computer Vision / Machine Learning / Operating Systems / Compiler Construction / Linear Algebra / Data Structures and Algorithms / Computer Organization / Embedded Systems Design / Digital Integrated Circuits / Analog Circuits

Shanghai Jiao Tong University

Shanghai, People's Republic of China

Bachelor of Science, Electrical and Computer Engineering

Sep. 2017 - Aug. 2021

- GPA: 3.5/4.0
- Subjects: Program and Data Structures / Compiling and Programs / Probabilistic Methods in Engineering / Discrete Mathematics / Signals and Systems / Circuits / Logic Design / Electromagnetics / Semiconductor Devices / Honors Mathematics / Honors Physics / Chemistry

PUBLICATIONS

1. "Long-Term Multi-Destination Autonomous Navigation without HD Maps", **Jinze Liu***, Dongmyeong Lee*, Rui Chen, Qi Dai, Dianhao Chen, Maani Ghaffari, Jiunn-Kai Huang, and Jessy W. Grizzle, preparing for *Journal of Field Robotics*, 2023 (* co-first author) [\[Video\]](#) [\[Paper\]](#) [\[GitHub\]](#)
2. "CLF-CBF Constraints for Real-time Avoidance of Multiple Obstacles in Bipedal Locomotion", **Jinze Liu***, Minzhe Li*, Jiunn-Kai Huang, and Jessy W. Grizzle, accepted by *International Conference on Intelligent Robots (IROS)*, 2023 (* co-first author) [\[Video\]](#) [\[Paper\]](#) [\[GitHub\]](#)
3. "Realtime Safety Control for Bipedal Robots to Avoid Multiple Obstacles via CLF-CBF Constraints", **Jinze Liu***, Minzhe Li*, Jiunn-Kai Huang, and Jessy W. Grizzle, submitted to *Robotics and Autonomous Systems (RAS)*, 2023 (* co-first author) [\[Video\]](#) [\[Paper\]](#) [\[GitHub\]](#)

HONORS AND AWARDS

First Prize of National Olympiad in Informatics in Provinces

Nov. 2015

Bronze medal of Asia-Pacific Informatics Olympiad (China District)

May 2016

University Honors

Dec. 2019, Apr. 2021, Apr. 2021

Dean's List

Dec. 2019, Apr. 2021, Apr. 2021

James B. Angell Scholar

Mar. 2021

Multiple Obstacles CLF-CBF Planning System for Biped Robots

[Video](#)

Research Assistant in *Biped Robotics Lab, Prof. Jessy W. Grizzle*

May. 2022 - Current

- Improved CLF-CBF system with a single obstacle to generate the optimal control for the robot to avoid obstacles and reach the target position.
- Designed a multiple obstacle CBF function with the product of single obstacle CBF functions, enabling the robot to avoid obstacles when obstacles do not intersect with each other
- Built local planner in ROS to send optimal control commands to the robot based on the designed CLF-CBF system
- Built obstacle detector in ROS by finding the ellipse boundary for each obstacle in the map
- Found all the equilibrium cases of the designed CLF-CBF system
- Broke equilibrium case by applying a different CLF-CBF cost function in equilibrium case to prevent the robot from stopping at the equilibrium point

Long Term Multi-Destination Autonomous Navigation Without HD Maps

[Video](#)

Research Assistant in *Biped Robotics Lab, Prof. Jessy W. Grizzle*

May 2022 - Current

- Built an autonomy system for Cassie to navigate to a target position using a known topological map
- Projected LiDAR point clouds to camera images, then used color and intensity features of points to generate semantic point clouds by using SVM and dynamic programming
- Built the multiple layer map, including an elevation layer generated by LiDAR point clouds and a semantic terrain layer generated by the semantic point cloud, in order to provide information to motion planning
- Localized robot position by using a particle filter to align the extracted curb features with the curb landmarks provided in the topological map.
- Built a terrain planner to generate optimal control commands and keep Cassie walking down the middle of the sidewalk
- Sent control commands in the robot frame to Cassie through UDP
- Used ND filter to solve color issues of the Realsense camera under strong sunlight

Construction of Topological Maps Based on Elevation Maps

Research Assistant in *Biped Robotics Lab, Prof. Jessy W. Grizzle*

Sep. 2021 - Current

- Built an occupancy grid map with an elevation map and robot poses
- Efficiently generated the Voronoi graph of the occupancy grid map by finding all the Voronoi points, which have multiple nearest obstacle points
- Found critical points in the Voronoi graph, which are the Voronoi points with local minimum distance from the nearest obstacle point
- Divided unoccupied areas into different regions by connecting critical points and the corresponding nearest obstacle points
- Merged adjacent regions based on the convexity of merged regions to simplify the region division
- Represented obstacles by fitting lines to obstacle boundary
- Represented safe paths for the robot by finding the center of each region and connecting to adjacent critical points

Elevation Mapping with ORB-SLAM2 and LiDAR

Research Assistant in *Biped Robotics Lab, Prof. Jessy W. Grizzle*

Jul. 2021 - Sep. 2021

- Calibrated LiDAR and camera with a target-based method
- Published tf message and pose topic in ROS with the information in ORB-SLAM2
- Built elevation map only with LiDAR and camera

PROJECTS

Local Implicit Grid Representations for 3D Scenes

Team Leader

Winter 2023, Ann Arbor, MI, U.S.A.

- Reproduced the result in the paper, Local Implicit Grid (LIG) Representations for 3D Scenes
- Proposed an algorithm extension to give a good initial guess of a training parameter in the algorithm
- Estimated the curvature of 3D point cloud surfaces to give a good guess of the part size parameter

Semantic Graph-Based Place Recognition for Swarm-SLAM

[Gitlab](#)

Team Member

Winter 2023, Ann Arbor, MI, U.S.A.

- Reproduced the result of Swarm-SLAM, a recently developed decentralized collaborative SLAM system, with the KITTI-360 dataset
- Replaced the Scan Context algorithm, a geometry-based place recognition algorithm with LiDAR, in Swarm-SLAM and integrated Semantic Graph Based Place Recognition (SG-PR), a semantic-based place recognition algorithm with LiDAR, with Swarm-SLAM in order to detect better loop closures
- Debugged the Swarm-SLAM algorithm

Dynamic RRT* with Obstacle Cache Biased Sampling

Individual Project

Winter 2022, Ann Arbor, MI, U.S.A.

- Designed a path planning algorithm based on RRT*FN-Dynamic, which can work in environments with multiple known obstacles
- Designed to do sampling in the area previously blocked by dynamic obstacles, which is a good region to do sampling in since no RRT nodes exist in the area
- Disconnect and reconnect RRT trees until the robot reaches the target position

Indoor Positioning by IMU Sensor and Bluetooth Low Energy

Team Member

Summer 2021, SJTU, Shanghai

- Built indoor positioning system by combining the methods of IMU sensor and Bluetooth Low Energy with Kalman-based fusion
- Used Kalman filter to smooth the received signal strength indicator (RSSI) values from beacons
- Used Kalman filter to combine the measurement of two methods to get a more precise result

Multiple Object Tracking with Kalman Filter

Team Leader

Winter 2021, Ann Arbor, MI, U.S.A.

- Tracked multiple objects moving in a sequence of images and generated the trajectories
- Trained Yolov3 to detect the position of desired objects in images
- Used Kalman filter to estimate current position and velocity of objects from the previous state
- Compared estimated position and detected position to do object index assignment

Teach Robot to Dance

[Video](#)

Team Member

Winter 2021, Ann Arbor, MI, U.S.A.

- Let a humanoid robot, Pepper, mirror human's motion with a Kinect v1
- Used Kinect v1 to capture human's motion and get 3D skeleton key points in real time
- Retargeted human's 3D key points motion to robot joint values of Pepper robot
- Smoothed robot's control after dance finishes and display in the reply

WORK EXPERIENCE

Institute of Automation, Chinese Academy of Science

Internship Researcher, [Multimodal Artificial Intelligence Systems Lab](#), [Prof. Yisheng Lv](#) Aug. 2023 - Current

- Learned concurrent deep learning techniques
- Did literature reviews of deep learning based techniques applied in autonomous driving research
- Get involved in projects in the future

University of Michigan

Research Assistant, [Biped Robotics Lab](#), [Prof. Jessy W. Grizzle](#) Sep. 2021 - Apr. 2023

- Designed experiments and conducted experiments with our team
- Analyzed the recorded data and discussed with the team to improve the project design and experiment design
- Researched in motion planning, robot perception, SLAM, and autonomous systems for bipedal robots

Shanghai Jiao Tong University

Teaching Assistant, [Introduction to Computers and Programming](#), [Jigang Wu](#) Fall 2018

- Graded homework assignment and exam
- Designed questions for lab sessions and held lab sessions
- Answered students' questions through email and holding office hours

SKILLS

Programming	C/C++ (real-time system and multi-threading), Python, Matlab, Julia, Pascal
Libraries	ROS, Eigen, PCL, OpenCV, GTSAM
Others	Pspice, Multisim, Vivado, Origin, STM32, Libero