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CURRENT ROLES

Korea Institute of Civil Engineering and Building Technology, Senior Researcher 2018-present
Department of geotechnical engineering research

EDUCATION

Ph.D. in Industrial Engineering 2026
Yonsei University, Department of Industrial Engineering, Republic of Korea
• Dissertation: Uncertainty-Aware Representation and Label Refinement on Tabular Data: Methods and Engineering Applications
• GPA: 4.01/4.5 (96/100)

M.S. in Civil and Environmental Engineering 2016
Chuo University, Department of Civil and Environmental Engineering, Tokyo, Japan
• Thesis: A study on formation of sand waves in movable bed based on stochastic process
• GPA: 3.75/4.0 (93.7/100)

B.S. in Civil and Environmental Engineering 2012
Yeungnam University, Department of Civil and Environmental Engineering, Republic of Korea
• GPA: 4.1/4.5 (91/100)

PAST RESEARCH AND WORK EXPERIENCE

Yonsei University, Smart system Lab 2022-2026
• Advisor: Wooju Kim

Dong Myeong Engineering Consultants & Architecture Co., Ltd., Republic of Korea 2017
• Environmental facility design work

Geosystem Research Inc., Republic of Korea 2016
• Marine Physics Research

Chuo University Hydrology Research Laboratory, Masters student 2014-2016
• Advisor: Tadashi Yamada

KOLON Industries, Republic of Korea 2012-2013
• Environmental engineer

Military Service, Republic of Korea Army 2005-2007

HONORS AND AWARDS

2025 Best Research Award (Year-end Award), KICT
2023 Young Geotechnical Engineer Thesis Award, Korean Geotechnical Society (KGS)
2022 Best Research Award (Year-end Award), KICT
2021 President's Award, Korean Geotechnical Society (KGS)
2020 New Researcher Award, Korea Institute of Civil Engineering and Building Technology (KICT)

2016 Ibaraki Academic Award for Best Master of Engineering Thesis, Ibaraki University
2013-2016 Full Scholarship, Ministry of Education, Culture, Sports, Science and Technology, Japan
2012 Outstanding Undergraduate Award, Korea Society of Environmental Engineers (KSEE)

RESEARCH AREA AND INTERST

Robust and uncertainty-aware machine learning:

- Uncertainty-aware representation learning: Developing robust models for high-stakes tabular data
- Noise-resilient label refinement: Graph-free Kernel Discriminant Analysis for scalable and robust label spreading.
- Physics-inspired diffusion control: Integrating physical principles into semi-supervised learning, specifically controlling label density via thermodynamic condensation to enhance diffusion processes.

Network Science & Complex Systems:

- Graph-based semi-supervised learning: Analyzing information propagation and label diffusion dynamics over complex network structures.
- Network dynamics & topology: Studying the structural evolution of data-driven graphs and their impact on model generalization.
- Interdisciplinary network modeling: Applying statistical mechanics and network theory to model nodal interactions in engineering data.

Data-driven geotechnics & intelligent monitoring:

- Deformation forecasting: Time-series modeling and monitoring for excavation and earth-retaining structures.
- Predictive geotechnics: Machine learning applications in pile capacity estimation and seepage modeling.
- Advanced sensing & measurement: Raman-based carbonation assessment and DIC-based (Digital Image Correlation) field measurements.

Scalable & adaptable AI Systems (MLOps for Engineering):

- Domain Adaptation & Shift: Addressing distributional shifts in geotechnical field data to ensure model reliability.
- Deployable Prediction Pipelines: Developing end-to-end, real-time monitoring solutions for underground urban risk management.

PUBLICATIONS (*corresponding author)

24. **Seo, S.***, Kwak, T.Y. Hong, S., & Chung, M., "Rethinking soft-ground settlement prediction: Learning settlement behavior via conditional generative modeling for cross-site generalization", *Computer-Aided Civil and Infrastructure Engineering*, (2026). (under review)
23. **Seo, S.*** & Kim, W., "Controlling diffusion in graph-based label spreading via thermodynamic condensation", *Information Sciences*, (2026). (under review)
22. **Seo, S.***, "XMR-Net: Residual-corrected blast-hole hierarchical learning for blast fragmentation prediction", *International Journal of Rock Mechanics and Mining Sciences*, (2026). (under review)
21. **Seo, S.*** & Kim, W., "UA-Tab: Uncertainty-Aware Self-Supervised Representation Learning for Tabular Data", *Knowledge-Based Systems*, 349, 116536 (2026).
20. **Seo, S.***, Chung, M., & Kim, W., "Challenging domain shift in excavation-induced wall deformation prediction: Feasibility of adversarial-discrepancy domain adaptation", *Measurement*, 264, 120294, (2026).
19. **Seo, S.***, & Kim, W., "Graph-Free Kernel Discriminant Analysis for Noise-Resilient Label Spreading", *Knowledge-Based Systems*, 335, 115214, (2026).
18. **Seo, S.***, & Chung, M., "Deployable and Accurate Time Series Prediction Model for Earth-Retaining Wall Deformation Monitoring", *Computer Modeling in Engineering & Sciences*, 144(3), 2893-2922, (2025).

17. **Seo, S.**, Kim, G., Park, J.-B., Kim, J., Park, Y.-B., & Chung, M. *, "Leveraging data-driven machine learning techniques to enhance bearing capacity estimation in prebored and precast piles", *Expert Systems with Applications*, 285, 128070, (2025).
16. **Seo, S.**, Byun, Y. *, Kim, J., Kong, S., Lee, S., & Seong, J., "Uncertainty-based on-site carbonation depth estimation of underground concrete structures using portable Raman spectrometer", *Case Studies in Construction Materials*, 21, e03902, (2024).
15. **Seo, S. ***, & Chung, M., "Estimation of the Phreatic Line for One-Dimensional Unsteady Seepage Flow Using Similarity Transformation", *Soil Mechanics and Foundation Engineering*, 61, 8-12, (2024).
14. Ko, J., Lim, H., **Seo, S.**, & Chung, M. *, "Assessment of pull-out behavior of tunnel-type anchorages under various joint conditions", *Geomechanics and Engineering*, 36(1), 71-81, (2024).
13. **Seo, S. ***, Hwang, J., & Chung, M., "Supervised Domain Adaptation for Remaining Useful Life Prediction Based on AdaBoost with Long Short-Term Memory", *IEEE Access*, 12, 96757-96768, (2023).
12. **Seo, S.**, Park, J., Ko, Y., Kim, G., & Chung, M. *, "Geotechnical factors influencing earth retaining wall deformation during excavations", *Frontiers in Earth Science*, 11, 1263997, (2023).
11. **Seo, S.**, & Chung, M. *, "Polynomial model controlling the physical properties of a gypsum-sand mixture (GSM)", *Geomechanics and Engineering*, 35(4), 425-436, (2023).
10. Kim, G., **Seo, S.**, Kim, J., Choi, C., & Chung, M. *, "Enhancing Quality Management of PHC Piles through Improved Driving Formulas: A Comprehensive Review and Analysis", *Applied Sciences*, 14(15), 6770, (2023).
9. **Seo, S. ***, Ko, Y., & Chung, M., "Evaluation of field applicability of high-speed 3D digital image correlation for shock vibration measurement in underground mining", *Remote Sensing*, 14(13), 3133, (2022).
8. **Seo, S.**, & Chung, M. *, "Evaluation of applicability of 1D-CNN and LSTM to predict horizontal displacement of retaining wall according to excavation work", *International Journal of Advanced Computer Science and Applications*, 13(2), 86-91, (2022).
7. Lim, H., **Seo, S.**, Ko, J., & Chung, M. *, "Influence of geometric factors on pull-out resistance of gravity-type anchorage for suspension bridge", *Geomechanics and Engineering*, 31(6), 573-582, (2022).
6. Ko, Y., Chung, M., Kwak, K., & **Seo, S.**, "Blasting experiments for stemming material development based on shear-thickening fluid", *Science and Technology of Energetic Materials*, 83(6), 153-162, (2022).
5. Doan, N. V., Goo, N. S., Ko, Y., **Seo, S.**, & Chung, M. *, "Design and Analysis of Micro-Vibration Isolation System for Digital Image Correlation System-Based Structural Health Monitoring", *International Journal of Aeronautical and Space Sciences*, 23, 711-722, (2022).
4. **Seo, S.**, Lee, M., Im, J., Kwon, Y.-M., Chung, M.-K., Cho, G.-C., & Chang, I. *, "Site application of biopolymer-based soil treatment (BPST) for slope surface protection: in-situ wet-spraying method and strengthening effect verification", *Construction and Building Materials*, 307, 124983, (2021).
3. Ko, Y., **Seo, S.**, Jin, T., & Chung, M. *, "Feasibility evaluation of the 3D-DIC non contact measurement system using small scaled model test of earth retaining wall", *International Journal of Geo-Engineering*, 12(12), (2021).
2. Lim, H., **Seo, S.**, Ko, J., & Chung, M. *, "Effect of joint characteristics and geometries on tunnel-type anchorage for suspension bridge", *Applied Sciences*, 11(24), 11688, (2021).
1. **Seo, S.**, Lim, H., & Chung, M. *, "Evaluation of failure mode of tunnel-type anchorage for a suspension bridge via scaled model tests and image processing", *Geomechanics and Engineering*, 24(5), 457-470, (2021).

LANGUAGES AND TOOLS

Python, Tensorflow, Pytorch, Matematica, Fortran, C#, Scipy, Scikit-learn, Pandas AWS, Google App Engine, Git, Octave, MySQL, SNAP, Mintpy