JANGJAE LEE

Postdoctoral Research Fellow

Infrastructure Resilience & Machine Learning

University of Houston • Department of Civil and Environmental Engineering
4226 Martin Luther King Boulevard, Houston, TX 77204-4003

jlee277@central.uh.edu +1 (979) 255-0299 LinkedIn GitHub

EDUCATION

TEXAS A&M UNIVERSITY, College Station, TX, USA — Aug 2020–Aug 2025

Ph.D. in Civil Engineering

Dissertation: ML-Based Decision Support: Modeling and Analysis of Power Outages in Texas Under Extreme Climate Conditions

Advisor: Dr. Stephanie G. Paal **Excellence Fellowship (2020–2024)** **Dissertation Fellowship (2024–2025)**

HANYANG UNIVERSITY (SEOUL), Seoul, South Korea — Mar 2016–Aug 2018

M.S. in Architectural Engineering

Thesis: Seismic Performance of Exterior Beam-Column Joint Subassemblies Reinforced with Steel Fibers

Advisor: Dr. Chang-Sik Choi GPA: **4.25/4.5** HY-in Scholarship (2016-2018)

HANYANG UNIVERSITY (ERICA), Ansan, South Korea — Mar 2010–Feb 2016

B.S. in Architectural Engineering

GPA: **3.67/4.5** Honor Scholarship (2015–2016)

RESEARCH INTERESTS

Machine Learning for Critical Infrastructure Resilience • Power Grid Analytics & Forecasting under Extreme Weather • Climate-Informed Multi-Hazard Risk Modeling • Explainable AI for Decision Support Systems • Machine Learning for High-Performance Materials • Machine Vision for Infrastructure Inspection • Large Language Models for Emergency Planning after disaster • Quantum Computing for Infrastructure Resilience Optimization • Community Resilience Assessment • LiDAR & Geospatial Data Fusion

PROFESSIONAL APPOINTMENTS

UNIVERSITY OF HOUSTON — Sep 2025–Present

Postdoctoral Research Fellow • Department of Civil and Environmental Engineering

Principal Investigator: Dr. Abigail L. Beck

Developing comprehensive data-driven frameworks for infrastructure and community resilience assessment integrating multi-source data (311 service requests, LiDAR, machine vision, meteorological data, census data). Research focuses on infrastructure quality estimation, outage impact modeling, and field-based validation employing statistical and empirical methodologies across multiple infrastructure systems.

OAK RIDGE NATIONAL LABORATORY (ORNL) — May 2024–Aug 2024

Research Intern • Geospatial Science and Human Security Division, Oak Ridge, TN

Mentor: Dr. Sangkeun M. Lee, Senior Staff Data Scientist

Conducted national-scale power grid resilience analysis within the Grid Resilience Research group. Developed interpretable machine learning models for critical energy infrastructure systems. Gained specialized knowledge in power system stability and sustainability. Contributed to a peer-reviewed journal paper and a conference publication on resilience enhancement.

PUBLICATIONS

Peer-Reviewed Journal Articles

[J1] **Lee, J.**, Zhang, Z., & Paal, S.G. (2025). *A data-driven approach to predicting power outages during*

winter storms in the southern U.S. leveraging nonparametric machine learning models. *Computational Urban Science*, Springer.
https://doi.org/10.1007/s43762-025-00222-9

[J2] **Lee, J.**, Lee, S.M., Chinthavali, S., & Paal, S.G. (2025). *A near-real-time model for predicting electricity disruptions in Texas during winter storms.* *IEEE Access*, 13, 139583–139603.
https://doi.org/10.1109/ACCESS.2025.3596531

[J3] Son, D.H., Bae, B.I., **Lee, J.**, & Choi, C.S. (2024). *Shear strength of steel fiber-reinforced concrete exterior beam-column joints with various anchorage details under cyclic loading.* *Structures*, 61, 105940.
https://doi.org/10.1016/j.istruc.2024.105940

[J4] **Lee, J.**, Bae, B.I., & Choi, C.S. (2018). *An experimental study on the seismic performance of reinforced concrete exterior beam-column joints with steel fiber volume fractions.* *Journal of Architectural Institute of Korea*, 34(4), 15–23.
https://doi.org/10.5659/JAIK_SC.2018.34.4.15

Manuscripts Under Review

[R1] **Lee, J.**, Lee, S.M., Chinthavali, S., & Paal, S.G. (2025). *An integrated model for predicting power outages caused by various types of extreme weather events.* **[R1 Revision]**

Manuscripts in Preparation

[P1] **Lee, J.**, & Paal, S.G. (2026). A knowledge-based predictive model for estimating power outages due to various hazardous weather events.

[P2] **Lee, J.**, & Beck, A. (2026). Community resilience to natural hazards using 311 reports and big data analytics.

[P3] **Lee, J.**, & Beck, A. (2026). U.S. infrastructure quality estimation in coastal regions using LiDAR data fusion.

[P4] **Lee, J.**, & Son, D.H. (2026). Knowledge transfer predictive model for the shear capacity of steel fiber reinforced concrete beams.

PRESENTATIONS & CONFERENCE ACTIVITIES

Peer-Reviewed Conference Proceedings

[CP1] Liu, J., Zhang, Z., Cheng, Y., **Lee, J.**, Paal, S., & Li, D. (2025). *A Wide-and-Deep-Based Time Sequence Model for Predicting Power Outages Caused by Extreme Winter Storms.* In *Proceedings of the International Cartographic Association (ICA-Proc)*, 7, 6.
https://doi.org/10.5194/ica-proc-7-6-2025

[CP2] **Lee, J.**, Lee, S.M., Paal, S.G., & Chinthavali, S. (2024). *A generalized outage prediction model for various types of extreme climate events in Texas.* In *Proceedings of the 2024 IEEE International Conference on Big Data (BigData)*, pp. 4162–4166. IEEE.
https://doi.org/10.1109/BigData62323.2024.10825479

[CP3] **Lee, J.**, & Paal, S.G. (2024). *Knowledge transfer predictive models for power outage caused by various types of extreme weather events.* In *Proceedings of the 2024 IEEE International Conference on Big Data (BigData)*, pp. 8227–8229. IEEE.
https://doi.org/10.1109/BigData62323.2024.10825465

Peer-Reviewed Oral Presentations

[O1] **Lee, J.**, & Beck, A. (2026). Automated Structural Assessment and Tilt Measurement of Coastal Utility Poles: Leveraging Human-Refined Grounded SAM 3 and LiDAR Integration. *ASCE Engineering Mechanics Institute (EMI) Conference*, Boulder, CO. **[Oral, Accepted]**

[O2] **Lee, J.**, & Paal, S.G. (2025). Harnessing transfer learning to predict power outages from diverse climate hazards. *ASCE Engineering Mechanics Institute (EMI) Conference*, Anaheim, CA. **[Oral]**

[O3] **Lee, J.**, & Paal, S.G. (2024). A generalized model for predicting power outages in Texas during extreme weather events: Integrating lagged information, geographical, climatic, and socio-demographic data. *EMI/PMC Conference*, Chicago, IL. **[Oral]**

[O4] **Lee, J.**, & Paal, S.G. (2024). A generalized machine learning model for predicting power outages across multiple climate zones. *ASCE EMI Conference*, Chicago, IL. **[Oral]**

[O5] **Lee, J.**, & Paal, S.G. (2023). Ensemble-based time series analysis considering lag information and feature importance to predict power outages during winter storms. *EMI Conference*, Atlanta, GA. **[Oral]**

Peer-Reviewed Posters & Lightning Talks

[PT1] **Lee, J.**, & Beck, A. (2026). Integrated Spatiotemporal Assessment of Infrastructure Resilience and Community Vulnerability in Houston. *2026 NHERI Computational Symposium*, Berkeley, CA. **[Lightning Talk, Accepted]**

[PT2] **Lee, J.**, Lee, S.M., & Paal, S.G. (2025). An integrated model for predicting power outages during various types of extreme weather events in Texas. *2025 NHERI Computational Symposium*, Los Angeles, CA. **[Poster]**

[PT3] **Lee, J.**, & Paal, S.G. (2024). Ensemble-based time series modeling for predicting power outages during extreme weather: A multi-factor approach integrating meteorological, geographical, and socio-demographical features. *2024 NHERI Computational Symposium*, Los Angeles, CA. **[Lightning Talk]**

Additional Conference Publications

[ACP1] Park, Y., **Lee, J.**, Son, D., & Choi, C.S. (2018). *An analytical study on ductility capacity of steel fiber reinforced concrete column.* CODE 2018, Changwon, South Korea, 139.

[ACP2] **Lee, J.**, Kim, J., & Choi, C.S. (2018). *Comparison of shear strength models on exterior beam-column joints with steel fiber reinforced concrete.* KCI Proceedings, 30(1), 635–636. (in Korean)

[ACP3] **Lee, J.**, Yoo, M., & Choi, C.S. (2017). *The behavior characteristics of steel fiber high strength RC tied column controlled by both flexure and shear.* KCI Proceedings, 29(1), 797–798. (in Korean)

[ACP4] **Lee, J.**, & Choi, C.S. (2017). *An experimental study on structural performance of SFRC exterior beam-column joints.* Structural Maintenance & Inspection, 21(2), 95–96. (in Korean)

[ACP5] **Lee, J.**, & Choi, C.S. (2017). *Seismic performance of reinforced concrete exterior beam-column joints according to steel fiber volume fraction.* KCI Proceedings, 29(2), 175–176. (in Korean)

[ACP6] **Lee, J.**, Choi, J., & Choi, C.S. (2016). *An experimental study on ductile capacity of steel fiber high-strength reinforced concrete tied columns.* KCI Proceedings, 28(2), 131–132. (in Korean)

[ACP7] Choi, J., **Lee, J.**, & Choi, C.S. (2016). *An experimental study on the shear strength of steel fiber reinforced concrete tied columns.* KCI Proceedings, 28(2), 139–140. (in Korean)

RESEARCH EXPERIENCE

Postdoctoral Research Fellow — Sep 2025–Present

University of Houston • Advisor: Dr. Abigail L. Beck

Community Resilience: Developed data-driven frameworks integrating **311 service requests** and socio-demographical data to quantify urban resilience and outage impact.
Machine Vision: Implemented **Grounded SAM** for automated assessment of utility pole deterioration and tilt angle evaluation via computer vision.
Infrastructure Assessment: Investigating U.S. infrastructure quality using **statistical modeling** and empirical **fieldwork validation** across multiple infrastructure systems.

Doctoral Researcher — Jan 2022–Aug 2025

Texas A&M University • Advisor: Dr. Stephanie G. Paal

Architected machine learning frameworks for large-scale power outage prediction across **nine U.S. states** utilizing comprehensive meteorological and socio-demographic datasets.

Developed and optimized ensemble models (**XGBoost, LightGBM, CatBoost**) and applied explainable AI (**SHAP**) to enhance model transparency.
Deployed near-real-time operational prediction systems and utilized **transfer learning** for data-sparse climate hazard scenarios.

Hands-On Research — Aug 2020–Dec 2020

Texas A&M University • Advisor: Dr. Stephanie G. Paal

Implemented **CNN-based steel defect detection** using **ResNet50** transfer learning and evaluated performance via IoU, Precision, and Recall.

Graduate Research Assistant & Mentor — Nov 2016–Feb 2021

Hanyang University, Seoul, South Korea • Advisor: Dr. Chang-Sik Choi **(NRF-funded)**

Conducted experimental research on the **seismic performance of SFRC structures** and RC squat shear walls through cyclic loading tests.
Supported a **$250,000 NRF project** proposal development and mentored junior graduate students on experimental protocols.
Evaluated shear bond strength of **UHPCC** and received the **Grand Prize** at the KIBC Design Contest.

Undergraduate Research Assistant — Apr 2015–Oct 2015

Hanyang University (ERICA), South Korea • Advisor: Dr. Han-seung Lee

Conducted capstone research on shear bond strength of ultra-high-performance cementitious composite.

TEACHING EXPERIENCE

Guest Lecturer — Spring 2026

University of Houston • Department of Civil and Environmental Engineering

ENGR 2301: Engineering Mechanics I (Statics) — Instructor: Dr. Vedhus Hoskere

Topic 1: 3D Rigid Body Equilibrium
- Instructed on calculating support reactions for **statically determinate 3D systems**, transitioning from 2D planar analysis to 6-DOF spatial equilibrium.
- Guided students in modeling 3D constraints (ball-and-socket, hinges, fixed supports) and formulating equilibrium equations ($\sum \mathbf{F} = 0, \sum \mathbf{M} = 0$) using Cartesian vector notation.

Topic 2: Truss Analysis (Planar & Space Trusses)
- Delivered a comprehensive lecture on the **Method of Joints** for 3D space trusses, emphasizing the decomposition of member forces in three-dimensional space.
- Taught structural determinacy criteria ($b + r = 3j$) and strategies for the rapid identification of **Zero-Force Members** in complex spatial configurations.

Guest Lecturer — Fall 2025

University of Houston • Department of Civil and Environmental Engineering

ENGR 2301: Engineering Mechanics I (Statics) — Instructor: Dr. Vedhus Hoskere

Centroids & Moment of Inertia: Delivered lectures to 40+ students, bridging mathematical derivations with engineering necessity.
Active Learning: Integrated "Learn by Doing" through a ruler-bending demonstration to intuitively explain the **Second Moment of Area** and its relationship to structural stiffness.
Facilitated step-by-step problem-solving sessions on **Center of Gravity** using a pen-balancing analogy to reinforce conceptual retention.

CIVE 3337: Structural Analysis — Instructor: Dr. Abigail Beck

Structural Classification: Instructed on determining the determinacy and stability of planar structures using the r vs. $3n$ relationship (Degrees of Freedom vs. Constraints).
Stability Analysis: Conducted a deep dive into geometric and static stability, training students to identify unstable configurations in complex truss and frame systems.

Teaching Assistant — Spring 2023–Spring 2024

Texas A&M University • Zachry Department of Civil and Environmental Engineering

CVEN 363: Engineering Mechanics (Dynamics) — Instructor: Dr. Stephanie Paal

Facilitated biweekly recitation sessions for 60+ students across two sections, clarifying complex concepts in kinematics and kinetics.
Developed detailed solution keys and grading rubrics to ensure consistent assessment standards.
Held weekly office hours and organized pre-exam review sessions to support student performance improvement.

CVEN 345: Theory of Structures — Instructors: Dr. J. Mander, Dr. L. Lowery, Dr. S. Hurlebaus

Collaborated with a team of professors to manage grading and assessment for a large-enrollment course (150+ students).
Created supplemental study materials focused on structural analysis methods to aid student comprehension.

PROFESSIONAL SERVICE & LEADERSHIP

Academic Service

- **Journal Reviewer:** *Reliability Engineering & System Safety*, ScienceDirect
- **Journal Reviewer:** *Natural Hazards Review*, American Society of Civil Engineers (ASCE)
- **Journal Reviewer:** *International Journal of Disaster Risk Reduction*, Elsevier

Memberships

- **Member, Natural Hazards Engineering Research Infrastructure (NHERI) Graduate Student Council** (2024–2025)
- Member, American Society of Civil Engineers (ASCE) (2016–Present)
- Member, American Concrete Institute (ACI) (2016–Present)
- Member, Architectural Institute of Korea (AIK) (2016–Present)
- Member, Korea Concrete Institute (KCI) (2016–Present)

STUDENT MENTORSHIP & ADVISING

- **Graduate Student Mentoring (University of Houston, 2025–Present)**
  - Mentoring four graduate research assistants (**Olubunmi Ogunleye, Nafeezat Ajenifuja, Swastika Barua, and Roydon Jude Samudio**) on research methodology, data analysis, and technical writing.
- **Research Mentoring (Texas A&M University, 2022–2025)**
  - Mentored graduate student (**Jacob Murphy**) and undergraduate student (**Robyn Andrew**) through the full research lifecycle, including experimental design and data interpretation.
- **Undergraduate Research Guidance (Hanyang University, 2018–2021)**
  - Guided junior researchers (**Jin-Sung Kim, Ki-Hyeon Kim**) on experimental protocols for NRF-funded projects.
  - Instructed students on seismic performance testing, safety protocols, and data acquisition instrumentation.

HONORS & AWARDS

- **Dissertation Fellowship** Texas A&M University **2024–2025**
- **Excellence Fellowship** Texas A&M University **2020–2024**
- **HY-in Scholarship** Hanyang University (Seoul) **2016–2018**
- **Grand Prize** The 10th Construction Technology Competition at the Korean Institute of Building Construction (KIC) *An Experimental Study on the Shear Adhesion Strength of Ultra-High Performance Cement Composite (UHPCC) According to Surface Treatment Methods at Construction Joints* **2015**
- **Honor Scholarship** Hanyang University (ERICA) **2015–2016**
- **Bronze Prize** Capstone Design Competition at Hanyang University (ERICA) *Developed a 3D-printed concrete mold for evaluating shear bond strength in construction joints.* **2015**

TECHNICAL SKILLS

3D Point Cloud & Machine Vision: **CloudCompare**, **Machine Vision (Grounded SAM)**, Semantic Segmentation, Point Cloud Processing, LiDAR Data Analysis

AI & High-Performance Computing: Python (scikit-learn, Pandas, NumPy, GeoPandas), TensorFlow, PyTorch, **HPC (Parallel Computing)**, MATLAB, R

ML Techniques: Ensemble Methods (XGBoost, CatBoost), Transfer Learning, Deep Learning (CNN, RNN), Bayesian Optimization, Explainable AI (SHAP)

Engineering & Geospatial: SAP2000, ABAQUS, AutoCAD, Revit, **QGIS**, **ArcGIS**

General Tools: LaTeX, Adobe Photoshop, Microsoft Office Suite

WORK EXPERIENCE

Design Assistant (Part-time) — Jun 2014–Aug 2014

In-dong Architectural Firm, Seoul, South Korea

Assisted in building design competition concept development and presentation materials. Designed the building using SketchUp, created AutoCAD floor plans and elevations, and made a 3D model with foam board.

Teaching Assistant (Part-time) — May 2015–Dec 2015

Perfect Knowhow (PK) Dok-hak Jae-su Academy, Seoul, South Korea

Managed classroom administrative tasks and delivered lectures. Assisted in creating and grading examination papers and assessments.

REFERENCES

Dr. Stephanie G. Paal

Associate Professor

Zachry Department of Civil and Environmental Engineering

Texas A&M University

spaal@civil.tamu.edu

(979) 845-4394

Dr. Nasir G. Gharaibeh

Professor

Zachry Department of Civil and Environmental Engineering

Texas A&M University

ngharaibeh@civil.tamu.edu

(979) 845-3362

Dr. Abigail L. Beck

Assistant Professor

Department of Civil and Environmental Engineering

University of Houston

albeck2@uh.edu

(713) 743-1492