ZHONGMING HUANG

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EDUCATION

University of Colorado Boulder (Colorado, United States)　　　　Aug. 2025 - May 2029 (Expected)
Ph.D. in Mechanical Engineering (incoming)
Advisor: Prof. Chahat Deep Singh (PRAISe Lab)

Cornell University (New York, United States)　　　　Aug. 2023 - Dec. 2024
M.Eng. in Electrical and Computer Engineering
GPA: 3.914/4.3
Research experience: *Graduate Research Assistant at the Collective Embodied Intelligence Lab (CEI Lab) and Napp Lab.*
Related courses: *Robots as Embodied Algorithms, Fast Robots, Bio-inspired Coordination of Multi-Agent Systems, Optimal System Analysis and Design, Statistical Inference and Decision, Computer Vision.*

Tiangong University (Tianjin, China)　　　　Aug. 2019 - Jun. 2023
B.Eng. in Telecommunications
GPA: 3.81/4.0 (top 2%)
Research experience: *Undergraduate Research Assistant at the Robotics Lab of Tiangong University.*
Related courses: *Embedded System, Control Theory, Mathematical Modeling, Communication Theory, Computer Networks, Digital Signal Processing.*

RESEARCH EXPERIENCE

Design and Control of a Multi-robot Construction System　　　　Sep. 2023 - Present
Supervisors: Prof. Kirstin Petersen (CEI Lab) *and Prof. Nils Napp* (Napp Lab)　　　　Cornell University

- Developed control strategies for 15-DoF quadruped robots with ESP32 MCU and Raspberry Pi 4B, enabling robots to autonomously climb the structure, navigate to a docking station, retrieve, place/align, and fasten 2:1 blocks with T-pins.
- Co-designed visual fiducials on the brick and computer vision algorithms on the robot to enable pose detection.
- Utilized AprilTags to determine the global pose of the robot outside the structure for navigation to the docker.
- Designed steady gait patterns for each intermediate construction procedure with visual pose feedback.
- Established a OpenGL real-time visualization framework to demonstrate the construction environment including the building process, robot pose and position, kinematics and inverse kinematics.
- Currently enhancing an existing decision framework to achieve collective robotic construction using 2:1 rectangular blocks in simulation.
- Paper [1] will be presented and published at IROS 2025.

Semantic Segmentation based on Polygon Vertices Regression　　　　Sep. 2022 - May 2023
Supervisor: Prof. Xiuyan Li　　　　Tiangong University

- Improved upon Poly-YOLO in segmenting larger objects [2] and adapted it with a modified YOLOv5 backbone to provide more accurate enclosing of a semantic object.
- Reconstructed the output layer of YOLOv5-s to embed a fixed-length tensor to each bounding box output tensor as the prediction for the contour of a semantic object.
- Experimented on the Cityscapes dataset, achieved 31.4% Mask mAP at 24FPS on a mid-end GPU.

Accurate Small Liver Cancer Detection with Improved EfficientNet　　　　Mar. 2022 - Jun. 2022
Supervisor: Prof. Xiuyan Li　　　　Tiangong University

- Developed a model that can better detect subtle small liver cancer (small hepatocellular carcinoma) in CT scans that may help with early stage liver cancer diagnosis [3].

- Integrated self-attention into the front end of EfficientNet to enhance the network's ability to differentiate features between healthy and cancerous livers in CT scan images.
- Conducted experiments on the LiTS dataset, achieving a test detection accuracy of over 97%.

6-DoF Robot Grasping with Partial Occlusions
Supervisor: Prof. Yukuan Sun

Jan. 2022 - Jun. 2022
Tiangong University

- Aimed to optimize the best-next-grasp for a partially covered target in a cluttered scene.
- Designed scoring algorithms that utilize 3D scene layout information from a single fixed camera to determine the next grasp [4]. This approach weights the occlusion area and grasp pose confidence using a non-linear method.
- Conducted experiments in CoppeliaSim with a simulated UR5 robot, improving the success rate by $4\times$ after applying the best-next-grasp algorithm.

Design and Control of Intelligent Quadrotor Drones
Supervisors: Prof. Yukuan Sun and Dr. Di Zhao

Dec. 2020 - May 2022
Tiangong University

- Built two quadrotor drones for logistics and aerial fire detection tasks, respectively. Used the TI MSP432 MCU as the lower-level PID rotor controller, integrating desired pose, IMU, and ToF feedback.
- Integrated an OpenMV camera module and a 1-DoF gripper on the logistics drone for picking and placing objects in designated spots. Installed an Nvidia Jetson Nano development board with a camera on the fire detection drone for visual-based fire detection.
- Proposed and implemented a computationally efficient fire detection algorithm, which identifies fire patterns in video streams by analyzing temporal brightness patterns of each pixel[5], [6].

PUBLICATIONS

[1] **Zhongming Huang**, H. Yao, H. Peng, S.-m. Lin, K. Petersen, and N. Napp, "Robust robotic assembly of reusable, rectangular blocks," to appear in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2025.
[2] **Zhongming Huang**, "Semantic road segmentation based on adapted poly-yolo," in *Journal of Physics: Conference Series (Vol. 2580, No. 1, p. 012015). IOP Publishing.*, 2023. [Online]. Available: `https://iopscience.iop.org/article/10.1088/1742-6596/2580/1/012015/meta`.
[3] Y. Wang and **Zhongming Huang**, "High precision small hepatocellular carcinoma detection using improved efficientnet with self-attention," in *2022 IEEE/ACIS 22nd International Conference on Computer and Information Science (ICIS) (pp. 76-81). IEEE.*, 2022. [Online]. Available: `https://ieeexplore.ieee.org/abstract/document/9882470/`.
[4] **Zhongming Huang** and S. Yang, "6-dof occluded object semantic grasp planning with de-occlusion instance segmentation," in *2022 5th International Conference on Intelligent Autonomous Systems (ICoIAS) (pp. 66-71). IEEE.*, 2022. [Online]. Available: `https://ieeexplore.ieee.org/abstract/document/9931318/`.
[5] **Zhongming Huang**, Y. Wang, H. Hu, X. Liu, T. Liu, and Z. Zhang, "Dynamic feature extraction using i-vector for video fire detection," in *2022 3rd International Conference on Pattern Recognition and Machine Learning (PRML) (pp. 26-31). IEEE.*, 2022. [Online]. Available: `https://ieeexplore.ieee.org/abstract/document/9882243/`.
[6] **Zhongming Huang**, Y. Wang, H. Hu, X. Liu, T. Liu, and Z. Zhang, P.R.China Computer Software Copyright #2022SR0916949, 2022.

ACHIEVEMENTS

Dean's Fellowship of Excellence, University of Colorado Boulder	Apr. 2025
Excellent Senior Thesis Award, Tiangong University (top 1 in the department)	May 2023
Best Presentation Award [4], [5]	Jul. 2022 & Sep. 2022
First-class Scholarship, Tiangong University	2020 & 2021
Provincial Second Prize, the 16th "Challenge Cup" Student Technology Competition	Jun. 2021

SKILLS

Programming Languages	Python, C, Arduino, MATLAB, HTML, VHDL
Tools	Linux, Fusion 360, FDM Printing, OpenCV, OpenGL, TensorFlow, PyTorch, LaTeX
English	TOEFL 109, GRE 330 (AW 4), CET-6