TAIGA SAITO
Ph.D student
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EXECUTIVE SUMMARY

- Ph.D. student at Tohoku University specializing in geotechnical engineering with a strong focus on data-driven methodologies and statistical machine learning.
- Demonstrated expertise in integrating advanced computational techniques to accelerate digital transformation in the construction industry, evidenced by significant contributions at renowned research institutes.
- Proven ability to innovate and lead complex projects, aiming to drive technological advancements in infrastructure development and natural disaster mitigation.

OBJECTIVE

I aim to secure a research traineeship where I can leverage my background in civil engineering, machine learning, and probability theory to advance cutting-edge geotechnical reliability research, while gaining hands-on experience in Bayesian inference and risk-based decision-making.

EDUCATION

Tohoku University Apr. 2024 – Present
Doctor of Engineering in Civil Engineering *Sendai, Miyagi, Japan*

- Member of the WISE Program for Sustainability in the Dynamic Earth
- Recipient of the Pioneering Research Support Project for PhD Students
- Recipient of the JEES Mitsubishi Corporation Scholarship for Science and Technology Students

Doctoral Dissertation Theme: Perspectives on Data-Driven Geotechnical Engineering through Statistical Machine Learning: Building a Foundation to Accelerate Construction DX

Tohoku University Apr. 2022 – Mar. 2024
Master of Engineering in Civil Engineering *Sendai, Miyagi, Japan*

- Member of the WISE Program for Sustainability in the Dynamic Earth
- Recipient of the JSCE Applied Mechanics Young Researcher Paper Award
- Recipient of the JSCE Applied Mechanics Presentation Award
- Recipient of the Japan Student Services Organization (JASSO) Scholarship

Master Thesis: Adaptive Missing Data Imputation of Multivariate Geotechnical Properties with Hierarchical Bayesian Model

Tohoku University Apr. 2018 – Mar. 2022
Bachelor of Engineering in Civil Engineering *Sendai, Miyagi, Japan*

- Recipient of the Tohoku University Best Presentation Award
- Recipient of the Japan Student Services Organization (JASSO) Scholarship

Bachelor Thesis: Data Oriented Control Method for Large-Scale Underground Space Construction

EXPERIENCE

The Institute of Statistical Mathematics   Nov. 2022 – Present
Visiting Research Fellow   *Tachikawa, Tokyo, Japan*

- Spearheaded a project on geotechnical site recognition, developing innovative data-driven methods to determine similarities in ground structures, enhancing subsurface characterization accuracy.
- Integrated engineering insights with advanced data analytics, simplifying codebases and expanding model dimensions for more robust geotechnical models.
- Co-authored a peer-reviewed publication, demonstrating the potential of large language models to replicate expert qualitative judgments in geotechnical engineering.

Port and Airport Research Institute   Aug. 2022 – Sep. 2022
Visiting Research Fellow   *Yokosuka, Kanagawa, Miyagi*

- Developed a Python-based analysis model to estimate uncertainties in wave forces and breakwater resistance, considering factors like shape parameters, settlement, and aging degradation, improving maritime structural safety assessments.
- Calculated failure probabilities and optimized design parameters, contributing to the revision of Port Technology Standards in collaboration with the National Institute for Land and Infrastructure Management.
- Introduced data-driven technological innovations, significantly advancing infrastructure development and natural disaster countermeasures within the company's projects.

Nippon Koei Co., Ltd.   Oct. 2023
Internship   *Sendai, Miyagi, Japan*

- Proposed technological innovations using data-driven approaches that significantly contribute to advancements in infrastructure development and natural disaster countermeasures.

RESEACH INTERESTS

- Uncertainty Quantification and Risk Analysis
- Data-Driven Approaches in Geosciences
- Advanced Subsurface Characterization

RESEARCH FUNDS

JSPS Research Fellowship for Young Scientists (DC2)   Apr. 2025 – Mar. 2027
Japan Society for the Promotion of Science (JSPS), Japan

Pioneering Research Support Project for PhD Students   Apr. 2024 – Mar. 2025
Tohoku University, Japan

ADDITIONAL

- Proficient in Machine Learning and Data Analysis using Python and R
- Strong Mathematical and Statistical Skills, including Statistical Machine Learning and Numerical Methods
- Fluent in Japanese (Native) and Advanced Proficiency in English

REFERENCES

Yu Otake
Associate Professor, Dept. of Civil and Environmental Engineering, Tohoku University, Japan
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Daijiro Mizutani
Assistant Professor, Dept. of Civil and Environmental Engineering, Tohoku University, Japan
daijiro.mizutani.a5@tohoku.ac.jp

PUBLICATIONS

1. **Saito, T.**, Otake, Y., Wu, S., Takano, D., Sugiyama, Y. & Yoshida, I. "Reliability Assessment of Multivariate Soil Properties under Offshore Airport Using Large-Scale Generic Database and Hierarchical Bayesian Model." *Japanese Journal of JSCE*, Vol. 80, No. 15, p. 23-15009, 2024.

2. **Saito, T.**, Otake, Y., Wu, S., Takano, D., Sugiyama, Y. & Yoshida, I. "What Defines a "Site" in Geotechnical Engineering?: A Comparative Study between Local and Global Big Indirect Databases." *Computers and Geotechnics*, Vol. 177, Part A, 106826, 2025.

3. **Saito, T.**, Otake, Y., Wu, S. & Yano, K. "Exploring Multivariate Geotechnical Features Using the Minimum Information Dependence Model." 2025. (under review).

4. Otake, Y. & **Saito, T.** "Reliability Analysis with Reduced Order Model," in *Uncertainty, Modelling, and Decision Making in Geotechnics*, Taylor & Francis, 2023. Chapter 7.

5. Wu, S., Otake, Y., Mizutani, D., Liu, C., Asano, K., Sato, N., **Saito, T.**, Baba, H., Fukunaga, Y., Higo, Y., Kamura, A., Kodama, S., Metoki, M., Nakamura, T., Nakazato, Y., Shioi, A., Takenobu, M., Tsukioka, K. & Yoshikawa, R. "Future-Proofing Geotechnics Workflows: Accelerating Problem-Solving with Large Language Models." *Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards*, pp. 1-18, 2024.

6. Otake, Y., **Saito, T.**, Wu, S., Yoshida, I. & Takano, D. "Exploring Challenges via Analysis of Multivariate Geotechnical Properties: Insights from Large-Scale Local Sampling of Japanese Marine Clay," in *Databases for Data-Centric Geotechnics*, Taylor & Francis, 2024. Chapter 11.

7. Otake, Y., Ching, J., **Saito, T.** & Asano, K. "GEOAI benchmark example BM/SoilProperties/1/2025." 2025. (under review).

CONFERENCE PRESENTATIONS (FIRST AUTHOR, ORAL PRESENTATIONS)

1. "Linear-System-Type Surrogate Model for Large-Scale Earth-Retaining Work Based on Dynamic Mode Decomposition." *8th International Symposium for Geotechnical Safety & Risk (ISGSR 2022)*, Newcastle, Australia, Dec 2022.

2. "Reliability Assessment of Multivariate soil Properties under Offshore Airport Using Large-Scale Generic Database and Hierarchical Bayesian Model." *26th JSCE Applied Mechanics Symposium*, Tokyo, Japan, May 2023.

3. "An Examination Using Hierarchical Bayesian and Principal Component Analysis." *TC304/TC309 Student Contest on Clustering Applied to A Global DB*, Okayama, Japan, Dec 2023.

4. "Exploring the Feasibility of Improving Multivariate Soil Property Estimation through the Development of a Big Indirect Database in Japan." *Joint Workshop on Future of Machine Learning in Geotechnics & Use of Urban Geoinformation for Geotechnical Practice*, Okayama, Japan, Dec 2023.

5. "Adaptive Missing Data Imputation of Multivariate Geotechnical Properties with Hierarchical Bayesian Model for a Major Offshore Airport." *The 4th International Conference on Vulnerability and Risk Analysis and Management (ICVRAM 2024) & The 8th International Symposium on Uncertainty Modelling and Analysis (ISUMA 2024)*, Shanghai, China, Apr 2024.

6. "Challenges in Database Hierarchization from the Perspective of Multivariate Geotechnical Property Estimation using a Hierarchical Bayesian Approach." *27th JSCE Applied Mechanics Symposium*, Okayama, Japan, May 2024.

7. "New Developments in Statistical Machine Learning Using Large-Scale Databases." *27th JSCE Applied Mechanics Symposium*, Okayama, Japan, May 2024. (Special Lecture).

8. "An Approach to Enhancing the Hierarchical Management Structure of Databases in Hierarchical Bayesian Models." *Japan Society of Civil Engineers 2024 Annual Meeting*, Miyagi, Japan, Sep 2024.

9. "A Discussion on the Hierarchical Management of Soil Investigation Data: Insights from High-Density Localized Sampling." *2nd Workshop on Future of Machine Learning in Geotechnics (2FOMLIG) & the 5th Machine Learning in Geotechnics Dialogue (5MLIGD)*, Chengdu, China, Oct 2024.

10. "Investigating Higher-Order Dependence in Geotechnical Properties Using the Minimum Information Dependence Model: Extracting New Statistical Features Using Mixed-Domain Data." *2nd International Workshop on Reliability-based Design*, Miyagi, Japan, Nov 2024.