

**Jingdao Chen**  
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## Education

### Georgia Institute of Technology

Ph. D. in Robotics

Dissertation: 3D Segmentation and Damage Analysis from Robotic Scans of Disaster Sites

Core Areas: Perception, Artificial Intelligence

Atlanta, GA

May 2021

### Georgia Institute of Technology

M.S. in Computer Science

*Specialization in Machine Learning*

Atlanta, GA

Dec 2019

### Washington University in St Louis

B. S. in Electrical Engineering, Computer Science minor

*Summa Cum Laude*

St. Louis, MO

May 2015

## Research Focus

My research is centered on creating rich, versatile, and informative 3D representations of the built environment through point cloud data. Emerging technologies such as robotics and ubiquitous sensing allow spatial data to be collected on a large-scale basis from civil infrastructure, yet interpreting the raw data and rendering it into formats that are useful for end users remains a fundamental challenge. My research aims to leverage databases of known building element models to infer structure and semantics from an unknown 3D scene [J1, J3, J4]. Machine learning and computational geometry techniques are used to process 3D point clouds and associate scanned objects with their corresponding design models [J7, C5]. Real-time algorithms have been developed that enable these data parsing solutions to be deployed on robotic platforms [J6, C10]. The algorithms are designed to deal with data imperfections such as occlusion and clutter in unstructured environments such as construction sites [J4, J11, J15] and disaster sites [C6-7, C10]. The research also has diverse potential applications in the fields of AR/VR, autonomous driving, and remote surveillance.

## Experience

### Georgia Institute of Technology, RICAL Lab

*Graduate Research Assistant with Dr. Yong K. Cho*

Atlanta, GA

Jun 2015 – May 2021

- Studied the theory and application of intelligent robots for construction automation
- Investigated real-time 3D infrastructure mapping with Lidar-mounted mobile robots
- Explored deep learning methods for semantic understanding from point cloud scenes
- Developed cloud-based infrastructure and real-time visualization tools for smart equipment operation

### Facebook, Inc.

*AR/VR Research Intern with Dr. Daniel Huber*

Menlo Park, CA

May 2020 – Aug 2020

- Conducted research in 3D scene understanding with deep learning for AR/VR applications

### Wheego Technologies, Inc.

*Intern, Autonomous Vehicle Project*

Atlanta, GA

May 2017 – Jul 2017

- Applied deep learning tools for the task of object detection from monocular camera
- Implemented computer vision algorithms for object tracking across video frames
- Performed large-scale object motion auto-annotation with Lidar data
- Designed an image-based distance estimation framework for longitudinal vehicle control

### Hunter Engineering Company

*Computer Science Co-op, Wheel Balancer Project*

St. Louis, MO

Jan 2014 – Jul 2014

- Developed software for the Wheel Balancer using C++ on Linux platform
- Designed a data-driven approach to feature testing with SQL databases
- Performed 3D modelling of wheel surfaces with laser-guided computer vision

### Washington University, Electrical and Systems Engineering

*Undergraduate Research Assistant, Autonomous Quadcopter Project*

St. Louis, MO

Sep 2013 – Dec 2013

- Developed computational tools for optimized control of an autonomous quadcopter
- Benchmarked numerical algorithm performance on embedded Linux
- Coded Python wrappers for numerical optimization libraries including SNOPT, NPSOL, NLOPT, and IPOPT

### Teaching Experience

#### CEE 8813 – Automation in Construction

*Co-developer and Instructor*

Georgia Institute of Technology

*Fall 2018, Fall 2019, Spring 2021*

- Prepared course materials and lectured for several class modules involving AI/ML in construction

#### Center for Teaching and Learning Certificate

*Tech to Teaching Certificate*

Georgia Institute of Technology

*Spring 2019 – Fall 2019*

- Completed two graduate-level courses to prepare future faculty in pedagogy and course design
- Completed a capstone practical teaching experience with peer review and feedback

#### CSE 241 – Data Structures and Algorithms

*Teaching Assistant*

Washington University

*Fall 2014*

- Held office hours and graded assignments and exams

### Mentoring Experience

- Mentored a student for CSE/CEE Master's thesis which culminated in a published research paper
- Mentored two students for CS undergraduate research which culminated in a published research paper

### Honors / Awards

- Best Paper Award (co-author), "SLAM-driven Intelligent Autonomous Mobile Robot Navigation for Construction Applications." (2018) European Group for Intelligent Computing in Engineering (EG-ICE), 25<sup>th</sup> Workshop, Lausanne, Switzerland
- Best Poster Award: 2<sup>nd</sup> runner-up, "Semantic Parsing of 3D Point Clouds for Construction Progress Estimation." (2018) Construction Research Congress (CRC), New Orleans, LA.
- Best Poster Award, "Autonomous Mobile Robot Navigation and Scan Planning for 3D Mapping of Infrastructure" (2018). Georgia Institute of Technology Career, Research, and Innovation Development Conference (CRIDC), Atlanta GA.
- Best Paper Award (co-author), "Building element recognition with thermal-mapped point clouds." (2017) International Symposium on Automation and Robotics in Construction (ISARC), Taipei, Taiwan.
- Best Paper Award (co-author), "Target-Free Automatic Registration of Point Clouds." (2016) International Symposium on Automation and Robotics in Construction (ISARC), Auburn, AL.
- David Levy ESE Award for Design Excellence (2015). Washington University in St. Louis.

### Professional / Service Activities

- 2019 Southeast Robotics Symposium, organizing committee member
- IEEE Robotics and Automation Society, student member
- Georgia Institute of Technology Council for GradLife, council member
- Reviewer for IEEE International Conference on Intelligent Robots and Systems
- Reviewer for IEEE International Conference on Advanced Intelligent Mechatronics
- Reviewer for IEEE International Conference on Ubiquitous Robots
- Reviewer for International Symposium on Automation and Robotics in Construction
- Volunteer for Girl Code Project, LEGO Mindstorms competition, National Robotics Week

### Journal Publications

- [J1] **Chen, J.**, Kira, Z., and Cho, Y. (2021). "LRGNet: Learnable Region Growing for Class-Agnostic Point Cloud Segmentation." IEEE Robotics and Automation Letters.
- [J2] Price, L., **Chen, J.**, Park, J.S. and Cho, Y. (2021). "Multisensor-driven Real-time Crane Monitoring System for Blind Lift Operations: Lessons Learned from a Case Study." Automation in Construction, Volume 124, April 2021, 103552
- [J3] **Chen, J.**, Yi, J., Kahoush, M., Cho, E. and Cho, Y. (2020). "Point Cloud Scene Completion of Obstructed Building Facades with Generative Adversarial Inpainting." MDPI Sensors, 20(18), 5029
- [J4] Zeng, S., **Chen, J.**, and Cho, Y. (2020). "User exemplar-based building element retrieval from raw point clouds using deep point-level features." Automation in Construction, Volume 114, June 2020, 103159
- [J5] Park, J.S., **Chen, J.**, Cho, Y., Kang, D., and Son, B. (2020). "CNN-Based Person Detection Using Infrared Images for Night-Time Intrusion Warning Systems." MDPI Sensors, 20(1), 34
- [J6] **Chen, J.**, Kira, Z. and Cho, Y. (2019). "Multi-view Incremental Segmentation of 3D Point Clouds for Mobile Robots." IEEE Robotics and Automation Letters. 4(2), pp. 1240-1246.

- [J7] **Chen, J.**, Kira, Z. and Cho, Y. (2019). "Deep Learning Approach to Point Cloud Scene Understanding for Automated Scan to 3D Reconstruction." *ASCE Journal of Computing in Civil Engineering*, 33(4).
- [J8] Fang, Y., **Chen, J.**, Cho, Y., and Kim, K.N. (2018). "Vision-based Load Sway Monitoring to Improve Crane Safety in Blind Lifts." *Journal of Structural Integrity and Maintenance*, 3(4), Pages 233-242.
- [J9] Kim, P., **Chen, J.**, and Cho, Y. (2018). "SLAM-driven robotic mapping and registration of 3D point clouds." *Automation in Construction*, Volume 89, Pages 38-48.
- [J10] Kim, P., **Chen, J.**, and Cho, Y. (2017). "Automated Point Clouds Registration using Visual and Planar Features for Construction Environments." *ASCE Journal of Computing in Civil Engineering*, Volume 32, March 2018
- [J11] **Chen, J.**, Fang, Y., and Cho, Y. (2017). "Performance Evaluation of 3D Descriptors for Object Recognition in Construction Applications." *Automation in Construction*, Volume 86, Pages 44-52, February 2018
- [J12] Kim, P., **Chen, J.**, and Cho, Y. (2017). "Robotic sensing and object recognition from thermal-mapped point clouds." *International Journal of Intelligent Robotics and Applications*. September 2017, Volume 1, Issue 3, Pages 243-254
- [J13] **Chen, J.**, Fang, Y., and Cho, Y. (2017). "Real-Time 3D Crane Workspace Update Using a Hybrid Visualization Approach." *ASCE Journal of Computing in Civil Engineering*, Vol. 31. Issue 5
- [J14] Park, J.W., **Chen, J.**, and Cho, Y. (2017). "Self-Corrective Knowledge-based Hybrid Tracking System Using BIM and Multimodal Sensors." *Advanced Engineering Informatics*, Volume 32, Issue C, April 2017, Pages 126-138
- [J15] **Chen, J.**, Fang, Y., Cho, Y., and Kim, C. (2016). "Principal Axes Descriptor (PAD) for Automated Construction Equipment Classification from Point Clouds." *ASCE Journal of Computing in Civil Engineering*, Volume 31, Issue 2
- [J16] Fang, Y., Cho, Y., and **Chen, J.** (2016). "A Framework for Real-time Pro-active Safety Assistance for Mobile Crane Lifting Operations." *Automation in Construction*, Volume 72, Part 3, December 2016, Pages 367-379

#### Conference Publications

- [C1] **Chen, J.**, Kira, Z., and Cho, Y. (2021). "LRGNet: Learnable Region Growing for Class-Agnostic Point Cloud Segmentation." *IEEE Conference on Robotics and Automation (ICRA)*.
- [C2] **Chen, J.**, Kim, P., Sun, D.I., Han, C.S., Ahn, Y.H., Ueda, J., and Cho, Y. (2020). "Workspace Modeling: Visualization and Pose Estimation of Teleoperated Construction Equipment from Point Clouds." *Proceedings of the 37th International Symposium on Automation and Robotics in Construction (ISARC)*, October 27-29
- [C3] Price, L., **Chen, J.**, and Cho, Y. (2020). "Dynamic Crane Workspace Update for Collision Avoidance during Blind Lift Operations." *Proceedings of the 18th International Conference on Computing in Civil and Building Engineering (ICCCBE) 2020*, August 18-20, São Paulo, Brazil
- [C4] **Chen, J.**, and Cho, Y. (2020). "Unsupervised Crack Segmentation from Disaster Site Point Clouds using Point Feature Clustering." *Proceedings of the 27th International Workshop on Intelligent Computing in Engineering (EG-ICE) 2020*, July 1-4, Berlin, Germany
- [C5] Park, J., Chen, J., and Cho, Y. (2020). "Point Cloud Information Modeling (PCIM): an Innovative Framework for as-is Information Modeling of Construction Sites". *ASCE Construction Research Congress (CRC) 2020*, March 9-10, Tempe, AZ
- [C6] **Chen, J.** and Cho, Y. (2019). "Exemplar-based Building Element Retrieval from Point Clouds." *International Conference on Smart Infrastructure and Construction (ICSIC)*, Churchill College, Cambridge, UK, July 8-9
- [C7] **Chen, J.** and Cho, Y. (2019). "Detection of Damaged Infrastructure on Disaster Sites using Mobile Robots." *IEEE 2019 16th International Conference on Ubiquitous Robots (UR)*, Jeju, Korea, June 24-27
- [C8] **Chen, J.**, Kim, K.N., Cho, Y., Lee, J., Kim, B., Ahn, Y., and Kang, J. (2019). "Nuclear Power Plant Disaster Site Simulation using Rigid Body Physics." *Proceedings of the ASCE 2019 International Conference on Computing in Civil Engineering (i3CE)*, Atlanta, GA, USA, June 17-19

- [C9] Kim, K.N., **Chen, J.**, and Cho, Y. (2019). "Evaluation of Machine Learning Algorithms for Worker's Motion Recognition using Motion Sensors." Proceedings of the ASCE 2019 International Conference on Computing in Civil Engineering (i3CE), Atlanta, GA, USA, June 17-19
- [C10] **Chen, J.**, Cho, Y., and Ueda, J. (2018). "Sampled-Point Network for Classification of Deformed Building Element Point Clouds". Proceedings of the 2018 IEEE Conference on Robotics and Automation (ICRA).
- [C11] **Chen, J.**, Kim, P., Cho, Y., and Ueda, J. (2018). "Object-sensitive potential fields for mobile robot navigation and mapping in indoor environments." Proceedings of the 2018 IEEE 15th International Conference on Ubiquitous Robots (UR), Honolulu, HI, USA, June 26-30.
- [C12] Fang, Y., **Chen, J.**, Cho, Y., Zhang, S., and Perez, E. (2018). " Enhance Blind Lift Safety by Real-Time Sensing and Visualization." Proceedings of the 18th International Conference on Construction Applications of Virtual Reality (CONVR2018), Auckland, New Zealand, Nov 22-23
- [C13] Kim, P., **Chen, J.**, Kim, J., and Cho, Y. (2018). "SLAM-Driven Intelligent Autonomous Mobile Robot Navigation for Construction Applications." Best Paper Award, Proceedings of Workshop of the European Group for Intelligent Computing in Engineering, EG-ICE. pp. 254-269, Lausanne, Switzerland,
- [C14] **Chen, J.** and Cho, Y. (2018). "Point-to-point Comparison Method for Automated Scan-vs-BIM Deviation Detection." Proceedings of 17th International Conference on Computing in Civil and Building Engineering, Tampere, Finland
- [C15] Kim, P., **Chen, J.**, Cho, Y. (2018). "Autonomous Mobile Robot Localization and Mapping for Unknown Construction Environments." ASCE Construction Research Congress (CRC) 2018, pp.147-156, April 2-4, New Orleans, LA
- [C16] **Chen, J.**, Cho, Y., and Kim, K. (2018). "Region Proposal Mechanism for Building Element Recognition for Advanced Scan-to-BIM Process." ASCE Construction Research Congress 2018, April 2 - 4, New Orleans, LA
- [C17] Kim, P., Cho, Y. and **Chen, J.** (2017). "Building element recognition with thermal-mapped point clouds." Proceedings of the 34rd International Symposium on Automation and Robotics in Construction (ISARC), Taipei, Taiwan, June 28-July 1
- [C18] **Chen, J.**, Fang, Y., and Cho, Y. (2017). "Mobile Asset Tracking for Dynamic 3D Crane Workspace Generation in Real Time." Proceedings of the 2017 International Workshop on Computing for Civil Engineering (IWCCE), Seattle, WA, USA, June 25-27
- [C19] **Chen, J.**, Fang, Y., and Cho, Y. (2017). "Unsupervised Recognition of Volumetric Structural Components from Building Point Clouds." Proceedings of the 2017 International Workshop on Computing for Civil Engineering (IWCCE), Seattle, WA, USA, June 25-27,
- [C20] Kim, P., Cho, Y., and **Chen, J.** (2016). " Automatic Registration of Laser Scanned Color Point Clouds Based on Common Feature Extraction." 16th International Conference on Construction Applications of Virtual Reality (CONVR), Hong Kong, Dec. 11-13
- [C21] **Chen, J.**, Fang, Y., and Cho, Y. (2016). "Automated Equipment Recognition and Classification from Scattered Point Clouds for Construction Management." International Symposium on Automation and Robotics in Construction (ISARC), Auburn, AL, July 18-21, 2016
- [C22] **Chen, J.**, Cho, Y. (2016). "Real-time 3D Mobile Mapping for the Built Environment". International Symposium on Automation and Robotics in Construction (ISARC), Auburn, AL, July 18-21, 2016
- [C23] Fang, Y., **Chen, J.**, Cho, Y., and Zhang, P. (2016). "A Point Cloud-Vision Hybrid Approach for 3D Location Tracking of Mobile Construction Assets." International Symposium on Automation and Robotics in Construction (ISARC), Auburn, AL, July 18-21, 2016
- [C24] Kim, P., Cho, Y., **Chen, J.** (2016). "Target-Free Automatic Registration of Point Clouds." International Symposium on Automation and Robotics in Construction (ISARC), Auburn, AL, July 18-21, 2016

#### Book Chapter

- [B1] **Chen, J.**, and Cho, Y. (2020). "Rapid Scan-to-BIM using Robotics and Artificial Intelligence for Construction Applications." Research Companion on Building Information Modeling, *under review*

## Skills

Programming: C, C++, C#, Python, Java, Bash, SQL  
Software Frameworks: Robot Operating System (ROS), Tensorflow, PyTorch, scikit-learn