Zhengbo Zou

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APPOINTMENTS

Columbia University — **New York, NY**
Assistant Professor, Department of Civil Engineering and Engineering Mechanics — 2024 - Present

The University of British Columbia — **Vancouver, CANADA**
Assistant Professor, Department of Civil Engineering — 2021 - 2024

EDUCATION

New York University — **New York, NY**
Doctor of Philosophy in Civil Engineering — 2021

Carnegie Mellon University — **Pittsburgh, PA**
Master of Science in Civil Engineering — 2015

Tongji University — **Shanghai, China**
Bachelor of Engineering in Civil Engineering — 2014

PUBLICATIONS

Students under Zou's supervision are underlined. Corresponding author is marked with an asterisk*

Journal Papers

1. Duan, K., & **Zou, Z.***, (2024). "Morphology Agnostic Gesture Mapping for Intuitive Teleoperation of Construction Robots". *Advanced Engineering Informatics*, 62, 102600.
2. Yang, K., Ding, Y.*, Jiang, H., Zhang, Y., & **Zou, Z.**, (2024). "Deep learning based bridge damage identification approach inspired by internal force redistribution effects". *Structural Health Monitoring*, 14759217231176050.
3. Huang, L., Cai, W., Zhu, Z., & **Zou, Z.***, (2023). "Dexterous manipulation of construction tools using anthropomorphic robotic hand". *Automation in Construction*, 156, 105133.
4. Duan, K., Suen, C., & **Zou, Z.***, (2023). "Robot morphology evolution for automated HVAC system inspections using graph heuristic search and reinforcement learning". *Automation in Construction*, 153, 104956.
5. Cai, W., Huang, L., & **Zou, Z.***, (2023). "Actively-exploring thermography-enabled autonomous robotic system for detecting and registering HVAC thermal leaks". *Automation in Construction*, 152, 104901.
6. Zhang, H. X., & **Zou, Z.***, (2023). "Quality assurance for building components through point cloud segmentation leveraging synthetic data". *Automation in Construction*, 155, 105045.
7. Huang, L., Zhu, Z., & **Zou, Z.***, (2023). "To imitate or not to imitate: An integrated approach to boost reinforcement learning-based construction robotic control for long-horizon tasks using virtual demonstrations". *Automation in Construction*, 146, 104691.
8. Li, R., & **Zou, Z.***, (2023). "Enhancing Construction Robot Learning for Collaborative and Long-Horizon Tasks using Generative Adversarial Imitation Learning". *Advanced Engineering Informatics*, 58, 102140.

9. Yu, X., **Zou, Z.***, & Ergan, S., (2023). "Extracting principal building variables from automatically collected façade images for energy conservation through deep transfer learning". *Applied Energy*, 344, 121228.
10. Li, Y., **Zou, Z.**, Zhang, J.*, & He, Y., (2023). "Study on the evolution of asphalt pavement integrated disease of airports based on associate rule mining". *Construction and Building Materials*, 369, 130565.
11. **Zou, Z.***, & Ergan, S. (2023). "Towards Emotionally Intelligent Buildings: A Convolutional Neural Network based Approach to Classify Human Emotional Experience in Virtual Built Environments". *Advanced Engineering Informatics*, 55, 101868.
12. Yang, K., Ding, Y.*, Geng, F., Jiang, H., & **Zou, Z.**, (2023). "A multi-sensor mapping Bi-LSTM model of bridge monitoring data based on spatial-temporal attention mechanism". *Measurement*, 217, 113053.
13. Li, Y., **Zou, Z.**, Zhang, J.*, He, Y., Huang, G., & Li, J. (2023). "Refined evaluation methods for preventive maintenance of project-level asphalt pavement based on confusion-regression model". *Construction and Building Materials*, 403, 133105.
14. Duan, K., Cao. S.*, **Zou, Z.**, Huang, L., & He, Z. (2022). "Revealing the nature of concrete materials using soft computing models". *Journal of Building Engineering*, 59, 105148.
15. Ergan, S.*, **Zou, Z.**, Bernardes, S. D., Zuo, F., & Ozbay, K. (2022). "Developing an integrated platform to enable hardware-in-the-loop for synchronous VR, traffic simulation and sensor interactions". *Advanced Engineering Informatics*, 51, 101476.
16. **Zou, Z.***, & Ergan, S. (2021). "Evaluating the effectiveness of biometric sensors and their signal features for classifying human experience in virtual environments". *Advanced Engineering Informatics*, 49, 101358.
17. **Zou, Z.***, Ergan, S., Fisher-Gewirtzman, D., & Curtis, C. (2020). "Quantifying the Impact of Urban Form on Human Experience: An Experiment using Virtual Environments and Electroencephalogram". *Journal of Computing in Civil Engineering*, 35(3), 04021004.
18. **Zou, Z.***, Yu, X., & Ergan, S. (2019). "Towards Optimal Control of Air Handling Units using Deep Reinforcement Learning and Recurrent Neural Network". *Building and Environment*, 106535.
19. Ergan, S., Radwan, A., **Zou, Z.***, Tseng, H. A., & Han, X. (2018). "Quantifying Human Experience in Architectural Spaces with Integrated Virtual Reality and Body Sensor Networks". *Journal of Computing in Civil Engineering*, 33(2), 04018062.
20. **Zou, Z.***, Arruda, L., & Ergan, S. (2018). "Characteristics of Models that Impact Transformation of BIMs to Virtual Environments to Support Facility Management Operations". *Journal of Civil Engineering and Management*, 24(6), 481-498.
21. Du, J.*, **Zou, Z.**., Shi, Y., & Zhao, D. (2018). "Zero Latency: Real-time Synchronization of BIM Data in Virtual Reality for Collaborative Decision-making". *Automation in Construction*, 85, 51-64.
22. Du, J.*, Shi, Y., **Zou, Z.**, & Zhao, D. (2017). "CoVR: Cloud-based Multiuser Virtual Reality Headset System for Project Communication of Remote Users". *Journal of Construction Engineering and Management*, 144(2), 04017109.

Highly Selective Conference Proceedings

1. Cai, W., Huang, L., & **Zou, Z.** (2023). "RoboAuditor: Goal-Oriented Robotic System for Assessing Energy-intensive Indoor Appliance via Visual Language Models". In *10th ACM International Conference on Systems for Energy-Efficient Built Environments* (*BuildSys 2023*). Nov. 15-16, Istanbul, Turkey. *acceptance rate: 30%*
2. Cai, W., Huang, L., Zhang, L., Yu, X., & **Zou, Z.** (2022). "TEA-bot: A Thermography Enabled Autonomous Robot for Detecting Thermal Leaks of HVAC Systems in Ceilings". In *9th ACM International Conference on Systems for Energy-Efficient Built Environments* (*BuildSys 2022*). Nov. 9-10, Boston, MA. *acceptance rate: 30%*

Peer-reviewed Conference Proceedings

1. Chen, X., Zhang, S., & **Zou, Z.** (2024). "Can Large Vision-Language Models Understand Construction Safety? A Novel Benchmark Using Construction Safety Posters". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), July 28-31. Pittsburgh, PA.
2. Tian, M., & **Zou, Z.**(2024). "Aligning Safe Construction Robot Actions with Human Preferences". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), July 28-31. Pittsburgh, PA.
3. Liu, Z., Xu, J., Suen, C., Chen, M., **Zou, Z.,** Feng, A., & Shi, Y. (2024). "Detecting without Training: An Open-vocabulary Object Detection Method for Identifying Hazardous Objects on the Construction Site". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), July 28-31. Pittsburgh, PA.
4. Duan, K. & **Zou, Z.** (2023). "Self-optimization of robot design for navigating in ceiling systems". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), June 25-27. Corvallis, Oregon.
5. Li, R., & **Zou, Z.** (2023). "Expert Demonstration Collection of Long-horizon Construction Tasks in Virtual Reality". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), June 25-27. Corvallis, Oregon.
6. Suen, C., Liu, Z., Shi, Y., & **Zou, Z.** (2023). "ICON-Pose: Towards Egocentric Action Recognition for Intelligent Construction". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), June 25-27. Corvallis, Oregon.
7. Liu, Z., Suen, C., **Zou, Z.**, Chen, M., & Shi, Y. (2023). "Assessing Workers' Operational Postures via Egocentric Collaborative Camera Mapping". In *ASCE International Conference on Computing in Civil Engineering* (*i3CE*), June 25-27. Corvallis, Oregon.
8. Huang, L., Cai, W., & **Zou, Z.** (2022). "Virtual Reality-based Expert Demonstration for Training Construction Robots via Imitation Learning". In *Canadian Society for Civil Engineering* (*CSCE*) *Annual Conference*, May 25-28, Whistler, BC, Canada. ***Best Student Paper of the General Conference.***
9. Cai, W., Huang, L., & **Zou, Z.** (2022). "An Integrated Approach Combining Virtual Environments and Reinforcement Learning to Train Construction Robots for Conducting Tasks under Uncertainties". In *Canadian Society for Civil Engineering* (*CSCE*) *Annual Conference*, May 25-28, Whistler, BC, Canada.
10. Zhang, H.X., Huang, L., Cai, W., & **Zou, Z.** (2022). "Semantic Segmentation of Synthetic Images into Building Components for Automated Quality Assurance". In *Canadian Society for Civil Engineering* (*CSCE*) *Annual Conference*, May 25-28, Whistler, BC, Canada.
11. Huang, L., & **Zou, Z.** (2022). "Boosting Performance of Reinforcement Learning based Construction Robots in Simulation using Expert Demonstrations Collected in Virtual Reality". In *Association for Computing Machinery* (*ACM*) *Winter Simulation Conference*, Dec. 11-14, Marina Bay Sands, Singapore.
12. Cai, W., & **Zou, Z.** (2022). "Generalizing Construction Robot Control using Multi-task Reinforcement Learning". In *Association for Computing Machinery* (*ACM*) *Winter Simulation Conference*, Dec. 11-14, Marina Bay Sands, Singapore.
13. Huang, L., & **Zou, Z.** (2022). "Deep Reinforcement Learning-based Construction Robots Collaboration for Sequential Tasks". In *IEEE International Conference on Robotics and Automation* (*ICRA*) *workshop - Future of Construction: Build Faster, Better, Safer - Together with Robots*, May. 23-27, Philadelphia, PA.
14. Cai, W., & **Zou, Z.** (2022). "A Reinforcement Learning Based Approach for Conducting Multiple Tasks using Robots in Virtual Construction Environments". In *IEEE International Conference on Robotics and Automation* (*ICRA*) *workshop - Future of Construction: Build Faster, Better, Safer - Together with Robots*, May. 23-27, Philadelphia, PA.
15. Bernardes, S. D., **Zou, Z.**, Zuo, F., Ergan, S., Khan, J. A. & Ozbay, K. (2021). "Development of a Virtual-Reality Based Immersive and Integrated Traffic Simulation Platform for Studying Traffic Work Zone Safety Problems". In *TRB Annual Meeting, Transportation Research Board*. January 5 - January 29.

Washington D.C.

16. **Zou, Z.**, Bernardes, S., Kurkcu, K., Ergan, S., & Ozbay, K. (2020). "An Integrated Approach to Capture Construction Workers' Response to Safety Notifications using Wearable Sensors and Virtual Reality". In *European Group for Intelligent Computing in Engineering* (*EG-ICE*), June 30 - July 3rd, Berlin, Germany.
17. **Zou, Z.**, & Ergan, S. (2020). "Impact of Design on Human Experience: Evaluating Space Preferences in Interior Design Alternates Presented in A Crowdsourcing Platform". In *ASCE Construction Research Congress*, March 8-10, 2019, Phoenix, Arizona.
18. **Zou, Z.**, Yu, X., & Ergan, S. (2019). "Integrating Biometric Sensors, VR, and Machine Learning to Classify EEG Signals in Alternative Architecture Designs". In *ASCE International Conference on Computing in Civil Engineering 2019: Visualization, Information Modeling, and Simulation, i3CE 2019*, June 17-19, Atlanta, Georgia.
19. **Zou, Z.**, & Ergan, S. (2019). "Zero Latency for Emergencies: A Machine Learning based Approach to Quantify the Impact of Construction Projects on Emergency Response in Urban Settings". In *Canadian Society for Civil Engineering* (*CSCE*) *Annual Conference*, June 12-15, Montreal, Quebec, Canada.
20. **Zou, Z.**, & Ergan, S. (2019). "A Framework towards Quantifying Human Restorativeness in Virtual Built Environments". In *Environmental Design Research Association* (*EDRA*), May 22-26, Brooklyn, New York.
21. **Zou, Z.**, Ergan, S. (2018). "Where Do We Look? An Eye-Tracking Study of Architectural Features in Building Design". In *Advances in Informatics and Computing in Civil and Construction Engineering*, Oct 1-3, Chicago, Illinois.
22. **Zou, Z.**, & Ergan, S. (2018). "Impact of Construction Projects on Urban Quality of Life: A Data Analysis Method". In *ASCE Construction Research Congress*, April 2-4, New Orleans, Louisiana.
23. Du, J., **Zou, Z.**, Shi, Y., & Zhao, D. (2017). "Simultaneous Data Exchange between BIM and VR for Collaborative Decision Making". In *International Workshop of Computing in Civil Engineering* (*IWCCE*), June 25-27, Seattle, Washington.
24. Kasireddy, V., **Zou, Z.**, Akinci, B., & Rosenberry, J. (2016). "Evaluation and Comparison of Different Virtual Reality Environments Towards Supporting Tasks Done on a Virtual Construction Site". In *ASCE Construction Research Congress*, May 31-June 2, San Juan, Puerto Rico.

Book Chapters

1. Zhang, H.X., Huang, L., Cai, W., & **Zou, Z.** (2023). "Towards Automated Quality Assurance: Generating Synthetic Images of Building Components for Vision-based Semantic Segmentation". In *Automation in Construction toward Resilience*, Taylor and Francis, pp. 139-156, CRC Press.
2. Cai, W., Huang, L., & **Zou, Z.** (2023). "Reinforcement Learning Based Robotic Motion Planning for Conducting Multiple Tasks in Virtual Construction Environments". In *Automation in Construction toward Resilience*. Taylor and Francis, pp. 43-56, CRC Press.

Poster Presentations

1. **Zou, Z.**, & Ergan, S. (2021). Classifying human experience in virtual environments using effective sensor signals. In *ANFA Academy of Neuroscience for Architecture Annual Conference*, September 16-18, La Jolla, California (online).
2. **Zou, Z.**, & Ergan, S. (2018). "Characterizing Human Experience in Stimulating Architectural Spaces: Integrating VR and Body Area Sensor Networks". In *ANFA Academy of Neuroscience for Architecture Annual Conference*, September 20-22, La Jolla, California.
3. **Zou, Z.**, & Du, J. (2016). "Real-time Synchronization of BIM Data in Virtual Reality for Collaborative Decision Making". In *CII Construction Industry Institute*, August 1 - August 4, National Harbor, Maryland.

TEACHING

The University of British Columbia **Vancouver, BC, CANADA**
Department of Civil Engineering

1. CIVL 520: Construction Planning and Control 2021-2024
   - Course description: This course provides an in-depth view of the theory and practice of construction planning and control, with a particular focus on construction project scheduling.
2. CIVL 498-A: Applied Machine Learning for Construction and Facility Management 2021-2024
   - Course description: This course provides theoretical backgrounds and applications of machine learning algorithms and tools in civil engineering.
3. CIVL 300: Construction Engineering and Management 2023-2024
   - Course description: This course provides theoretical backgrounds of key construction management modules, including delivery methods, contracts, cost, schedules, safety, and sustainability.

Session	Course Number	Class Size	Course Evaluation
2024 Spring	CIVL 300	133	4.7/5
2023 Fall	CIVL 498A	35	4.3/5
2023 Fall	CIVL 520	23	4.9/5
2023 Spring	CIVL 498A	27	4.9/5
2022 Fall	CIVL 520	33	4.7/5
2022 Spring	CIVL 498A	25	4.8/5
2021 Fall	CIVL 520	23	4.1/5

New York University **Brooklyn, NY**
Teaching Assistant, Department of Civil and Urban Engineering

1. CE-GY 8303: Information Systems in Project Management 2017, 2018
   - Instructor: Dr. Semiha Ergan
   - Course description: The course examines the use of contemporary tools for managing the vast array of information over the life of a project.
2. CE-GY 8383: Building Information Modeling (BIM) and its Applications in AEC/FM 2019
   - Instructor: Dr. Semiha Ergan
   - Course description: The intent of this course is to strengthen the knowledge of students on the concepts associated with information modeling and analysis.
3. CE-UY 3453: Building Information Modeling (BIM) 2019, 2020
   - Instructor: Dr. Semiha Ergan
   - Course description: This course aims to introduce the terminology related to drafting and modeling, and the application areas of building information modeling and related technologies in the design and construction phase of projects.

GRANTS

Total: $2.8M, **my share: $1.3M**

1. Emotionally Intelligent Construction Robots, **PI**. Canada Foundation for Innovation, JELF Grant, **2024-2026**, $270,000

2. MICRO-BODD: A Miniaturized Intelligent Construction Robot for Optimal Building Operations and Defect Detection, **PI**. Natural Sciences and Engineering Research Council of Canada, Alliance Grant, **2023-2026**, $1,089,640
3. Social-emotional intelligence in construction robots: reducing barriers for dynamic human-robot collaboration in construction environments, **PI**. Social Sciences and Humanities Research Council, Canada, New Frontiers in Research Grant, **2023-2025**, $242,837
4. Developing the learning module with advanced lightweight computing system and sensor kit, **Co-PI**. UBC, Education Research and Teaching Innovation Seed Funding, **2023-2024**, $9,500
5. Leak detection for UBC buildings using autonomous robots **PI**. UBC, Campus as a Living Lab, **2023-2024**, $37,000
6. Intuitive demonstrations of construction tasks in VR for construction robot learning, **PI**. UBC, CREATE in Immersive Technology, **2023-2025**, $60,000
7. Automated LiDAR scan to building information modeling using computer vision, **PI**. Mathematics of Information Technology and Complex Systems, Canada, Mitacs Globalink, **2023-2024**, $10,000
8. Automated energy auditing – A robotic solution for identifying leaks from mechanical, electrical and plumbing (MEP) systems in buildings, **PI**. Mathematics of Information Technology and Complex Systems, Canada, Mitacs Globalink, **2023-2024**, $10,000
9. Towards establishing the Digital Construction Excellence Cluster, **PI**: UBC, Collaborative Research Mobility Award, **2022-2023**, $5,000
10. Optimizing Indoor Environment Quality through Quantifying Human Experience using Ubiquitous Sensing, **PI**: Natural Sciences and Engineering Research Council of Canada, Discovery Grant, **2022-2027**, $147,500
11. High-Performance Timber Modular Tall Buildings Toward Resilient Constructions, **Co-PI:** Natural Sciences and Engineering Research Council of Canada, Alliance Grant, **2022-2024**, $996,300

MENTORED STUDENTS

Columbia University **New York,NY**
Department of Civil Engineering and Engineering Mechanics

Ph.D. Students

- Lei Huang (2024 -), Weijia Cai (2024 -), Christine Suen (2024 -)

The University of British Columbia **Vancouver, BC, CANADA**
Department of Civil Engineering

Ph.D. Students

- Kangkang Duan (2022 -), Harry Zhang (2024 -)

M.A.Sc. Students

- Harry Zhang (2022 - 24), Christine Suen (2022 - 24), Rui Li (2022 - 24), Xuezheng Chen (2023 - 24)

B.A.Sc./B.Sc./B.A. Students

- Civil Engineering: Wahid Bitar (2022 - 23), Harry Zhang (2021 - 22)
- Computer Science: Rosaline Baek (2022 - 23), Zihan Zhu (2022 - 23)

- Material Science: Royce Zhang (2022 - 24)
- Arts: Aaron Yang (2022 - 24)

Visiting Ph.D. Students

- Kang Yang (2021 - 22), Yan Li (2022 - 23), Shuai Gao (2023 - 24), Fei Jiang (2023-24)

HONORS AND AWARDS

- Best Student Paper Award (with supervised UBC Ph.D. students Lei Huang and Weijia Cai) at Canadian Society for Civil Engineering (CSCE) Annual Conference, May 25-28, Whistler, BC, Canada, 2022
- Outstanding Dissertation Award, New York University, 2021
- Editor's Choice Award by Journal of Computing in Civil Engineering, New York University, 2019
- Inaugural class of Urban Doctoral Fellowship, New York University , 2018

INVITED TALKS

- Embodied AI for Construction. IEEE Vancouver Section, Vancouver, Canada. 2024
- Intelligent Construction with Robotics. University of Waterloo, Waterloo, Canada. 2023
- Construction robotics and its applications in construction engineering. Tongji University, Shanghai, China. 2022
- Applications of Virtual Reality for Work Zone Safety. C2SMART Center Learning Hub Lecture Series, New York University, Brooklyn, NY. 2021.
- Work Zone Safety: Behavioral Analysis with Integration of VR and Hardware in the Loop. C2SMART Center, New York University, Brooklyn, NY. 2021.
- Increasing work zone safety: Worker behavioral analysis with integration of wearable sensors and virtual reality. C2SMART Center, New York University, Brooklyn, NY. 2021.

OUTREACH ACTIVITIES

Invited Demos

- e@UBC: entrepreneurship at UBC 2023
- TRB 2020: Exhibition of University Transportation Center (UTC) 2020
- Skanska: 2nd Annual Con-Tech in Context 2019
- Research Expo @ NYU Tandon 2018, 2019
- New York City AR/VR Center Expo 2018
- PWC Technology Forum 2018
- ExxonMobil Poster Presentation 2017
- NYC MediaLab Exploring Future Reality 2017

K-12 STEM Outreach

- Applied Research Innovations in Science and Engineering (ARISE) 2017 - 2019

Public Outreach

- USA Science Engineering Festival Expo 2018

SERVICES AND PROFESSIONAL AFFILIATIONS

University Service - UBC Civil Engineering

- Equity, Diversity, and Inclusion Committee, 2023-2024
- Faculty Merit Review Committee, 2023-2024
- 3 Minute Thesis Competition Judge, 2023-2024

Professional Service

- Technical Program Committee member of ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (Buildsys 2024)
- Technical Co-Chair of ASCE International Conference on Computing in Civil Engineering (i3CE) 2024 Track: Artificial Intelligence and Data-driven Applications for Built-Environment Management
- Technical Co-Chair of ASCE International Conference on Computing in Civil Engineering (i3CE) 2023 Track: Big data and Machine Learning
- Technical Co-Chair for the ASCE Construction Research Congress (CRC) conference 2024. Track: Advanced Technologies and Data Analytics

Selected Journal Reviewer

- Advanced Engineering Informatics
- Architectural Science Review
- Automation in Construction
- Building and Environment
- Development in the Built Environment
- IEEE Sensors Journal
- International Journal of Transportation Science and Technology
- Journal of Computing in Civil Engineering
- Journal of Construction Engineering and Management
- Journal of Management in Engineering

Selected Conference Reviewer

- ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (Buildsys 2024)
- ASCE International Conference on Computing in Civil Engineering (i3CE 2024)
- Construction Research Congress (CSC 2024)
- ASCE International Conference on Computing in Civil Engineering (i3CE 2023)
- Winter Simulation Conference (WSC 2022)
- Canadian Society for Civil Engineering Annual Conference (CSCE 2022)
- Transportation Research Board Annual Meeting (TRB 2021)
- Construction Research Congress (CRC 2020)
- ASCE International Conference on Computing in Civil Engineering (i3CE 2019)
- Environmental Design Research Association (EDRA 2019)

Professional Affiliations

- American Society of Civil Engineers (ASCE)
- Visualization, Information Modeling, and Simulation (VIMS-ASCE)