CHUL MIN YEUM

Last updated: Feb 21, 2024

CONTACT INFORMATION

Assistant Professor
Civil and Environmental Engineering
The University of Waterloo
E2-2313, 200 University Ave W
ON, N2L 3G1, Canada

Email: cmyeum@uwaterloo.ca
Homepage: https://cviss.net/
YouTube: https://www.youtube.com/@cviss
Google Scholar:
https://scholar.google.com/citations?user=6PiF3MkAAAAJ&hl=en

RESEARCH INTERESTS

Smart Structure; Computer Vision; Mixed (Augmented) Reality; Machine Learning; Robotics; Nondestructive Testing; Sensing Technologies

EDUCATION

Ph.D., Civil Engineering, Purdue University, West Lafayette, IN, USA *2012-2016*
- Dissertation: *Computer Vision-Based Structural Assessment Exploiting Large Volumes of Images.*

M.S., Civil Engineering, Korea Advanced Institute of Science & Technology (KAIST), South Korea *2008-2010*
- Thesis: *Lamb Wave Mode Decomposition using Concentric Ring and Circular PZT Transducers.*

B.S., Civil Engineering, Korea Advanced Institute of Science & Technology (KAIST), South Korea *2002-2008*

EMPLOYMENT HISTORY

Assistant Professor, Department of Civil & Environmental Engineering *2018-Present*
University of Waterloo, Waterloo, ON, Canada

Postdoctoral Researcher, Lyles School of Civil Engineering *2016-2018*
Purdue University, West Lafayette, IN, USA

Research Assistant, Lyles School of Civil Engineering *2012-2016*
Purdue University, West Lafayette, IN, USA

Researcher, Department of Civil & Environmental Engineering *2010-2012*
Korea Advanced Institute of Science & Technology (KAIST), South Korea

Research Assistant, Department of Civil & Environmental Engineering *2008-2010*
Korea Advanced Institute of Science & Technology (KAIST), South Korea

RESEARCH EXPERIENCE

1. **Mitacs Accelerate (PI)**, supported by Mitacs (industry partner: Rogers Communication). *2024-present*
   Award funding: $300,000 (CAD) for 04/01/22-31/12/25 in the support of a research project entitled “Enhancing Tower Inspection with 5G-Connected Drone Systems”

2. **NSERC Alliance-Mitacs (PI),** supported by NSERC-Mitacs. Award funding: $135,000 (NSERC) + $148,333 (Mitacs) for 01/04/24-30/04/25 in the support of a research project entitled "5G-enabled Drone-based Online Inspection System", leveraged from Rogers' Communication fund. *2024-present*

3. **Collaborate 2 Commercialize (PI),** supported by Ontario Centre of Innovation (OCI#: 35835). Award funding: $130,000 (CAD) for 01/04/24-30/09/25 in the support of a research project entitled "Rapid Culvert Inspection using a Low-cost Electromagnetic Sensor" *2024-present*

4. **NSERC Alliance (PI),** supported by NSERC. Award funding: $88,600 (CAD) for 28/04/23-27/04/25 in the support of a research project entitled "Development of an Image-based Surface Roughness Measurement System" *2023-present*

5. **Research Collaboration (PI)**, supported by The State University of New York, Korea. Award funding: $21,500 (CAD) for 09/01/23-11/30/23 in the support of a research project entitled "Space Exploration and In-Situ Resource Utilization Center" *2023*

6. **KIMM-AKCSE (PI)**, supported by KIMM and AKCSE. Award funding: $20,000 (CAD) for 08/01/23-03/31/24 in the support of a research project entitled "Investigation of Digital Twin-based Lifecycle Infrastructure Monitoring Technology" *2023*

7. **Research partnership: 5G-enabled Drone-based Online Inspection System (PI),** supported by Rogers (extra funding for the 3rd year). Award funding from Rogers: $68,000 (CAD) for 04/01/2023-09/31/2024. *2023-present*

8. **Mitacs Globalink Research Award (PI)**, supported by Mitacs and National Research Foundation of Korea). Award funding: $12,000 (CAD) for 01/07/23-30/06/24 in the support of graduate student internships (5 students) for the project entitled "Development of an AI-based decision system for facility safety using computer vision and non-destructive technology" *2023-present*

9. **NSERC Alliance (Co-PI),** supported by NSERC. Award funding: $1,099,150 (CAD) for 09/15/22-9/17/27 in the support of a research project entitled "Buildings and floods: Micro-scale flood risk assessment in cities" *2022-present*

10. **KIMM-AKCSE (PI)**, supported by KIMM and AKCSE. Award funding: $20,000 (CAD) for 08/01/22-12/31/22 in the support of a research project entitled "Structure Inspection using Building Information Modeling and Augmented Reality" *2022*

11. **HIIFP (PI)**, supported by MTO. Award funding: $105,750 (CAD) for 04/01/22-03/31/2024 in the support of a research project entitled "Development of an Image-based Surface Roughness Measurement System" *2022- Present*

12. **Mitacs Accelerate (PI)**, supported by Mitacs (industry partner: JACOBB). Award funding: $30,000 (CAD) for 04/01/22-03/30/23 in the support of a research project entitled "Compatible Sewer Pipe Defect Detection and Estimation of its Key Characteristic with Two Different Imaging System" *2022-2023*

13. **Mitacs Accelerate (PI)**, supported by Mitacs (industry partner: MDA). Award funding: $60,000 (CAD) for 01/01/22-04/30/24 in the support of a research project entitled "Nuclear Decommissioning Management using Building Information Modeling and Augmented Reality" *2022-2024*

14. **Seed Grant Program (Co-PI),** supported by the Water Institute. Award funding: $20,000 (CAD) for 04/01/2021– 03/31/2022 in the support of a research project entitled "Data fusion and analysis to predict overland flow flood risk: establishing a proof of concept". *2021-2022*

15. **SOSCIP GPU-Accelerated platform (PI),** supported by SOSCIP consortium. Access 4 GPU years and 100 TB storage to support research partnership with Rogers. Subscription period: 06/01/2021-12/31/2022 *2021-2022*

16. **Funding for research infrastructure (CFI-JELF),** supported by John R. Evans Leaders Fund. Award funding: $277,830 (CAD) for 05/01/21-04/30/26 in the support of a research project entitled "Infrastructure for Advancing Vision-based Structural Assessment Technologies". *2021-present*

17. **Consulting service (PI)**, funded by MacDonald, Detwiller, and Associates, Inc. (MDA) in the support of a research project entitled "Study on Decommissioning Robotics". Award funding: $5,000 (CAD) for 03/01/2021– 03/31/2021. *2021*

18. **Voucher for Innovation and Productivity (VIP) program (Co-PI),** supported by Ontario Centers of Excellence (OCE). Award funding: $150,000 (CAD) for 09/01/2020 – 08/31/2022, leveraged from Roger's grant for "Research partnership: 5G-Enabled Smart Infrastructure Applications". *2021- 2022*

19. **Research partnership: 5G-Enabled Smart Infrastructure Applications (Co-PI),** supported by Rogers. Award funding from Rogers: $135,000 (CAD) for 09/01/2020 – 08/31/2022. Use 5G to create geo-spatial maps in real-time using ground-based robots and design mobile edge computers for on-device analysis of the data using AI algorithms. *2020- 2022*

20. **Mitacs Globalink Research Internship (PI)**, supported by Mitacs. Three international undergraduate students will come and do an internship in my lab during Summer 2022. *2021*

21. **Discovery Launch Supplement (PI),** supported by NSERC, Award funding: $12,500 (CAD) for 04/01/2020 – 03/31/2026: This award provides timely resources to support Early Career Researchers as they establish a Discovery Grant-funded research program (award of $12,500 (CAD)). *2020- present*

22. **Discovery Grant: Enhancing Infrastructure Resiliency Through Visual Data Analytics (Principal Investigator),** supported by NSERC under Grant No. RGPIN-1509, Award funding: $130,000 (CAD) for 04/01/2020 – 03/31/2026: Deliver the computational algorithm to accelerate the development of safer, more resilient infrastructure by collecting and analyzing visual data. *2020- present*

23. **Collaborative research with Aerialtronics (PI)**, creating the data-sharing agreement with Aerialtronics**:** Develop vision-based visual inspection using an autonomous drone equipped with a new dual spectrum sensor, PENSAR (developed by Aerialtronics). *2018-2019*

24. **CDS&E: Enabling time-critical decision-support for disaster response and structural engineering through automated visual data analytics (Postdoctoral Researcher, Purdue University)**, supported by NSF under Grant No. NSF-1608762 (07/17/16 – 07/15/19): Develop a deep learning algorithm to automatically classify images collected from post-event reconnaissance missions to enable scientific research and code development. *2017-2018*

25. **EAGER: Active citizen engagement to enable lifecycle management of infrastructure systems, (Postdoctoral Researcher, Purdue University)**, supported by NSF under Grant No. NSF-1645047 (07/28/16 – 08/31/18): Develop a lifecycle structural management system using crowdsourcing images. *2017-2018*

26. **Automated (Image-Based) collection and measurements for construction pay items, (Research Assistant, Purdue University)**, supported by Indiana Dept. of Trans. under JTRP Project SPR-4006 (08/01/15 – 08/01/17): Develop software for orthophoto generation and graphical measurement to improve efficiency and safety in measuring the pay items placed at a construction site. *2015-2017*

27. **Ultra-low-power wireless sensors for advanced, in situ structural health monitoring, (Research Assistant, Purdue University),** Supported by Small Business Innovative Research (SBIR) Program under Contract No. W9132T-12-C-0020 (08/01/12 – 08/01/15): Develop a self-contained, low-power distributed wireless sensor network to monitor usage patterns of a rapidly emplaced military bridge. *2012-2015*

28. **Development of on-board SHM technologies for composite air vehicles, (Research Assistant, KAIST)**, supported by The Boeing Company (08/01/08 – 07/31/11): Develop an online structural health monitoring system that allows detection and localization of delamination in composite aircraft without relying on past reference data. *2008-2011*

TEACHING EXPERIENCES

CIVE497-CIVE700: **Smart Structure Technology** at the University of Waterloo *W2024*

- This course offers an introduction to emerging smart structure technologies in civil engineering. Among several topics in smart structure, this course focuses on structural assessment using optical sensor data by implementing state-of-art image processing and computer vision techniques. *W2022, W2021 W2020, W2019*
- Course website: https://github.com/chulminy/CIVE497-CIVE700

AE/CIVE/ENVE/GEOE 121: **Computational Method** at the University of Waterloo *S2022*

- This course offers a practical introduction to computer programming for engineering students using MATLAB. MATLAB is an easy and readable programming language and is an excellent choice for those learning programming for the first time. This course will cover various topics including programming fundamentals, matrix operations, file I/O, numerical methods, and data visualization. *S2021, W2022 S2020, S2019*
- Course website: https://github.com/chulminy/AE_ENVE_GEOE_121

EDUCATIONAL EXPERIENCES

Invited Guest Lecturer *May 2022*

- Building Instrumentation in AE 405 at Waterloo

Invited Guest Lecturer *Feb 2022*

- Deep learning in C211 at UCLA *May 2023*

Invited Guest Lecturer *July 2016*

- Image-based Sensing in CE 597 at Purdue University.

Invited Guest Lecturer *June 2010*

- International Research Experience for Undergraduates Program in Smart Structures, KAIST.

STUDENT ADVISING

Supervisor, Ph.D. Student, *University of Waterloo* *2020-present*

- **Kay Han** (Will start in F2024): TBD
- **Hamad Khan** (Will Start in S2024): TBD
- **Ryulri Kim** (Started in F2023, co-supervised by Giovanni Cascante): Defect detection in corrugated pipes using electromagnetic waves
- **Fuad Hassan** (Started in F2023): Community data processing using computer vision
- **Raza Rizvi** (Started in S2023): Industrial metaverse for infrastructure inspection
- **Anas Share** (Started in S2023, co-supervised by Derek Robinson): Community mapping using aerial platforms
- **Huaiyuan Weng** (Started in W2023 as a master and transferred to a PhD in F2023): Developing community data collection platforms
- **Wilson Carofilis** (Started in W2022, co-supervised by Eugen Kim): Vision-based concrete surface roughness estimation technique
- **Rishabh Bajaj** (Started in F2020, co-supervised by Sriram Narasimhan): Adaptive image collection system for visual inspection
- **Max Midwinter** (Started in S2020 as a master and transfered to a PhD in F2021): Deep learning application for visual assessment.
- **(Complete) Zaid Abbas Al-Sabbag** (F2020-W2024, co-supervised by Sriram Narasimhan): Application of mixed reality in civil engineering

Supervisor, Master Student, *University of Waterloo* *2019-present*

- **Tanish Shah** (Will start in F2024): TBD
- **Shaekh Shithil** (Will start in F2024): TBD
- **Jason Su** (Started in F2023): Use of AR in architecture visulaization
- **Noreen Gao** (Started in S2023, co-supervised by Carl Haas): Data visualization using augmented reality
- **(Complete) Juan Park** (W2019 – W2021): Visual analytics for visual assessment.

Supervisor, Undergraduate Research Internship (Co-op), *University of Waterloo* *2019-present*

- **Jason Su** (F2022): Nuclear Decommissioning Management using Building Information Modeling and Augmented Reality (supported by Mitacs Accelerate)
- **Jesse St. John - Parker** (F2022): Extended Reality for Remote Inspections (supported by NSERC USRA)
- **Noreen Gao** (F2021, S2022): Structure assessment using augmented reality
- **Alice Liang** (S2021): Crack segmentation using deep learning
- **Jason Connelly** (F2020)**:** Augmented reality smart glass application for visual assessment (supported by NSERC USRA)
- **Max Midwinter** (W2019): Development of the adaptive image collection system for visual inspection
- **Joyceline Nathaniel** (W2019): Development of an image-based recommendation system for home buyers

Supervisor, Undergraduate Research Assistantship (URA), *University of Waterloo* *2018-present*

- **Joyce Ke** (W2024): 3D model visualization using augmented reality
- **David Yen** (F2023): Virtual/Augmented Reality Applications in Structures Assessment
- **Tanish Shah** (F2023): Augmented Intelligence: A Fusion of AR and AI Technologies
- **Aidan Hum** (F2022): AR-based structural assessment
- **Andy Zhao** (S2022): Build a mobile data collection system (hardware)
- **Andrei Muresanu** (F2021): Flood risk analysis using deep learning
- **Shuxian Nian** (W2020)**:** Disaster recovery monitoring
- **Jason Connelly** (F2019, S2020)**:** Unity 3D design for Hololens application
- **Juan Park** (F2018; W2019): Structural assessment using big visual data
- **Max Midwinter** (F2018; S2019): Vision-based structural inspection
- **Shuai Yuan** (W2018): Smart assistance platform for pipe inspection
- **Tianyi Yu** (W2018): Smart assistance platform for pipe inspection
- **Wendy Chikowero** (W2018): Machine learning approach for finite element methods
- **Zaid Abbas Al-Sabbag** (W2018): Mobile digital image correlation solution
- **Marilyn Wang** (W2018): Detection of efflorescence stains using images
- **Tianpeng Hong** (W2018): Deployment of a PENSAR camera for visual inspection.

Supervisor, Globalink Research Internship, *Mitacs* *2021-present*

- **Qi Jing** (S2023): Computer vision-based building feature extraction
- **Sameer Memon** (S2022): Robotics-Based Infrastructure Inspection
- **Fedrick Hasan** (S2022): Augmented Reality Applications in Structure Assessment and Asset Management
- **Swasti Shreya Mishra** (F2021)**:** Enabling resilient communities through Visual Data Analytics
- **Yao Lin** (S2021)**:** Augmented reality applications in structure assessment and asset management

- **Bowei Song** (S2021)**:** Augmented reality applications in structure assessment and asset management

GRADUATE EXAMINATION ACTIVITIES

PhD Committee Member, Ph.D. Student, *University of Waterloo* *2018-present*

- **Niloofar Elyasi** (W2021-present): Advancing Structural Engineering Through Data-Driven Methodologies: Seismic Vulnerability Assessment and Reliability Analysis
- **Ce Zhang** (S2021-present): Real-Time Interaction Turning Movement Flows Forecasting Using Deep Learning Models
- **Gabriel Earle** (F2020-present): Rethinking Infrastructure Deconstruction Through Reality Data Capture and Interactive Simulations
- **Cristobal Lara** (W2017-present)**:** Integration of numerical modelling and non-destructive evaluation in Digital Twins for Legacy Plants
- **Saeed Hatefi Ardakani** (W2020-present): Model Order Reduction Methods for Geo-mechanical Analysis
- **Tyler Hull** (F2019-present): Investigation of the Effective Flange Width and Performance of Mass Timber Composite T-beams and I-beams
- **Daniel Lopez Morales** (F2020-present): Finding Exact Industrial Objects in Point Clouds using Machine Learning and Procedural Scene Generation
- **Kareem Mostafa** (F2018-F2021): Image-based Learning for Smart City Rehabilitation

Thesis Defense Examiner, Master Student, *University of Waterloo* *2020-present*

- **Tarek Ghareeb Mohamed** (2022): Early Flame Detection system Using Real-time Machine-Vision and Image Analysis
- **Ben O'Callaghan** (2021): Effects of GFRP Reinforcement on the Compressive Behaviour of Square SPF Timber Columns
- **Nik Knezic** (2021): Coagulant addition for managing sediment-associated phosphorus bioavailability to prevent cyanobacterial blooms in drinking water reservoirs
- **Devin Feng** (2021): A Rules-based Mode Choice Model using CHAID Decision Trees and Dynamic Transit
- **Alan Xaykongsa** (2021): AADT Estimation Models and Analytical Comparison of Pedestrian Safety Risk Evaluation Methods for Signalized Intersections
- **Matthew Iannetta** (2020): Design of a Remote, Integrated, Automatic and Continuous Bedload Sediment Transport Monitoring Station and Application in a Rural Stream in Southern Ontario
- **Evan Marco McLaughlin** (S2020): A deep learning approach for automating concrete bridge defect assessment using computer vision

HONORS & AWARDS

Travel Award from the University of Nebraska Durham School *Jun. 2023*

- I was invited as an early career delegate to the Future of the Building Industry Workshop. This opportunity came with an award that covered my registration fee, flight, and accommodation expenses.

Engineer of the Future Fund from Faculty of Engineering at the University of Waterloo *Mar. 2023*

- Scan Map Inspect (SMI) team, comprised of Max Midwinter, Zaid Abbas Al-Sabbag, and Rishabh Bajaj has won the Engineer of the Future Fund ($5k).

Editor's Choice *from Journal of Performance of Constructed Facilities* *Dec. 2022*

- The paper, "*Multioutput Image Classification to Support Postearthquake Reconnaissance*" is selected as an Editor's Choice article.

GRADflix from Waterloo AI *Nov. 2021*

- Zaid AI-Sabbag won first place in Waterloo.AI GRADflix Competition with his research on augmented reality and its uses in infrastructure maintenance ($2,000 cash prize)
- Video: https://www.youtube.com/watch?v=9_qA6SwnLOU

MS Azure Credit *from Microsoft* *Nov. 2019*

- Microsoft awarded free Azure credits ($20,000 in 2019, $9,000 in 2020) to selected projects in AI for Waterloo.ai members. *Dec. 2020*

Editor's Choice *from Journal of Performance of Constructed Facilities* *Feb. 2019*

- The paper, "Post-*Event Reconnaissance Image Documentation using Automated Classification*" is selected as an Editor's Choice article.

NVIDIA GPU Grant from NVIDIA *Dec. 2018*

- This program seeds a gift of one GPU intended to enable researchers to get started using GPUs. One Titan V GPU is received for deep learning research.

Travel award *from Natural Hazards Engineering Research Infrastructure (NHERI)* *June 2018*

- *The* awardee *receives full travel support up to $2,500 for the participation in NHERI-the Summer Institute at the University Texas at San Antonio*

CE Outstanding Graduate Student *from Lyles School of Civil Engineering, Purdue University* *May 2017*

- This award recognizes excellence in both research and serve to the school, college and the university community (award of $500).

Innovation in Computing Award *from Computer-Aided Civil and Infrastructure Engineering* *July 2016*

- The paper, "Vision-*Based Automated Crack Detection for Bridge Inspection*," is selected as 2015 Hojjat Adeli Award for innovation in computing (award of $1,500).

Discovery, Engagement & Learning (DEAL) Grant *from Purdue Graduate Student Government* *2013-2014*

- This grant offers monetary assistance by helping multidisciplinary research of graduate students (award of $2,500 for each project).

Research Assistantship *from Purdue University* *2012-2016*

- Graduate researcher assistantship in the Lyles School of Civil Engineering, Purdue University.

Top 25 Hottest Articles *in Wave Motion* *2011*

- The paper entitled "Lamb Wave Mode Decomposition using Concentric Ring and Circular PZT Transducers" is ranked as the 3rd hottest article (among 25) for 2011 full year through.

Research Assistantship *from KAIST* *2008-2010*

- Graduate researcher assistantship in the school of civil engineering, KAIST.

Undergraduate Research Program Award *from KAIST* *2008*

- Receive the 3rd prize for the winter/spring undergraduate research program at KAIST in 2008.

Scholarships for outstanding students *from KAIST* *2006-2008*

- This scholarship is awarded to three prominent students in the School of Civil Engineering, KAIST (award of $2,000 per year for three years).

PRESENTATIONS & TALKS

Research Seminar, Korea Institute of Materials Science**,** South Korea *Apr 2023*

Research Seminar, Ajou University, Suwon, South Korea *Apr 2023*

Research Seminar, The State University of New York- SUNY-Korea, Incheon, South Korea *Oct 2022*

Research Seminar, Korea Research Institute of Standards and Science, Daejeon, South Korea *Oct 2022*

Research Seminar, *Apr 2022*

- Organized by MARS-SHM (https://mars-shm.com/workshops/)

Research Seminar, Dankook University, Yongin, South Korea *Nov 2019*

Research Seminar, Sejong University, Seoul, South Korea *Nov 2019*

Research Seminar, Korea Advanced Institute of Science & Technology, Daejeon, South Korea *Oct 2019*

Professional Presentation *Sep 2017*

- SHM-in-Action (invited) in the 11th Inter. Workshop on SHM (IWSHM), Stanford, CA, USA.

Professional Presentation

- 3rd Midwest Smart Structures Colloquium, Danville, IL. *Oct 2017*
- 2nd Midwest Smart Structures Colloquium, West Lafayette, IN. *Sep 2016*
- 1st Midwest Smart Structures Colloquium, Grafton, IL. *Oct 2015*

MEMBERSHIPS

Committee Member, *SEI Technical Activities Division Structural Control and Sensing Committee of the Technical Administrative Committee on Analysis and Computation.* *Apr 2021-Sep 2027*

Member, *Waterloo Artificial Intelligence Institute* 2020-present

Regular Member*, Association of Korean-Canadian Scientists and Engineers (AKCSE)* 2020-present

Associate Member, *American Society of Civil Engineers (ASCE)* 2020-present

SYNERGISTIC LEADERSHIP POSITIONS

Co-Organizer, *ASCE Structure Congress*, *New Orleans, Louisiana* *May 2023*

- Co-organized a special session on *"Advances in Intelligent Structural Sensing and Control"*

Co-Organizer, *7th World Conference on Structural Control and Monitoring (7WCSCM)*, *Qingdao, China* *June 2018*

- Co-organized a special session on *"Innovations in Computer Vision for Structural Monitoring and Damage Detection."*

Workshop Secretary, *Global Policies for Infrastructure Monitoring & Management, Purdue University* *August 2012*

PEER-REVIEWED JOURNAL PAPERS (26 published, 2 submitted, 1 accepted, 1 in preparation)
*****: direct- or co-supervision.

1. Zaid Abbas Al-Sabbag, **Chul Min Yeum**, and Sriram Narasimhan, "Distributed Collaborative Inspections through Smart Infrastructure Metaverse," *submitted to Automation in Construction.*

2. Max Midwinter*, Zaid Abbas Al-Sabbag*, Rishabh Bajaj*, and **Chul Min Yeum,** "Defect Quantification Using Novel Civil RGB-D Dataset," *submitted to Advanced Engineering Informatics.*

3. Rishabh Bajaj*, Zaid Abbas Al-Sabbag*, **Chul Min Yeum**, and Sriram Narasimhan, "High-Fidelity 3D Reconstruction for Damage Quantification," *Accepted at ASCE Open: Multidisciplinary Journal of Civil Enginering.*

4. Sangyoung Han, Taemin Heo, **Chul Min Yeum**, Kukjoo Kim, Jongkwon Choi, Mang Tia, "Machine learning approach to evaluate built-in curling of concrete pavement," *submitted to International Journal of Concrete Structures and Materials (2023).*

5. Niloofar Elyasi, Eugene Kim, **Chul Min Yeum**, "A Machine Learning-Based Seismic Vulnerability Assessment Approach for Low-Rise RC Buildings," *Journal of Earthquake Engineering, 1-17,* (2023).

6. Max Midwinter*, Zaid Abbas Al-Sabbag*, **Chul Min Yeum**, "Unsupervised Semantic Segmentation with Pose Prior", *Accepted for Computer-Aided Civil and Infrastructure Engineering*, 38(17), 2455-2471, (2023).

7. Zaid Abbas Al-Sabbag*, **Chul Min Yeum**, Sriram Narasimhan, "Enabling Human-Machine Collaboration in Infrastructure Inspections through Mixed Reality," *Advanced Engineering Informatics*, 53, 101709, (2022).

8. Ju An Park*, Xiaoyu Liu, **Chul Min Yeum**, Shirley J. Dyke, Max Midwinter*, Jongseong Choi, Zhiwei Chu, Thomas Hacker, Bedrich Benes, "Multi-output Image Classification to Support Post-Earthquake Reconnaissance," *Journal of Performance of Constructed Facilities,* 36(6), 04022063, (2022).

9. Zaid Abbas Al-Sabbag*, **Chul Min Yeum**, Sriram Narasimhan, "Interactive Defect Quantification Through Extended Reality", *Advanced Engineering Informatics, 51, 101473, (2022)*

10. Jongseong Choi, Lazaros Toumanidis, Shirley J. Dyke, **Chul Min Yeum**, Patrikakis Charalampos, Ali Lenjani, Xiaoyu Liu, and Panagiotis Kasnesis, "Automated Graffiti Detection: A Novel Approach for Maintaining Historical Structures in Community," *Applied Sciences*, 12(6), 2983, (2022).

11. Jongseong Choi, Ju An Park*****, Shirley J. Dyke, **Chul Min Yeum**, Xiaoyu Liu, Ilia Billionis, and Ali Lenjani, "Similarity-based Building Search Capability for Post-event Image Data," *Computer-Aided Civil and Infrastructure Engineering,* 37 (2), 261-275, (2022).

12. Ju An Park*****, **Chul Min Yeum**, Trevor D. Hrynyk, "Learning-based Image Scale Estimation using Surface Textures for Quantitative Visual Inspection," *Computer-Aided Civil and Infrastructure Engineering*, 36(2), 227-241, (2020).

13. Xiaoyu Liu, Shirley J. Dyke, **Chul Min Yeum**, Ilias Bilionis, Ali Lenjani, and Jongseong Choi, "Automated Indoor Image Localization to Support a Post-Event Building Assessment," *Sensors*, 20, no. 6 (2020).

14. Ali Lenjani, Ilias Bilionis, Shirley Dyke, **Chul Min Yeum**, and Ricardo Monteiro, "A Resilience-based Method for Prioritizing Post-event Building Inspections," *Natural Hazards,* 100, 877-896, (2020).

15. Ali Lenjani, Shirley Dyke, Ilias Bilionis, **Chul Min Yeum**, Kenzo Kamiya, Jongseong Choi, Xiaoyu Liu, and Arindam Gan Chowdhury, "Towards fully automated post-event data collection and analysis: pre-event and post-event information fusion," *Engineering Structures,* 208, no.1, (2020).

16. Bernard Engel, Won Seok Jan, and **Chul Min Yeum**, "Integrated environmental modeling for efficient aquifer vulnerability assessment using machine learning," *Environmental Modelling and Software*, 124, (2020).

17. Ali Lenjani, **Chul Min Yeum**, Shirley J. Dyke, and Ilias Bilionis, "Automated Building Image Extraction from 360-degree Panoramas for Post-Disaster Evaluation," *Computer-Aided Civil and Infrastructure Engineering,* 35, no. 3, (2020).

18. **Chul Min Yeum**, Shirley J. Dyke, Bedrich Benes, Thomas Hacker, Julio A. Ramirez, Alana Lund, and Santiago Pujol, "Post-Event Reconnaissance Image Documentation using Automated Classification," *Journal of Performance of Constructed Facilities, 33(1),* (2018). Editor's Choice Selection (2019).

19. **Chul Min Yeum**, Jongseong Choi, and Shirley J. Dyke, "Automated Region-of-interest Localization and Classification for Vision-based Visual Assessment of Civil Infrastructure," *Structural Health Monitoring 15, no. 3* (2019).

20. **Chul Min Yeum**, Alana Lund, Shirley J. Dyke, Julio A. Ramirez, "Automated Recovery of Documents from Earthquake Reconnaissance Images," *Journal of Computing in Civil Engineering 33, no. 1* (2018).

21. Jongseong Choi, **Chul Min Yeum**, Shirley J. Dyke, and Mohammad R. Jahanshahi, "Computer-Aided Approach for Rapid Post-Event Visual Evaluation of a Building Façade," *Sensors, 18, 3017* (2018).

22. **Chul Min Yeum**, Shirley J. Dyke, and Julio A. Ramirez, "Visual Data Classification in Post-Event Building Reconnaissance," *Engineering Structures 155 (2018): 16-24*.

23. Hacker, Thomas, Shirley Dyke, Ali Irmak Ozdagli, Gemez Marshall, Christopher Thompson, Brian Rohler, and **Chul Min Yeum**, "A Researcher-oriented Automated Data Ingestion Tool for rapid data Processing, Visualization and Preservation," *Advances in Engineering Software 114 (2017): 134-143*.

24. **Chul Min Yeum**, Jongseong Choi, and Shirley J. Dyke, "Autonomous image localization for visual inspection of civil infrastructure*," Smart Materials and Structures 26, no. 3 (2017)*.

25. **Chul Min Yeum**, Shirley J. Dyke, Ricardo E. Basora Rovira, Christian Silva, and Jeff Demo, "Acceleration-Based Automated Vehicle Classification on Mobile Bridges," *Computer-Aided Civil and Infrastructure Engineering 31, no. 11 (2016): 813-825.*

26. **Chul Min Yeum** and Shirley J Dyke, "Vision-Based Automated Crack Detection for Bridge Inspection," *Computer-Aided Civil and Infrastructure Engineering 30, no. 10 (2015): 759-770*. Recipient of 2015 Innovation Award for this journal

27. **Chul Min Yeum**, Hoon Sohn, Hyung Jin Lim, and Jeong Beom Ihn, "Reference-Free Delamination Detection Using Lamb Waves," *Structural Control and Health Monitoring 21, no. 5 (2014): 675-684*.

28. Hyung Jin Lim, Hoon Sohn, **Chul Min Yeum**, and Ji Min Kim, "Reference-Free Damage Detection, Localization, and Quantification in Composites," *The Journal of the Acoustical Society of America 133, no. 6 (2013): 3838–3845*.

29. Byeongjin Park, Hoon Sohn, **Chul Min Yeum**, and Thanh C Truong, "Laser Ultrasonic Imaging and Damage Detection for a Rotating Structure," *Structural Health Monitoring 12, no. 5–6 (2013): 494–506*.

30. **Chul Min Yeum**, Hoon Sohn, Jeong Beom Ihn, and Hyung Jin Lim, "Instantaneous Delamination Detection in a Composite Plate Using a Dual Piezoelectric Transducer Network," *Composite Structures 94, no. 12 (2012): 3490–99*.

31. Jungeun An, Raphael T. Haftka, Nam H. Kim, Fuh-Gwo Yuan, Byung Man Kwak, Hoon Sohn, and **Chul Min Yeum**, "Experimental Study on Identifying Cracks of Increasing Size Using Ultrasonic Excitation," *Structural Health Monitoring 11, no. 1 (2012): 95–108*.

32. **Chul Min Yeum**, Hoon Sohn, and Jeong Beom Ihn, "Lamb Wave Mode Decomposition Using Concentric Ring and Circular Piezoelectric Transducers," *Wave Motion 48, no. 4 (2011): 358–370*.

REFEREED CONFERENCE PROCEEDING (19 published) *****: direct- or co-supervision.

---

1. Max Midwinter*****, Zaid Abbas Al-Sabbag*****, Rishabh Bajaj*****, and **Chul Min Yeum**, "Defect Quantification Using Novel Civil RGB-D Dataset," Proceedings of *the Canadian Society for Civil Engineering,* University of New Brunswick, New Brunswick, May 24-27, 2023.

2. Rishabh Bajaj*****, Zaid Abbas Al-Sabbag*****, **Chul Min Yeum**, and Sriram Narasimhan, "Volumetric damage quantification for visual inspection," *8th World Conference on Structural Control and Monitoring, Orlando, Florida,* June 5, *2022.*

3. Max Midwinter*****, Zaid Abbas Al-Sabbag*****, and **Chul Min Yeum**, "Unsupervised Semantic Segmentation with Pose Prior," Proceedings of *11th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-11)*, *Concordia University, Montreal,* August 8, 2022.

4. Niloofar Elyasi, Max Midwinter*****, Eugene Kim, and **Chul Min Yeum**, "Rapid Seismic Vulnerability of Low-Rise RC Buildings Using Machine Learning," Proceedings of *12th National Conference on Earthqauke Engineering*, Salt Lake City, Utah, June 27, 2022.

5. Max Midwinter*****, **Chul Min Yeum**, and Eugene Kim, "Explainable Machine Learning for Seismic Vulnerability Assessment of Low-Rise Reinforced Concrete Buildings," Proceedings of *the Canadian Society for Civil Engineering,* online, 2021.

6. Ali Lenjani, **Chul Min Yeum**, Shirley Dyke, Ilias Bilionis, Jongseong Choi, Alana Lund, and Amin Maghareh, "Hierarchical Convolutional Neural Network for Activity Source Detection in Building Floors," Proceedings of *the 12th International Workshop on Structural Health Monitoring*, Stanford, CA, September 10-12, 2019.

7. Jongseong Choi, **Chul Min Yeum**, Shirley Dyke, Mohammad Jahanshahi, and Gun Wook Park, "Rapid Vision-

Based Inspection of Nonstructural Components in Buildings," Proceedings of *the 9th European Workshop on Structural Health Monitoring, Manchester*, UK, July 10-13, 2018.

8. **Chul Min Yeum**, Shirley J. Dyke, Bedrich Benes, Thomas Hacker, Julio A. Ramirez, Alana Lund, Chungwook Sim, and Santiago Pujol, "Automating Damage Classification in Post-Earthquake Building Images," Proceedings of *the 11th National Conference on Earthquake Engineering*, Los Angeles, CA, June 25-29, 2018.
9. **Chul Min Yeum**, Jongseong Choi, and Shirley J. Dyke, "Automated Region-of-Interest Localization and Classification for Visual Assessment on Civil Infrastructure," Proceedings of *the 11th International Workshop on Structural Health Monitoring, Stanford*, CA, September 12-14, 2017.
10. **Chul Min Yeum**, Shirley J. Dyke, Bedrich Benes, Thomas Hacker, Julio A. Ramirez, Alana Lund, and Santiago Pujol, "Rapid, Automated Image Classification for Documentation," Proceedings of *the 7th Conference on Advances in Experimental Structural Engineering*, Pavia, Italy, September 6-8, 2017.
11. **Chul Min Yeum**, Shirley J. Dyke, Julio A. Ramirez, Tomas Hacker, Santiago Pujol and Chungwook Sim, "Annotation of Image Data from Disaster Reconnaissance," Proceedings of *the 16th World Conference on Earthquake Engineering*, Santiago, Chile, Jan 09-13, 2017.
12. **Chul Min Yeum**, Shirley J. Dyke, Julio A. Ramirez, and Bedrich Benes, "Big Visual Data Analysis for Damage Evaluation in Civil Engineering," Proceedings of *International Conference on Smart Infrastructure and Construction*, Cambridge, U.K., June 27-29, 2016.
13. Shirley J. Dyke, **Chul Min Yeum**, Christian Silva, and Jeff Demo, "Applications of Computer Vision in Structural Health Monitoring," (a keynote speech) Proceedings of *the 7th Structural Health Monitoring and Intelligent Infrastructure*, Italy, July 1-4, 2015.
14. **Chul Min Yeum** and Shirley J. Dyke, "Vision-based Automated Visual Inspection of Large-scale Bridges," the Proceedings of *the 6th Conference on Structural Control and Monitoring*, Barcelona, Spain, July 15-17, 2014.
15. Byeongin Park, Troung Thanh Chung, **Chul Min Yeum**, and Hoon Sohn, "Laser Ultrasonic Imaging of a Rotating Blade," Proceedings of *SPIE International Symposia, Smart Structures & Materials and Nondestructive Evaluation for Health Monitoring and Diagnostics*, San Diego, CA, March 6-10, 2012.
16. Troung Thanh Chung, Byeongin Park, Hoon Sohn and **Chul Min Yeum**, "A Dropout Elimination Technique for Noncontact Laser Ultrasonic Imaging of a Rotating Object," Proceedings of *the 24th KKCNN Symposium on Civil Engineering*, Hyogo, Japan, December 14-16, 2011.
17. **Chul Min Yeum**, Hoon Sohn, Jeong Beom Ihn, and Hyung Jin Lim, "Reference-free Delamination Detection using Lamb Wave Time Delay," Proceedings of *the 8th International Workshop on Structural Health Monitoring*, Stanford, CA, September 13-15, 2011.
18. **Chul Min Yeum**, Hoon Sohn, and Jeong Beom Ihn, "Delamination Detection in a Composite Plate using a Dual Piezoelectric Transducer Network," Proceedings of *the SPIE International Symposia, Smart Structures & Materials and Nondestructive Evaluation for Health Monitoring and Diagnostics*, San Diego, CA, March 6-10, 2011.
19. Hyung Jin Lim, **Chul Min Yeum,** and Hoon Sohn, "Modeling of Impact-induced Delamination in a Multilayer Composite Plate," Proceedings of *the 23rd KKCNN Symposium on Civil Engineering*, Taipei, Taiwan,

November 13-15, 2010.

20. **Chul Min Yeum**, Hoon Sohn, and Jeon Beom Ihn, "Lamb Wave Decomposition using Amplitude Matching with Concentric Circular PZT Transducers," Proceedings of *the 5th European Workshop on Structural Health Monitoring*, Sorrento, Italy, June 29-July 02, 2010.

REFEREED CONFERENCE ABSTRACTS (25 published) *****: direct- or co-supervision.

---

1. Rishabh Bajaj*, Wilson Carofilis*, and **Chul Min Yeum**, "Quantitative Evaluation of Concrete Surface Roughness Using Smartphone-Based 3D Reconstructions", *20th World Conference on Non-Destructive Testing*, Incheon, Korea, May 27-31, 2024.

2. Alfredo Valenzuela, Jee Won Lee, **Chul Min Yeum**, Ricardo Ortiz, Jongseong (Brad) Choi, "Remote Monitoring Assessments Through Pan-Tilt-Zoom Automated Camera Control", *20th World Conference on Non-Destructive Testing*, Incheon, Korea, May 27-31, 2024.

3. Hanbeom Chang, Jongseong Choi, **Chul Min Yeum**, Ricardo David Ortiz Pozo, "Digital Twin Platform for Remote Assessment: Application in Extensive Ship Engine Inspection", *20th World Conference on Non-Destructive Testing*, Incheon, Korea, May 27-31, 2024.

4. Huaiyuan Weng*, **Chul Min Yeum**, Derek Robinson, Bruce MacVicar,"Automated Registration of Ground 3D Point Cloud Data for Individual Buildings", *20th Conference of the International Society for Computing in Civil and Building Engineering*, August 25-28, 2024.

5. Hanbeom Chang, Jongseong Choi, Sangho Song, Ricardo David Ortriz Pozo, Yongseok Choi, Dongguk Im, and **Chul Min Yeum**, "Digital Twin Platform engaged Remot Assessment: Full-Scale Ship Engine Inspection Application", *The 14th International Symposium on NDT in Aerospace*, Busan, Korea, November 5-8, 2023.

6. Hanbeom Chang, Jongseong Choi, and **Chul Min Yeum**, "Human-Machine Collaborative Platform in Metaverse", *2023 The Korean Society of Mechanical Engineers, Incheon*, Korea, November 1-4, 2023.

7. **Chul Min Yeum**, Zaid Al-Sabbag*, Max Midwinter*, Rishabh Bajaj*, Wilson Carofilis*, and Huiyuan Weng* (invited), "Transforming Infrastructure Assessment with Reality Capture," *Canada-Korea Conference on Science and Technology*, Ottawa, ON, July 17-21, 2023.

8. Rishabh Bajaj***** and **Chul Min Yeum**, "High Fidelity Image Based Concrete Surface Roughness Evaluation," *Structure Congress*, New Orleans, Louisiana, May 4, 2023.

9. Rishabh Bajaj*****, Zaid Abbas Al-Sabbag*****, **Chul Min Yeum**, and Sriram Narasimhan, "Multi-Dimensional Structural Assessment with a Mobile Scanning Device," *Transforming Construction with Reality Capture Technologies*, University of New Brunswick, New Brunswick, Aug 23, 2022.

10. Zaid Al-Sabbag*****, **Chul Min Yeum**, and Sriram Narasimhan, "Distributed Collaboration in Infrastructure Assessment through Mixed and Virtual Reality," *Transforming Construction with Reality Capture Technologies*, University of New Brunswick, New Brunswick, Aug 23, 2022.

11. **Chul Min Yeum**, Zaid Al-Sabbag*****, Rishabh Bajaj*****, and Max Midwinter***** (invited)," Human-Machine Collaborative Infrastructure Assessment through Mixed and Virtual Reality," *Canada-Korea Conference on*

Science and Technology, Niagara Falls, ON, July 4, 2022.

12. Zaid Abbas Al-Sabbag*****, Max Midwinter*****, **Chul Min Yeum**, and Sriram Narasimhan, "Human-Machine and Human-Human Collaborative Inspection Through Extended Reality," *Engineering Mechanics Institute Conference, 2022.*

13. Jongseong Choi, Ju An Park*****, **Chul Min Yeum**, and Shirley J Dyke, "Similarity Learning to Building Search Capability: Post-event Image Data Application," *Asia Pacific Conference of the Prognostics and Health Management Society, Sep 9, 2021.*

14. Zaid Abbas Al-Sabbag*****, Jason Paul Connelly, **Chul Min Yeum**, and Sriram Narasimhan, "Real-time Quantitative Visual Inspection using an Extended Reality Headset," (short paper, presentation) *6th Annual Conference on Vision and Intelligent Systems*, Waterloo, Ontario, Canada, Nov 25-27, 2020.

15. Ju An Park*****, **Chul Min Yeum**, and Trevor Hyrnyk, "Image Scale Estimation Using Surface Textures for Quantitative Visual Inspection," (short paper, presentation) *6th Annual Conference on Vision and Intelligent Systems, Waterloo*, Ontario, Canada, Nov 25-27, 2020.

16. Ju An Park*****, **Chul Min Yeum**, Jongseong Choi, and Xiaoyu Liu, "Automated Image Classification for Post-Earthquake Reconnaissance Images," (short paper, poster) *5th Annual Conference on Vision and Intelligent Systems*, Waterloo, Ontario, Canada, Nov 26, 2019.

17. Shirley J. Dyke, Xiaoyu Liu, Jongseong Choi, **Chul Min Yeum**, Ju An Park*****, Ali Lenjani, Julio A. Ramirez, and Randall Poston, "Learning from Earthquakes Using the Automatic Reconnaissance Image Organizer," *the 17th World Conference on Earthquake Engineering*, Sendai, Japan, Sep 27- Oct 2, 2021.

18. Ali Lenjani, Shirley Dyke, Ilias Bilionis, and **Chul Min Yeum**, "Accelerating Post-Event Data Collection and Analysis Using Artificial Intelligence," (abstract) *Tornado Hazard Wind Assessment and Reduction Symposium*, IL, USA, Oct 14-15, 2019.

19. Xiaoyu Liu, **Chul Min Yeum**, Shirley J. Dyke, Ali Lenjani, and Jongseong Choi, "Automated Image Localization and 3D Reconstruction for Post-Event Building Reconnaissance," (abstract) *the Engineering Mechanics Institute Conference (EMI)*, CA, USA, June 18-21, 2019.

20. Ali Lenjani, **Chul Min Yeum**, Shirley J. Dyke, and Ilias Bilionis, "Automated Pre-disaster Building Images Extraction from Street View Imagery," (abstract) *Tornado Hazard Wind Assessment and Reduction Symposium*, IL, USA, Sep 26-27, 2018.

21. **Chul Min Yeum**, Ali lenjani, Shirley J. Dyke and Ilias Bilionis, "Automated Detection of Pre-Disaster Building Images from Google Street View," (short paper) *the 7th World Conference on Structural Control and Monitoring*, Qingdao, China, July 22-25, 2018.

22. Shirley J. Dyke, **Chul Min Yeum**, Mathieu Gaillard, Bedrich Benes, Thomas Hacker, Alana Lund, Ali Lenjani, and Julio Ramirez, "The Automated Reconnaissance Image Organization Tool," (abstract) *the 43th Annual Natural Hazards Research and Applications Workshop*, Colorado, USA, July 8-11, 2018.

23. **Chul Min Yeum**, Shirley J. Dyke, Julio A. Ramirez, and Chungwook Sim, "Automated Damage Evaluation for Big Visual Data Collected from Earthquake," (abstract) *US-Korea Conference on Science, Technology and Entrepreneurship*, Washington D.C., August 9-12, 2017.

24. **Chul Min Yeum**, Jongseong Choi, and Shirley J. Dyke, "Image Localization for Computer-enhanced Visual Inspection of Civil Infrastructure," (abstract) *Engineering Mechanics Institute Conference*, San Diago, CA, United States, June 4-7, 2017.

25. Hoon Sohn, Yun Kyu An, Byeongin Park, Troung Thanh Chung, **Chul Min Yeum**, Jin Yeol Yang, and Hyun Seok Lee, "Laser Ultrasonic Techniques for Structural Health Monitoring Applications," (abstract) *CIMTEC*, Montecatini, Terme, Italy, June 10-14, 2012.

26. Hoon Sohn, Seung Bum Kim, Chang Gil Lee, **Chul Min Yeum**, and Jeong Bum Ihn, "Reference-Free Delamination Detection in Multilayer Composite Panels," *Multi-Functional Materials and Structures*, Hong Kong, China, July 28-31, 2008.

27. Hoon Sohn, Seung Bum Kim, Sang Jun Lee, Debaditya Dutta, Hyun Jun Park, Chang Gil Lee, Abhinav Agrawal, **Chul Min Yeum**, Seung Hee Park, and Yun Kyu An, "Transition from Guided Wave Based Non-Destructive Testing to Structural Health Monitoring," the 35th *Annual Review of Progress in Quantitative Nondestructive Evaluation* (QNDE 2008), Chicago, IL, July 20-25, 2008.

28. Hoon Sohn, Seung Bum Kim, Sang Jun Lee, Debaditya Dutta, Hyun Jun Park, Chang Gil Lee, Abhinav Agrawal, and **Chul Min Yeum**, "Robust Crack Detection under Changing Temperature Environment," (Invited Paper) *US-Korea Workshop on Bio*, Bio-Inspired and Smart Sensing, Jeju, Korea, May 23-25, 2008.

29. **Chul Min Yeum** and Hoon Sohn, "Probabilistic Damage Localization using Embedded Piezoelectric Sensor Networks," (abstract) *the 2nd UITM-KAIST Symposium on Urban Engineering and Sustainability*, Daejeon, Korea, March 31, 2008.

TECHNICAL REPORT

1. **Chul Min Yeum**, Anup Mohan, Shirley J. Dyke, Mohammad Jahanshahi, Jongseong Choi, Ziyi Zhao, Ali Lenjani, and Julio A. Ramirez. "Image-based collection and measurements for construction pay items." *Joint Transportation Research Program Publication No. FHWA/IN/JTRP-2017/10*. West Lafayette, IN: Purdue University.

PATENTS

1. Hoon Sohn, **Chul Min Yeum** and Jeong Bum Ihn. "Time delay based health monitoring system using a sensor network," (2014) https://www.google.com/patents/US8707787

2. Hoon Sohn, Hyung Jin Lim, **Chul Min Yeum** and Jeong Bum Ihn. "Reference free inconsistency detection system," (2013) http://www.google.com/patents/US20130139598

3. Hoon Sohn, **Chul Min Yeum** and Jeong Bum Ihn. "Transducer based health monitoring system cross-reference to related application," (2013) http://www.google.ch/patents/US8544328

4. Hoon Sohn, **Chul Min Yeum** and Jeong Beom Ihn. "Mode Decomposition of Sound Waves Using Amplitude Matching," (2012) http://www.google.com/patents/US8286492