ZHONGMING HUANG

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EDUCATION

Cornell University (New York, United States) *Aug. 2023 - Dec. 2024 (expected)*
M.Eng. in Electrical and Computer Engineering
GPA: 3.82/4.3
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) *Sep. 2019 - Jun. 2023*
B.Eng. in Telecommunications
GPA: 3.81/4.0
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] is under review at the 2025 IEEE International Conference on Robotics and Automation (ICRA).

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 Jan. 2022 - Jun. 2022
Supervisor: Prof. Yifei Shi National University of Defense Technology

- 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× after applying the best-next-grasp algorithm.

Design and Control of Intelligent Quadrotor Drones Dec. 2020 - May 2022
Supervisors: Prof. Yukuan Sun and Dr. Di Zhao 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 a computationally efficient fire detection algorithm [5], which identifies fire patterns in video streams by analyzing the brightness patterns of each pixel over time. Implemented this algorithm on the fire detection drone [6].

PUBLICATIONS

[1] **Zhongming Huang**, H. Yao, H. Peng, S.-m. Lin, K. Petersen, and N. Napp, "System design for robotic construction with reusable, off-the-shelf material and fasteners," under review with the *2025 IEEE International Conference on Robotics and Automation (ICRA)*.

[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.

[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.

[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.

[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.

[6] **Zhongming Huang**, Y. Wang, H. Hu, X. Liu, T. Liu, and Z. Zhang, P.R.China Computer Software Copyright #2022SR0916949, 2022.

ACHIEVEMENTS

Excellent Senior Thesis Award, Tiangong University	*May 2023*
Best Presentation Award [4], [5]	*Jul. 2022 & Sep. 2022*
First-class Scholarship, Tiangong University	*2020 & 2021*
Provincial Second Prize, the 16^{th} "Challenge Cup" Student Technology Competition	*Jun. 2021*
National Supreme Prize, National English Competition (NECCS)	*Dec. 2020*

SKILLS/HOBBIES

Programming Languages	Python, C, Arduino, MATLAB, HTML, VHDL
Tools	Linux, Fusion, OpenCV, OpenGL, TensorFlow, PyTorch, LaTeX
English	TOEFL 109, GRE 330(AW4)
Hobbies	fitness, badminton, music, photography