Houhao Liang

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SUMMARY

Highly motivated and detail-oriented Data Science professional with a specialization in Robotics and Vision-based methodologies. Four years of research experience in the conceptualization, design, and development of robotics systems for infrastructure project monitoring, automated data collection, and decision-making, consistently demonstrating resilience and the ability to execute tasks swiftly under pressure. Multiple internships experience in data analysis, report writing, and project management. Skilled in creating AI and robotics solutions tailored for construction management. Eager to contribute to a challenging role, applying robotics and computer vision to solve industry problems and translate research into practical applications.

EDUCATION

National University of Singapore, Singapore, Singapore — Aug. 2019 — Expected Feb. 2024
Ph.D. in Construction Management

- Thesis Title: Unmanned Ground Vehicle-Driven Indoor Monitoring: Enhancing Routine Data Acquisition And On-Site Deployment
- Advisor: Dr. Justin Yeoh, Prof. David Chua

University of Illinois at Urbana-Champaign, Urbana-Champaign, US — Aug. 2017 — May. 2019
M.S. in Civil and Environmental Engineering

- Research study on "Visual Sensing for Civil Infrastructures".
- Advisor: Dr. Jacob Lin, Prof. Mani Golparvar-Fard
- Relevant Coursework: Machine Learning; Computer Vision; Data Mining; Virtual Design and Construction
- Cumulative GPA: 3.78/4.0

Central South University, Changsha, China — Sep. 2014 — Jun. 2018
B.S. in Civil Engineering, specialized in Bridge Engineering.

- Relevant Coursework: Fundamental of Computer Science; Construction Economics; Project Management
- Cumulative GPA: 88.72/100, Rank: 34/497 (Top 7%)

RESEARCH EXPERIENCE

National University of Singapore — Singapore, Singapore
Research Engineer (Systems Developer) — Aug. 2023 — Present

- Designing a digital twin system within Unity, aimed at revolutionizing manufacturing and assembly processes through the integration of intelligent inspection and measurement functionalities.
- Developing a HoloLens application, embedding advanced tracking, evaluation, and visualization tools for the efficient management of the prefabricated component installation process.

National University of Singapore — Singapore, Singapore
Graduate Researcher — Aug. 2019 — Aug. 2023

- Doctoral research study on the development and deployment of an automated UGV for progress monitoring and inspection system of building structure.

  - Implemented a video-based method to generate a reliable navigation map accounting for scene changes as a mapping process, resulting in improved task planning and enhanced localization.
  - Developed a learning-based method to semantically segment building objects at the point level leveraging a 2D-3D fusing approach. Increased the 3D point cloud segmentation accuracy by up to 20
  - Innovated a perspective alignment method for improving the localization accuracy of UGV by matching cross-modality images, resulting in reduced alignment error including angle and distance to enhance decision confidence made by the UGV.
  - Dynamically optimized data acquisition tasks using a Genetic Algorithm, given the progress and time-points, ensuring efficient on-site implementation of UGV and minimizing redundant data collection.
  - Collaborated with team members to develop a similarity-based method for automatic filtering of facade images captured by UAVs for enhanced documentation, reducing 116 images to a set of six representative images.
- Actively presented research results and insights at local and international scientific conferences and meetings.

University of Illinois at Urbana-Champaign Urbana-Champaign, US
Graduate Researcher Dec. 2017 — May. 2019

- Collaborated with doctoral students to conduct learning-based image data analysis to automatically recognize construction activities and quantify the project progress.
- Created an extensive image dataset related to construction activities, with the intention of analytics and prediction.
- Studied an automated method to identify BIM elements from 2D drawings and link elements with the corresponding schedule.

PROFESSIONAL EXPERIENCE

China Construction Fifth Engineering Division Corp Changsha, China
Intern Apr. 2017 — Jun. 2017

- Investigated the methods of collecting project progress data and participated in the weekly monitoring.
- Consolidated and produced reports for staff to be used for project delay analysis and control improvement.

TEACHING AND SUPERVISORY EXPERIENCE

National University of Singapore
Teaching Assistant
CE 2183/ TCE 2183 Construction Project Management Aug. 2019 — Present

- Graded assignments and guided students to finish their project of planning the construction of part of a sewage treatment plant.
- Prepared course material including tutorials, practice problems, and course projects.
- Led weekly tutorial and/or problem-solving and discussion sections for groups of 15-30 students.

CE 2102 Principles & Practice in Infrastructure and Environment Jan. 2020 — May. 2021

- Coordinated group sessions for 20-30 students on the impact of civil infrastructures on the environment.
- Guided students to finish their group project to provide a framework for understanding and evaluating infrastructure projects from a holistic perspective covering the technical feasibility, economic, environmental, and social aspects.

Student Advisor Jan. 2021 — Dec. 2021

- Co-supervised two final-year undergraduate research students in developing a simulated Gazebo platform to monitor construction progress, and automated data filtering for façade defect inspection. Guided literature survey, experimental techniques, thesis writing, and edited drafts.
- Coached 5 undergraduates and 1 master student, convened monthly meetings to track research progress, and advised students' transitions into consulting, and Ph.D. program.

PROFESSIONAL MEMBERSHIP

Student Member, American Society of Civil Engineers (ASCE) 2017 — Present
Reviewer, ASCE Journal of Construction Engineering and Management 2023 — Present
Reviewer, ASCE Journal of Computing in Civil Engineering 2023 — Present
Reviewer, Computer-aided in Civil and Infrastructure Engineering 2023 — Present
BIM Modeler, China Graphics Society 2017 — Present
General Associate, Leadership in Energy and Environmental Design (LEED) 2019 — 2021

TECHNICAL SKILLS AND LANGUAGES

Programming: Python, MATLAB, C++, ROS
Software: AutoRevit, AutoCAD, Primavera
Language: Mandarin, English
Soft Skills: Resilience, Self-Motivation, Goal-Oriented, Curiosity

AWARDS

Best Presentation Award Pattaya, Thailand
Best Presentation for the 34th KKHTCNN Symposium on Civil Engineering 2023

Research Scholarship Singapore
To outstanding PhD candidates to pursue a full-time graduate research degree at NUS 2019 — 2023

Dean's List - Central South University Changsha, China
Awarded for Academic Excellence to Distinguished Undergraduate Students. 2018

Central South University Outstanding Student Changsha, China
Award for academic excellence: recognizing outstanding students. 2015

Central South University Scholarship Changsha, China
Annual academic achievement award for undergraduate students 2014 — 2018

PUBLICATIONS

Referred Academic Journals Published and Under Review

5. **H. Liang**, Y. Weng, S. W.Y. Tang, and J. K.W. Yeoh. (2023). "Automated Filtering of Façade Defect Images Using a Similarity Method for Enhanced Inspection Documentation," *Building Research & Information.* (Published)

4. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. "Material augmented semantic segmentation of point clouds for building elements," *Computer-aided Civil and Infrastructure Engineering.* (Under Review)

3. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. "Robust Alignment of UGV Perspectives with BIM for Inspection in Indoor Environments," *Journal of Computing in Civil Engineering.* (Under Review)

2. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. "Progress-Driven Waypoint Planning for UGV-based Data Collection," *Automation in Construction.* (Under Review)

1. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. "Transit objects removal in point cloud scene for a generation of a robust robot navigation map," *Journal of Computing in Civil Engineering.* (Under Review)

Referred Conference Proceedings

4. **H. Liang** and J. K.W. Yeoh. (2023) "Automated Filtering of Façade Defect Images Using a Similarity Method for Enhanced Inspection Documentation," *The 34th KKHTCNN Symposium on Civil Engineering*, Pattaya, Thailand.

3. **H. Liang** and J. K.W. Yeoh. (2023). "Transit Construction Object Detection, Tracking, and Segmentation in Construction Site Video Frames," *ASCE International Conference on Computing in Civil Engineering 2023 (I3CE 2023)*. Corvallis, OR, US

2. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. (2022). "Progress-Oriented Waypoint Sampling for Unmanned Ground Vehicle Mission Planning," *Proceedings of the 22nd International Conference on Construction Applications of Virtual Reality (CONVR2022)*. Seoul, South Korea

1. **H. Liang**, J. K.W. Yeoh, and D. K.H. Chua. (2021). "Accurate matching between BIM-rendered and real-world images," *Proceedings of the 1st Future of Construction Workshop at the International Conference on Robotics and Automation (ICRA 2022)*. Philadelphia, PA, US

PRESENTATIONS (*Conference, ˜Industry)

7. **Conference Presentation*. Automated Filtering of Façade Defect Images Using a Similarity Method for Enhanced Inspection Documentation. *The 34th KKHTCNN Symposium on Civil Engineering*. Pattaya, Thailand, November 23, 2023

6. **Conference Presentation*. Transit Construction Object Detection, Tracking, and Segmentation in Construction Site Video Frames. *ASCE International Conference on Computing in Civil Engineering 2023 (I3CE 2023)*. Corvallis, OR, US, June 26, 2023

5. **Conference Presentation*. Progress-Oriented Waypoint Sampling for Unmanned Ground Vehicle Mission Planning. *Proc. 22nd International Conference on Construction Applications of Virtual Reality*. Seoul, South Korea, November 17, 2022

4. **Conference Presentation*. Accurate matching between BIM-rendered and real-world images. *Proc. of the 1st Future of Construction Workshop at the International Conference on Robotics and Automation*. Philadelphia, PA, US, May 23, 2022

3. ˜*Research Presentation*. Robust Alignment of UGV Perspectives with BIM for Inspection in Indoor Environments. *Home Team Science and Technology Agency*, Singapore, July 21, 2022

2. *Research Seminar Presentation*. Progress-oriented waypoints optimization for UGV image acquisition. *National University of Singapore*, Singapore, Feb 24, 2022

1. *Research Seminar Presentation*. UGV pose rectification in BIM using a two-phase alignment for indoor monitoring. National University of Singapore, Singapore, Feb 24, 2022