

Yu Hou Ph.D.

Department of Civil and Environmental Engineering, Carnegie Mellon University

Porter Hall, 4815 Frew St, Pittsburgh, PA, USA 15213

Email: yhou2@andrew.cmu.edu, uscyyhou@gmail.com

Website: <https://www.yuhou.info/> (to download the newest version)

RESEARCH INTERESTS

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- Building Information Modeling (BIM)
- Construction Management
- Computer Vision
- Energy Audits
- Digital Twins

TEACHING INTERESTS

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Project Controls-Budgeting and Estimating; Construction Practices

Building Information Modeling and Integrated Practice; Machine Learning and Data Mining

EDUCATION

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Ph.D. in Civil Engineering, University of Southern California (8/2016-8/2021)

Concentrations: Unmanned Aircraft Systems (UASs), AI, Data Mining, and Building Energy Audits, Construction Management. GPA: 3.70/4.00

Dissertation title: “*Point Cloud Data Fusion of RGB and Thermal Information for the Building Energy Simulations in a Large District*”

Committee: *Lucio Soibelman (Chair), Burcin Becerik Gerber, Sami F. Masri, George Ban Weiss, Cyrus Shahabi*

Student Exchange Program in Civil Engineering, Karlsruhe Institute of Technology (11/2018-1/2019)

M.S. in Computer Science, University of Southern California (5/2017-5/2020)

Concentrations: AI, Data Science, and Computer Vision.

M.S. in Engineering Management, China University of Mining & Technology (5/2014-5/2017)

Concentrations: Building Information Modeling (BIM) and Safety Management.

B.S. in Engineering Management, China University of Mining & Technology (5/2010-5/2014)

GPA: 3.74/4.00 (Rank: 2/60)

PUBLICATIONS

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Peer-Reviewed Journal Papers:

1. **Yu Hou**, Rebekka Volk, Lucio Soibelman, (2021). “An Innovative Approach to Simulating Temperature Information for Generating Synthetic Aerial Thermal Images for Enlarging Deep Learning Training Datasets,” *Energies* (IF:3.004) 2021, 14, 353. DOI: <https://doi.org/10.3390/en14020353>
2. **Yu Hou**, Rebekka Volk, Meida Chen, Lucio Soibelman, (2021). "Data Fusion of Tie Points' RGB and Thermal Information for Mapping Large Areas: A Study of Fusion Performance under Experimental Conditions," *Automation in Construction* (IF:7.700) 2021, 124 DOI: <https://doi.org/10.1016/j.autcon.2021.103554>

3. **Yu Hou**, Meida Chen, Rebekka Volk, Lucio Soibelman, (2021). “An Innovative Approach to RGB Point Cloud and Thermal Information Data Fusion for Building Thermal Map Modeling Using Aerial Images: Fusion Performance Results under Different Experimental Conditions,” *Journal of Building Engineering* (IF:5.318). DOI: <https://doi.org/10.1016/j.jobe.2021.103380>
4. **Yu Hou**, Rebekka Volk, Lucio Soibelman, (2021). An Approach to Semantically Segmenting Building Components and Outdoor Scenes Based on Multi-channel Aerial Imagery Datasets. *Remote Sensing* (IF:4.848). DOI: <https://doi.org/10.3390/rs13214357>

Peer-Reviewed Conference Papers:

5. Meida Chen, Andrew Feng, **Yu Hou**. Ground material classification and for UAV-based photogrammetric 3D data A 2D-3D Hybrid Approach. *The 2021 Annual Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2021* DOI: <https://arxiv.org/ftp/arxiv/papers/2109/2109.12221.pdf>
6. **Yu Hou**, Zoe Mayer, Rebekka Volk. Lucio Soibelman. A Computer Vision Approach for Building Facade Component Segmentation on 3D Point Cloud Models Reconstructed by Aerial Images. *The 28th International workshop on intelligent computing in engineering, 2021*. DOI: <https://depositonce.tu-berlin.de/handle/11303/13226>
7. Zoe Mayer, **Yu Hou**, Rebekka Volk. AI-based thermal bridge detection of building roofs on district scale using drones. *The 28th International workshop on intelligent computing in engineering, 2021*. DOI: <https://depositonce.tu-berlin.de/handle/11303/13226>
8. **Yu Hou**, Siyuan Yao, Lucio Soibelman. Optimization for RGB Point Cloud and Thermal Information Data Fusion to Model Building Thermal Map. *The 2021 ASCE International Conference on Computing in Civil Engineering (i3CE 2021)* (Accepted)
9. **Yu Hou**. Lucio Soibelman. Rebekka Volk. Meida Chen. Factors Affecting the Performance of 3D Thermal Mapping for Energy Audits in A District by Using Infrared Thermography (IRT) Mounted on Unmanned Aircraft Systems (UAS). *In Proceedings of the 36th International Symposium on Automation and Robotics in Construction (ISARC) 2019, Banff, AB, Canada, 21–24 May 2019; pp. 266–273*, DOI: <https://doi.org/10.22260/ISARC2019/0036>
10. **Yu Hou**. Lucio Soibelman. & Yan, Jin. Enhanced Simulations in Architectural and Engineering (A&E) Design Processes: A Data-Driven Approach. *The 2019 ASCE International Conference on Computing in Civil Engineering (i3CE 2019)*. 2019. DOI: <https://doi.org/10.1061/9780784482421.079>
11. Jianliang Zhou., Jihan Fang. & **Yu Hou**. System Dynamics Model for the Effect of Stakeholders on Construction Safety. *International Conference on Construction and Real Estate Management (ICCREM, 2014)*: 868-874. DOI: <https://doi.org/10.1061/9780784413777.102>

Open-Source Datasets:

12. **Yu Hou**, Rebekka Volk, Lucio Soibelman. Building Object and Outdoor Scene Segmentation (BOOSS) - Multi-channel (RGB + Thermal) Aerial Imagery Datasets. DOI: <https://doi.org/10.5281/zenodo.5241286>
13. Zoe Mayer, **Yu Hou**, James Kahn, Tobias Beiersdörfer, Rebekka Volk Thermal Bridges on Building Rooftops - Hyperspectral (RGB + Thermal + Height) drone images of Karlsruhe,

Germany, with thermal bridge annotations. DOI: <https://doi.org/10.5281/zenodo.4767772>

Journal papers under review:

14. Meida Chen, Qingyong Hu, Hugues Thomas, Andrew Feng, **Yu Hou**, Kyle McCullough, Lucio Soibelman, (2021) A Large-Scale Aerial Photogrammetry Dataset with Synthetic and Real 3D Point Clouds, *IEEE/CVF Conference on Computer Vision and Pattern Recognition CVPR 2022*.

RESEARCH EXPERIENCE

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Postdoctoral research associate

08/2021-present

Mosaic team and INFERLab, CMU, Advisors: Dr. Burcu Akinci, Dr. Mario Berges

- Wrote proposals, lead research teams, and edited conference and journal papers.
- Contributed to creating prototypes and use cases of digital twins for buildings in a related project.
- Developed a surrogate model, for example probabilistic graphical model (PGM) of co-simulation for fault diagnosis and prognosis in HVAC systems
- Built a computational fluid dynamic model (CFD) of room temperature simulation using Ansys packages; Built HVAC system simulation using Dymola Modelica software; Built an accurate co-simulation model combining CFD and Modelica for room temperature simulation
- Built the cabin's Environmental Control and Life Support System (ECLSS) co-simulation in space for missions of exploration

Research Assistant

05/2016-08/2021

i-Lab, USC, Advisor: Dr. Lucio Soibelman

- Conducted comprehensive literature review on the virtual design team (VDT) and engineering organization structure—*Enhance the Simulation of Architecture and Engineering Design Process*
- Conducted comprehensive literature review on building energy audits, thermal photogrammetry, and computer vision—*Point Cloud Data Fusion of RGB and Thermal Information for the Building Energy Simulations in a Large District*.
- Developed a framework of RGB and thermal information data fusion for building energy audits and simulations
- Conducted heat loss data collection for buildings and district heating networks in Karlsruhe, Germany, and Boston, the U.S.
- Developed and published open-source datasets called *Thermal Bridges on Building Rooftops (TBRR)* and *Building Object and Outdoor Scene Segmentation (BOOSS)* datasets.
- Developed and compared multiple segmentation algorithms on images and 3D models for detecting the location of heat loss from buildings and district heating networks
- Generated synthetic datasets to improve segmentation performance.

Research Assistant

11/2018-1/2019

Karlsruhe Institute of Technology (KIT), Collaborator: Dr. Rebekka Volk

- Wrote proposals and edited conference and journal papers.
- Collected drone-based thermal and RGB imagery data in Karlsruhe, Germany
- Developed and published open-source datasets called *Thermal Bridges on Building Rooftops - Hyperspectral (RGB + Thermal + Height) drone images of Karlsruhe, Germany, with thermal bridge annotations*.

Research Assistant

05/2021-08/2021

USC Institute for Creative Technologies, USC, Collaborator: Dr. Meida Chen

- Wrote proposals and edited conference and journal papers.

- Contributed to generating semantic terrain points labeling database for mission planning, training, and simulations. This database will be released in 2022.

Undergraduate Research Assistant

12/2012-12/2013

CUMT, Advisor: Jianliang Zhou

- Explored the effects of stakeholders' behaviors on construction safety and corresponding remedy mechanism using a structural equation modeling (SEM) approach.
- Reviewed the literature and assisted in building up the system dynamics models of questionnaires
- Contributed to preparing materials and a conference paper

PROPOSAL WRITING EXPERIENCE

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2022- Energy audits on building envelopes and district heating networks using unmanned aircraft systems (UASs) PI: Dr. Lucio Soibelman

- Contributed to generating ideas, defining the scope, tasks, timeline, intellectual merit, and broader impacts, and writing the proposal in collaboration with professors from Computer Science and Construction Management and experts from industry partners
- Contributed to preparing supplemental materials such as data management plan, facilities, equipment, and other resources.

2019- Automated life-cycle assessment and maintenance planning of reinforced concrete structures in the harsh climate of Qatar Submitted to Qatar National Research Fund (QNRF) **PI: Dr. Bora Gencturk.**

TEACHING EXPERIENCE

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Teaching Assistant

08/2016-08/2021

- Prepared teaching materials for the lectures and design assignments, tasks, and exams
- Introduced real-world construction management use cases and scenarios in discussion classes. Led discussions and guided students to solve problems.
- Held regular office hours and seminars for students after class
- Courses I have taught are listed as follows:

CE569 – Project Controls- Budgeting and Estimating

Spring 2020, Fall 2019, Fall 2018

CE501 – Construction Practices

Fall 2020, Fall 2017, Fall 2016

CE557 – Advanced Building Estimating

Spring 2019, Spring 2018, Spring 2017

CE412 – Construction Contracts and Law (Undergraduate Level)

Spring 2021

Undergraduate Students Mentor

Summer 2019/2020

Viterbi Summer Institute (VSI) Fellow

- Fostered the formation of students' engineering identity by introducing engineering foundation courses and explaining how to conduct research
- Explained the research topics such as computer vision applications in construction, data analysis for buildings and infrastructures, and digital twins in smart buildings
- Mentored and shared my experience as an engineer and a researcher

WORKING EXPERIENCES

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Postdoctoral research associate in Civil Engineering, Carnegie Mellon University 8/2021-present
Concentrations: Digital Twins, Probabilistic Graphical Models, Co-simulation, and Agent-based Modeling

Undergraduate Student Mentor

Summer 2019/2020

Viterbi Summer Institute (VSI) Fellow

Research Assistant

06/2017-08/2017

CrunchFlow Co., Ltd., Chicago, USA

- Data engineer and data analyst for building information modeling and architect organization
- Designed and analyzed the database of architects and structural engineers

ACADEMIC AND PROFESSIONAL AWARDS

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- Germany Government Scholarship & Karlsruhe Student Exchange Program Scholarship (2018-2019)
- USC Annenberg Symposium Interdisciplinary Collaboration Award
- Outstanding Teaching Award from the Civil and Environmental Engineering at USC (2020)
(Awarded to three Ph.D. students from the Department of Civil and Environmental Engineering)

OTHER RESEARCH OUTCOMES

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Symposium and presentations

- **Y Hou.** 2019 Le Val Lund Student Symposium on Lifeline Infrastructure and Community Resilience
- **Y Hou.** & Y Li. Team Assignment Conundrum and Innovation. USC Annenberg Graduate Fellowship Research and Creative Project Symposium. April 2018.

PROFESSIONAL AND ACADEMIC SERVICES

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Reviewer for Peer-Reviewed Journals and Conferences:

- Automation in Construction (Journal; IF:7.7)
- Scientific Reports – Nature (Journal; IF: 5.133)
- Journal of Physics: Energy (Journal; IF: 5.967)
- Building and Environment (Journal; IF: 6.456)
- International Journal of Digital Earth (Journal; IF: 3.538)
- The Journal of Engineering (Journal; IF:1.52)
- Smart Infrastructure and Construction (Journal; IF: None)
- 2019 International Symposium on Automation and Robotics in Construction (ISARC2019) (Conference)
- The 2019 ASCE International Conference on Computing in Civil Engineering (i3CE) (Conference)

Guest speaker:

- Working as a guest speaker for CE505 Data Management for Civil and Environmental Engineering instructed by Dr. Lucio Soibelman

- Working as a guest speaker for CE461/561 Horizontal Construction Methods at the University of Alabama instructed by Dr. Yangming Shi

CERTIFICATIONS

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- International Project Management Professional (IPMP) (Level-D)
- Unmanned Aircraft Systems – Remote Pilot Flying License

SKILLS

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Software:

AutoCAD, REVIT, Sketch Up, LUMION,
Unity3D, Unreal,
OpenModelica, Dymola, Ansys
Pix4d, ContextCapture

Programming:

C++, Python, Java, R, C#

MEDIA COVERAGE

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Energy AI consultant project on the ZDF program, 2021 HelmholtzAI, Germany
<https://www.helmholtz.ai/themenmenu/news/news/news/article/28555/index.html>

Video with thermal bridge predictions marked by the AI model, 2021, Vimeo
<https://vimeo.com/546532111>

Drone flights for energetic district analysis, 2019, KIT News
https://www.iip.kit.edu/1064_4549.php

RESEARCH MENTORING

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Graduate Students at USC:

Manuel Benitez Ruiz, *MS in Civil Engineering*
Jiayuan Fan, *MS in Civil Engineering*
Janelle Elise Hizon, *MS in Civil Engineering*
Nina Zanghi, *MS in Civil Engineering*

Students as part of summer outreach programs:

Erik Ingram, *incoming freshman in Computer Science, USC*
Mark Bowen, *incoming freshman in Computer Science, USC*
Benjamin Licon, *incoming freshman in Engineering, USC*
Bryan Roque, *incoming freshman in Mechanical Engineering, USC*
Kathy Ramirez-Gijon, *incoming freshman in Mechanical Engineering, USC*
Kurt Liam Magsumbol, *incoming freshman in Mechanical Engineering, USC*
Leslie Ramos, *incoming freshman in Civil Engineering, USC*
Marcus Gutierrez, *incoming freshman in Civil Engineering, USC*
Michael Hernandez, *incoming freshman in Mechanical Engineering, USC*
Salvador Rodriguez, *incoming freshman in Mechanical Engineering, USC*
Thomas Bulow, *incoming freshman in Mechanical Engineering, USC*

Victoria Pinkett, *incoming freshman in Mechanical Engineering, USC*
Jacy DeVault, *incoming freshman in Mechanical Engineering, USC*

Graduate Students at CMU:

Min Young Hwang, *Ph.D. student in Civil Engineering*
Nicolas Gratius, *Ph.D. student in Civil Engineering*
Zhichen Wang, *Ph.D. student in Civil Engineering*