Lingdan Gu

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EDUCATION BACKGROUND

Xi'an Jiaotong Liverpool University (XJTLU), China 09/2021 – 07/2025
BEng in Intelligent Robotics Engineering with Contemporary Entrepreneurialism | Overall **GPA: 3.83/4.0**

Coursework (Math & Physics & Robotics): Multivariable Calculus | Linear Algebra | Engineering Mathematics | Physics | Sensors and Instrumentation | Microprocessor Systems | Dynamic Systems | Electrical Circuits | Mechatronics | Engineering Drawing | Analogue and Digital Circuits | Intelligent Robotics and Application

PUBLICATION

Chen W, Lu Q, **Gu L**, et al. *Development of a Bionic Metastructure and Its Coupling to Sensor Fusion* [C]. International Conference on Mechatronics and Intelligent Robotics. Singapore: Springer Nature Singapore, 2023: 355-361.
Lingdan Gu, *Pedestrian Identification Through Vibration Monitoring and Machine Learning,* Rita, In Press
Jiang H, **Gu L**, et al. AgileVision Academy: Indoor Drone Navigation and Obstacle Avoidance, ITME 2024, Accepted

RESEARCH EXPERIENCES

Feature Extraction and Classification of Sensitive Targets
Research Assistant | Advisor: Prof. Wei Chen 05/2023 – 02/2024

- Developed a bionic stone system embedding sensors to collect real-time audio and vibration signals, achieving 94% classification accuracy in distinguishing pedestrians from vehicles using lightweight deep neural networks, with real-time latency reduced by 30%:
  - Characterized the limitations and errors of conventional signal feature extraction technique via FFT with the presence of background noises and multiple target audio/vibration signals
  - Developed novel feature extraction algorithms for audio and vibration signals, including Mel frequency cepstrum and wavelet decomposition, to enhance noise reduction and classification accuracy
  - Established a multi-sensor, multi-objective convolutional neural network to drive classification and recognition, followed by model optimization via re-structuring and regularization
  - Evaluated the system in 10 real-world environments with varying noise levels and signal interference and demonstrated its robust performance with a latency of 100ms per classification

Development of a Robust and Adaptive Navigation System for Drone
Research Assistant | Advisor: Prof. Fanxin Wang 06/2024 – 09/2024

- Developed a robust and adaptive navigation system for drones that can operate autonomously in complex indoor environments, enhancing their agility and reliability
  - Designed and assembled lightweight drones incorporating essential sensors such as cameras, lidars, and inertial measurement units
  - Implemented visual mapping using an Intel RealSense camera to collect 3D data and convert it into a 2D grid map via bird's-eye view (BEV) transformation
  - Designed and implemented an A* algorithm for path finding, integrated with a model predictive control (MPC) algorithm to optimize energy efficiency, minimize flight time, and ensure effective obstacle avoidance
  - Deployed a nonlinear model predictive control (NMPC) for real-time trajectory following and deployed an Explicit model predictive control scheme to optimize performance metrics, enabling the system to accurately predict and adapt to changing conditions
  - Conducted extensive simulations to test the drone's navigation capabilities in various environmental conditions

WORK EXPERIENCES

***Robotics R&D Intern* | DeepBlue Technology Co., Ltd., Shanghai, China** 06/2022– 09/2022

- Coordinated a team of six to design, prototype, and test a robot for playing chess, integrating vision systems, chess engines, and robotic manipulators:
  - Trained an EfficientDet computer vision model to enable scalable and efficient chess board recognition; built anchor boxes set with k-means clustering to facilitate chess piece detection
  - Designed, simulated, and built a robotic arm for moving the chess pieces; performed forward and inverse kinematics modeling; established inter-joint spatial relationship; conducted trajectory planning via Cartesian space planning method; performed simulation in MATLAB to verify the smoothness and compliance of motion
  - Implemented a set of AI algorithms to drive chess playing, covering board representation, min-max searching, alpha-beta pruning, null move heuristic, and quiescence searching to minimize the time/space complexity; optimized board evaluation functions via genetic algorithms to further improve the computational efficiency
  - Adopted a set of system engineering principles to drive iterative, team-driven, divide-and-conquer system integration and testing

***Algorithm Engineer Intern* | Suzhou Inovance Tech Co. Ltd., Suzhou, China** 07/2023 – 08/2023

- Designed, implemented, and validated an integrated system for automatic vial defect detection:
  - Leveraged a set of proprietary platforms (Jinovision, Finovision) to drive computer vision and deep learning

model construction

- Implemented Sobel-Feldman, Canny, and morphological image processing techniques for edge detection and region-of-interest (ROI) extraction; achieved 94.5% detection accuracy under varying lighting and environmental conditions
- Trained and validated a set of fit-for-purpose CNN models to drive classification; performed hyperparameter tuning to boost model performance, leading to a 7% increase in precision and a 5% decrease in false negatives; controlled the learning rate using the cosine annealing algorithm

EXTRACURRICULAR EXPERIENCES

***Team Member* | DJI RoboMaster Robotics Competition** 08/2021 – 08/2022

- Joined a cross-departmental team to prepare for the DJI Robomaster competition, focusing on the development and operation of robots that launch projectiles at opponents in order to deduct Hit Points:
  - **Control:** customized a PID algorithm via parameter tuning and Simulink-based simulation; enabled omnidirectional robot motion control with Mecanum wheels; integrated and fine-tuned the MPU6050 IMU for real-time gimbal stabilization; implemented Bluetooth communication via I2C
  - **Embedded System:** performed PCB design/testing using Altium Designer and NI Multisim, embedded system design and programming based on Keil uVision and STM32CubeMX
  - **Mechanical Design:** Modeled robotic components in SolidWorks, optimizing for structural integrity, weight efficiency, and manufacturability; managed part production using CNC machining, laser cutting, and 3D printing; conducted iterative testing and fine-tuning of bullet-loading mechanisms, Mecanum wheels, and gimbal mounts to enhance performance under competition conditions

***Navigation Team Leader* | China Collegiate Intelligent Vehicle Competition** 09/2022 – 08/2023

- Led a team of three to design and prototype an intelligent vehicle capable of autonomous navigation and motion control for agricultural applications:
  - Implemented control algorithms in C++ and Python, covering voice control, SLAM, path planning, obstacle avoidance, target crop recognition, and navigation
  - Employed simultaneous localization and mapping (SLAM) techniques for concurrent location tracking, and map updating; created maps using Gmapping and Cartographer
  - Levergaed the navigation package in ROS to enable the robot to autonomously navigate and avoid obstacles
  - Used A* algorithm and Teb algorithm for global and local trajectory planning; optimized performance through iterative tuning in Rviz, reducing path planning time by 30% and achieving 100% success rate in obstacle avoidance

COURSE PROJECTS

Final Year Project (FYP): Path Planning for Swarm of Pollination Robots in Agriculture 09/2024 – Present

- Developed a multi-robot system for autonomous pollination using a swarm of hummingbird robots, focusing on efficient path planning, collision avoidance, and formation control:
  - Implemented Multi-Agent Path Finding (MAPF) using Conflict-Based Search (CBS) to coordinate multiple aerial vehicles, resolving agent conflicts and generating collision-free paths through recursive constraint-based resolution
  - Integrated Velocity Obstacle (VO) Algorithm for local path planning and obstacle avoidance, allowing real-time adjustments based on the actual velocities and positions of the agents
  - Designed a formation control algorithm using the Leader-Follower model to maintain the formation of the swarm, to ensure orderly execution of tasks over large agricultural fields

Project, Problem Solving and Sustainability in Robotics Course Project, XJTLU 03/2023 – 05/2023

- Designed and developed a robot for pollinating crops, which consisted of a mobile car with a mounted robotic arm:
  - Compared various path planning algorithms and ultimately chose Rapidly Exploring Random Tree (RRT) as the global path planning strategy
  - Used the Levenberg-Marquardt algorithm provided by Moveit for adjusting and controlling specified positions of cameras' location and angles
  - Employed yolov5 visual recognition algorithm to identify and classify crops

AWARDS AND HONORS

University Academic Achievement Award (Top10%) 08/2024

The 3rd Prize | The 18th China Collegiate Intelligent Vehicle Competition (Intelligent Agriculture Group) 08/2023

The 3rd Prize | China-U.S. Young Maker Competition (Suzhou Division) 08/2022

The 1st Prize | The 21st China Collegiate Robotics Competition (RoboMaster) 08/2022

SKILLS

Programming Languages: C/C++ | Java | Python | MATLAB | SQL | AHDL | Verilog | Assembly
Libraries: TensorFlow | NumPy | SciPy | Pandas | Scikit-Learn | Scrapy | Matplotlib | Selenium
Software: Gazebo | RViz | ROS | SolidWorks | Creo | Keil | Linux | Simulink | STM32CubeMX | Arduino
Hobbies: Go (a Chinese abstract strategy board game) | Soccer