Ci-Jyun (Polar) Liang, Ph.D.

Curriculum Vitae
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EDUCATION

Ph.D., Civil Engineering, University of Michigan, Ann Arbor, MI, USA 2021
- Dissertation: *Affecting fundamental transformation in future construction work through replication of the master-apprentice learning model in human-robot worker teams*
- Advisors: Vineet R. Kamat and Carol C. Menassa

M.S., Robotics, University of Michigan, Ann Arbor, MI, USA, 2017
- Research: *Real-time construction site layout and equipment monitoring*
- Advisors: Vineet R. Kamat and Carol C. Menassa

M.S., Civil Engineering, National Taiwan University, Taipei, Taiwan, 2015
- Thesis: *ABAS: an autonomous beam assembly system for steel structure*
- Advisor: Shih-Chung Kang

B.S., Civil Engineering, National Taiwan University, Taipei, Taiwan, 2013
- Research: *BotBeep – an affordable warning device for wheelchair rearward safety*
- Advisors: Shih-Chung Kang and Pei-Chun Lin

PROFESSIONAL APPOINTMENTS

Robotics Fellow, Division of Safety Research, National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV, USA, 2021-present

Consultant, RoBIM Technologies Inc., Edmonton, Alberta, Canada, 2021-present

Graduate Student Research Assistant/Graduate Student Instructor, University of Michigan, Ann Arbor, MI, USA, 2016-2021

Research Associate, National Taiwan University, Taipei, Taiwan, 2015-2016

Research/Teaching Assistant, National Taiwan University, Taipei, Taiwan, 2010-2015

Robotics Laboratory Manager, National Taiwan University, Taipei, Taiwan, 2011-2015

Intern, High-Tech Facility Laboratory, National Taiwan University, Taipei, Taiwan, 2011-2012

Co-Founder, TaiwanBIM.net, Taipei, Taiwan, 2011-2013

Intern, China Engineering Consultants Inc., Taipei, Taiwan, 2012

Intern, Sansin Builder Co., Ltd., Taipei, Taiwan, 2011

PUBLICATIONS

Refereed Journal Articles

Liang, C.-J., Kamat, V. R., Menassa, C. C., and McGee, W. (2022) "Trajectory-based skill learning for construction robots using generalized cylinders with orientation." *Journal of Computing in Civil Engineering*, 36(2), 04021036.

Liang, C.-J., Wang, X., Kamat, V. R., and Menassa, C. C. (2021) "Human-robot collaboration in construction: classification and research trends." *Journal of Construction Engineering and Management*, 147(10), 03121006.

Wang, X., **Liang, C.-J.,** Menassa, C. C., and Kamat, V. R. (2021) "Interactive and immersive process-level digital twin for collaborative human-robot construction work." *Journal of Computing in Civil Engineering*, 35(6), 04021023.

Liang, C.-J., Start, C., Boley, H., Kamat, V. R., Menassa, C. C., and Aebersold, M. (2021). "Enhancing stroke assessment simulation experience in clinical training using augmented reality." *Virtual Reality*, 25, 575-584.

Liang, C.-J., Kamat, V. R.,and Menassa, C. C. (2020). "Teaching robots to perform quasi-repetitive construction tasks through human demonstration." *Automation in Construction*, 120, 103370.

Liang, C.-J., Lundeen, K. M., McGee, W., Menassa, C. C., Lee, S., and Kamat, V. R. (2019). "A vision-based marker-less pose estimation system for articulated construction robots." *Automation in Construction*. 104, 80–94.

Liang, C.-J., Kang, S.-C., and Lee, M.-H. (2017). "RAS: a robotic assembly system for steel structure erection and assembly." *International Journal of Intelligent Robotics and Applications*, 1(4), 459–476.

Wu, T.-H., Wu, F., **Liang, C.-J.**, Li, Y.-F., Tseng, C.-M., and Kang, S.-C. (2017). "A virtual reality tool for training in global engineering collaboration." *Universal Access in the Information Society*, 1–13.

Hung, W.-H., Liu, C.-W., **Liang, C.-J.**, and Kang, S.-C. (2016). "Strategies to accelerate the computation of erection paths for construction cranes." *Automation in Construction*, 62, 1–13.

Refereed Conference Proceedings

Liang, C.-J., McGee, W., Menassa, C. C., and Kamat, V. R. (2020). "Bi-directional communication bridge for state synchronization between digital twin simulations and physical construction robots." *Proceedings of the International Symposium on Automation and Robotics in Construction (ISARC)*, IAARC, Kitakyshu, Japan (Online), 1480–1487.

Wang, X., **Liang, C.-J.,** Menassa, C. C., and Kamat, V. R. (2020). "Real-time process-level digital twin for collaborative human-robot construction work." *Proceedings of the International Symposium on Automation and Robotics in Construction (ISARC)*, IAARC, Kitakyshu, Japan (Online), 1528–1535.

Liang, C.-J., Kamat, V. R., and Menassa, C. C. (2019). "Teaching robots to perform construction tasks via learning from demonstration." *Proceedings of the International Symposium on Automation and Robotics in Construction (ISARC)*, IAARC, Banff, Alberta, Canada, 1305–1311.

Liang, C.-J., Lundeen, K. M., McGee, W., Menassa, C. C., Lee, S., and Kamat, V. R. (2019). "Fast dataset collection approach for articulated equipment pose estimation." *Proceedings of the International Conference on Computing in Civil Engineering (I3CE)*, ASCE, Atlanta, GA, USA, 146–152.

Liang, C.-J., Start, C., Boley, H., Kamat, V. R., Menassa, C. C., and Aebersold, M. L. (2018). "An augmented reality environment for enhancing clinical training experience: stroke assessment simulation." *Proceedings of the International Academic Conference on Meaningful Play*, East Lansing, MI, USA.

Liang, C.-J., Lundeen, K. M., McGee, W., Menassa, C. C., Lee, S., and Kamat, V. R. (2018). "Stacked hourglass networks for markerless pose estimation of articulated construction robots." *Proceedings of the International Symposium on Automation and Robotics in Construction (ISARC)*, IAARC, Berlin, Germany, 859–865.

Liang, C.-J., Kamat, V. R., and Menassa, C. C. (2018). "Real-time construction site layout and equipment monitoring." *Proceedings of the Construction Research Congress (CRC)*, ASCE, New Orleans, LA, USA, 64–74.

Yang, C.-H., **Liang, C.-J.,** and Kang, S.-C. (2016). "Unmanned aerial vehicles path planning for alluvial fan digital terrain model reconstruction." *Proceedings of the International Conference on Construction Applications of Virtual Reality (CONVR)*, Hong Kong.

Lee, Y.-F., **Liang, C.-J.**, and Kang, S.-C. (2015). "Experience and reflections on a global collaborative course, sky classroom – global project team course, from National Taiwan University." *Proceedings of the International Workshop on Design in Civil and Environmental Engineering (DCEE)*, Taipei, Taiwan.

Cheng, S.-Y., Kuo, T.-Y., **Liang, C.-J.**, and Kang, S.-C. (2015). "A sway reduction controller for construction crane." *Proceedings of the International Symposium on Automation and Robotics in Construction and Mining (ISARC)*, IAARC, Oulu, Finland, 1-4.

Liang, C.-J., and Kang, S.-C. (2015). "Robotic assembly system for steel structure." *Proceedings of the Modular and Off-site Construction Summit (MOC)*, Edmonton, Canada.

Liang, C.-J., and Kang, S.-C. (2014). "Development of a steel beam hauling system for automatic steel beam assembly." *Proceedings of the International Conference for Computing in Civil and Building Engineering (ICCCBE)*, ASCE, Orlando, FL, USA, 1295-1302.

Sung, E.-S., Wei, S.-C., **Liang, C.-J.**, Tsai, M.-H., Kang, S.-C., Lai, J.-S., and Tan, Y.-C. (2013). "Interactive system for decision-making for giving flood warnings." *Proceedings of the APRU Research Symposium on Multi-Hazards around the Pacific Rim*, Taipei, Taiwan.

Liang, C.-J., Yang, Y.-Y., Lin, Y.-S., Kang, S.-C., Lin, P.-C., and Chen, Y.-C. (2013). "BotBeep – an affordable warning device for wheelchair rearward safety." *Proceedings of the International Conference on Orange Technologies (ICOT)*, IEEE, Tainan, Taiwan, 159-163.

Manuscripts in Progress

Liang, C.-J., McGee, W., Menassa, C. C., and Kamat, V. R. "Real-time state synchronization between physical construction robots and process level digital twins." *Construction Robotics*. (In Review)

Patents

S. C. Kang, P. C. Lin, Y. S. Su, **C. J. Liang**, P. Y. Lee, Y. Y. Yang, Y. S. Lin and C. E. Lee, "Early Warning Method and Device to Prevent Wheelchair from Tipping Over," US9549861B2, Date of Patent: January 24, 2017. **Granted**

S. C. Kang and **C. J. Liang**, "Autonomous Beam Assembly System for Steel Structure," US Patent Application Number: US 2017/0247875, Application Date: October 13, 2015. **Pending**

Y. C. Liou, **C. J. Liang**, C. H. Yang, M. C. Wen, C. N. Tsai, Y. C. Liu, Y. C. Chu, and C. H. Huang, "Medication Dispensing System and Method and Non-Stationary Computer Readable Recording Medium," US Patent Application Number: US 2016/0354284A1, Application Date: December 18, 2015. **Pending**

Theses and Dissertations

Liang, C.-J. (2021). "Affecting fundamental transformation in future construction work through replication of the master-apprentice learning model in human-robot worker teams." Ph.D. Dissertation, Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, MI, USA.

Liang, C.-J. (2015). "ABAS: an autonomous beam assembly system for steel structure." M.S. Thesis, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan.

Other Publications

Kang, S.-C., Chang, C.-M., Yang, Y.-Y., and **Liang, C. J.** (2018). "Independent hoisting system: structural components, lifting mechanism, crane control." *Impact*, 2018(5), 59-61.

HONORS AND AWARDS

2021, **Richard and Eleanor Towner Prize for Distinguished Academic Achievement Award,** University of Michigan, Ann Arbor

2020, **Tishman Pre-Doctoral Fellowship**, University of Michigan, Ann Arbor

2019, 2018, **Rackham Conference Travel Grant**, University of Michigan, Ann Arbor

2018, **C.E. Bottum and R. Harris Fellowship**, University of Michigan, Ann Arbor

2017, **Rackham International Students Fellowship**, University of Michigan, Ann Arbor

2013, **The Excellent Award, Student Poster Competition**, APRU Symposium, Taiwan

2012, **Research Innovation Scholarship**, China Technical Consultants Inc. Foundation, Taiwan

2012, **Second Place Award, Student BIM Competition**, Chinese Institute of Civil and Hydraulic Engineering, Taiwan

2011, **Presidential Award**, National Taiwan University, Taiwan

GRANT WRITING EXPERIENCE

2021, **Assessing Mental Workload and Trust Level in Industrial Human-Robot Collaboration**, National Institute for Occupational Safety and Health (NIOSH), Submitted, Role: PI.

2021, **FW-HTF: Collaborative Research: Partnering Workers with Interactive Robot Assistants to Usher Transformation in Future Construction Work**, National Science Foundation (NSF), Granted, Role: Led Proposal Writing, PI: Carol C. Menassa, Co-PI: Vineet R. Kamat, Joyce Chai, Arash Adel, and Wes McGee

2020, **FW-HTF-P: Redesigning the Future of Construction Work by Replicating the Master-Apprentice Learning Model in Human-Robot Worker Teams**, National Science

Foundation (NSF), Granted, Role: Led Proposal Writing, PI: Carol C. Menassa, Co-PI: Vineet R. Kamat, Joyce Chai, Honglak Lee, and Xi Jessie Yang

2015, **Autonomous Erection System: Structural Component, Rigging Mechanism and Crane Control**, Ministry of Science and Technology, Taiwan, Granted, Role: Led Proposal Writing, PI: Shih-Chung Kang

2015, **Virtual BIM Reviewer for Global Collaboration Project**, Microsoft, Redmond, Granted, Role: Led Proposal Writing, PI: Shih-Chung Kang, Co-PI: Carrie Sturt Dossick

2014, **Holistic Smart Construction and Operation: Using Logistic Campus as an Example**, Ministry of Science and Technology, Taiwan, Submitted, Role: Led Proposal Writing, PI: Shih-Chung Kang

2012, **Robot Arm Simulation Method**, Industrial Technology Research Institute, Taiwan, Granted, Role: Led Proposal Writing, PI: Shih-Chung Kang

2012, **Evaluation: BOTBeep System—An Affordable Alarm Device for Wheelchair Users**, Ministry of Science and Technology, Taiwan, Granted, Role: Led Proposal Writing, PI: Shih-Chung Kang, Co-PI: Pei-Chun Lin

2011, **Design: BOTBeep System—An Affordable Alarm Device for Wheelchair Users**, Ministry of Science and Technology, Taiwan, Granted, Role: Led Proposal Writing, PI: Shih-Chung Kang, Co-PI: Pei-Chun Lin

INVITED TALKS

2022, "Human-Robot Learning and Safety on Future Construction Sites." Department of Civil and Environmental Engineering, Princeton University, Princeton, NJ, USA (Online).

2021, "Construction Robotics Research." NORA Construction Sector Council Meeting, National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV, USA (Online).

2021, "Human-Robot Collaboration on Future Construction Sites: Replication of the Master-Apprentice Learning." Department of Civil and Environmental Engineering, Florida International University, Miami, FL, USA.

2021, "Affecting Foundation in Future Construction Work Through Replication of the Master-Apprentice Learning Model in Human-Robot Teams." Department of Visualization, Texas A&M University, College Station, TX, USA (Online).

2020, "Bi-Directional Communication Bridge for State Synchronization Between Digital Twin Simulations and Physical Construction Robots." International Symposium on Automation and Robotics in Construction (ISARC), Kitakyshu, Japan (Online).

2019, “Teaching Robots to Perform Construction Tasks via Learning from Demonstration.” International Symposium on Automation and Robotics in Construction (ISARC), Banff, Alberta, Canada.

2019, “Fast Dataset Collection Approach for Articulated Equipment Pose Estimation.” International Conference on Computing in Civil Engineering (I3CE) Atlanta, GA, USA.

2018, “An Augmented Reality Environment for Enhancing Clinical Training Experience: Stroke Assessment Simulation.” International Academic Conference on Meaningful Play, East Lansing, MI, USA.

2018, “Stacked Hourglass Networks for Markerless Pose Estimation of Articulated Construction Robots.” International Symposium on Automation and Robotics in Construction (ISARC), Berlin, Germany.

2018, “Monitoring Excavation Slope Stability Using Drones.” Construction Research Congress (CRC), New Orleans, LA, USA.

2018, “Real-Time Construction Site Layout and Equipment Monitoring.” Construction Research Congress (CRC), New Orleans, LA, USA.

2015, “Robotic Assembly System for Steel Structure.” Modular and Off-site Construction Summit (MOC), Edmonton, Canada.

2014, “Development of an Autonomous Beam Assembly System for Steel Structure.” International Conference for Computing in Civil and Building Engineering (ICCCBE), Orlando, FL, USA.

2013, “BotBeep – an Affordable Warning Device for Wheelchair Rearward Safety.” International Conference on Orange Technologies (ICOT), Tainan, Taiwan.

TEACHING EXPERIENCE

University of Michigan, Ann Arbor, MI, USA
(Evaluation on a scale of 5.0 / Number of students)

Building Information Modeling, Department of Civil and Environmental Engineering, Graduate Student Instructor, 2020 Fall (4.9/21), 2019 Fall (4.6/15), 2018 Fall (4.1/28)

Construction Professional Practice, Department of Civil and Environmental Engineering, Student Team Supervisor, 2020 Winter, 2019 Winter

National Taiwan University, Taipei, Taiwan
(Evaluation on a scale of 5.0 / Number of students)

Sky Classroom: Global Team Project, Department of Civil Engineering, Teaching Assistant, 2016 Winter (4.8/9), 2015 Winter (4.7/11)

T–Workshop, Center of Innovation and Synergy for Intelligent Home and Living Technology, Teaching Assistant, 2013 Fall

Automation and Robotics, Department of Civil Engineering, Teaching Assistant, 2014 Fall (4.7/16), 2013 Fall (4.8/16), 2012 Fall (4.7/18), 2011 Fall (4.7/15)

Supervisor of Visiting Graduate Researcher, Emerson Lin, National Taiwan University, 2015-2016, Project: Autonomous erection and assembly

Supervisor of Undergraduate Researcher, Li-Yu Chen, National Taiwan University, 2015-2016, Project: P-Bot: a remote meeting robot with basic body language functions

Supervisor of Undergraduate Researcher, Peng-Yuan Chen, National Taiwan University, 2015-2016, Project: Using photometric stereo method in evaluating the volume of pavement distress

Supervisor of Undergraduate Researcher, Sheng-Yung Cheng, National Taiwan University, 2014-2015, Project: A sway reduction controller for construction crane

RESEARCH EXPERIENCE

National Institute for Occupational Safety and Health, Morgantown, WV, USA

2021, Safe Human-Robot Interaction: Gaining Knowledge to Protect Workers, Division of Safety Research

2021, Smart Path Planning of Collaborative Robots for Worker Safety, Division of Safety Research

2021, Contact Avoidance Between Human Workers and Collaborative Robots, Division of Safety Research

University of Michigan, Ann Arbor, MI, USA

2020, Georeferenced Augmented Reality for Discovery Based Learning in Construction Education, Advisor: Vineet R. Kamat

2020-2021, Redesigning the Future of Construction Work by Replicating the Master-Apprentice Learning Model in Human-Robot Worker Teams, Advisors: Vineet R. Kamat, Carol C. Menassa, Joyce Chai, Honglak Lee, and Xi Jessie Yang

2017-2020, Vision-Based Monitoring and Intervention for Construction Safety, Advisors: Vineet R. Kamat, Carol C. Menassa, SangHyun Lee, and Jia Deng

2017-2018, Augmented Reality for Clinical Training, Advisors: Vineet R. Kamat, Carol C. Menassa, and Michelle Aebersold

2017, Visual Simulation of Robotic Assembly of Healthcare Modules, Advisors: Vineet R. Kamat, Wes McGee, and Jessy W. Grizzle

National Taiwan University, Taipei, Taiwan

2014-2016, Stereoscopic Kinesthetic Crane Training System, Advisor: Shih-Chung Kang

2014-2016, Sky Classroom – Globalized Engineering Drawing Course, Advisor: Shih-Chung Kang

2014-2015, Global Participating Student, ME310 Design Innovation, Collaborated with Optoma Corporation and Stanford University, Stanford, CA, USA

2012-2013, Robot Arm Simulation Method, Advisor: Shih-Chung Kang

2011-2012, BOTBeep System – an Affordable Alarm Device for Wheelchair Users, Advisor: Shih-Chung Kang and Pei-Chun Lin

PROFESSIONAL LEADERSHIP AND SERVICE

2017, Networking Chair, Robotics Graduate Student Council, University of Michigan, Ann Arbor

2013, Computer-Aided Engineering Group Representative, Graduate Student Association, National Taiwan University, Taiwan

2010, 2013-2014, Volunteer Mentor, Agape Community Dream Center, Taiwan

2010-2011, Academic Committee Member, Undergraduate Student Association, National Taiwan University, Taiwan

Conference Organization

Area Chair, International Symposium on Automation and Robotics in Construction (ISARC), Bogota, Colombia, 2022

Area Chair and Session Chair, International Symposium on Automation and Robotics in Construction (ISARC), Dubai, UAE (Online), 2021

Reviewer

2022-present, Mechatronics, Elsevier

2021-present, Journal of Computing in Civil Engineering, ASCE

2021-present, IEEE Access, IEEE

2021, Computers, MDPI

2021, Applied Sciences, MDPI

2020-present, Automation in Construction, Elsevier

2019, 2021, International Symposium on Automation and Robotics in Construction (ISARC), IAARC

2019, International Conference on Computing in Civil Engineering (I3CE), ASCE

PROFESSIONAL MEMBERSHIPS

American Society of Civil Engineers, 2018-present