

# Yeonju Lee

Ph.D. Student | H. Milton Stewart School of Industrial & Systems Engineering  
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## RESEARCH INTEREST

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My research interest focuses on knowledge-informed machine learning methods that integrate domain knowledge into data-driven models, with applications in healthcare and precision agriculture.

- Methodology
  - Knowledge-Informed Machine Learning
  - Semi-/Self-Supervised Learning under Scarce Dataset
  - Multi-Modal Data Fusion under Heterogeneous Data
- Application Domains
  - Healthcare: Automated 3D Segmentation and Differential Diagnosis
  - Precision Agriculture: Crop Yield Forecasting, Time-series Sensor Anomaly Detection
  - Manufacturing & Market Analytics: Root Cause Analysis and Dynamic Pricing Optimization in Semiconductor Markets

## EDUCATION

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<b>Georgia Institute of Technology</b>	(Expected) 2027
Ph.D. in Machine Learning, Advisor: Dr. Jing Li (Home Department: ISyE)	
<b>Yonsei University</b>	2022
M.S. in Industrial Engineering, Advisor: Dr. Chang Ouk Kim	
<b>Yonsei University</b>	2021
B.S. in Information and Industrial Engineering	

## HONORS & SELECTED AWARDS

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- **George Fellowship**, H. Milton Stewart School of Industrial & Systems Engineering, 2025
- **Finalist for Best Track Paper Award**, IISE DAIS, 2024
- **Stewart Fellowship**, H. Milton Stewart School of Industrial & Systems Engineering, 2022, 2025
- **Accelerated Degree Program Scholarship**, Yonsei University, 2021
- **Finalist for Undergraduate Project Competition**, Korean Institute of Industrial Engineers, 2019

## PUBLICATIONS

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- (P1) R.Q. Chen, **Y. Lee**, B. Joffe, P.C. Costa, C. Filan, B. Wang, S. Balakirsky, F. Robles, K. Roy, J. Li, A Foundation Model Cascade for Zero-Shot Analysis of Microscopy Images in Cell Therapy Manufacturing. Submitted to *Cytotherapy*.

- (P2) **Y. Lee**, R.Q. Chen, X. Qiao, Y. Shi, W. Liang, Y. Chen, J. Li, SPADE: A Large Language Model Framework for Soil Moisture Pattern Recognition and Anomaly Detection in Precision Agriculture. Submitted to *Computers and Electronics in Agriculture*.
- (P3) A. Cohen, Y. Sun, H. Muriki, X. Zihao, **Y. Lee**, M. Housley, A.F. Sharkey, R.S. Ferrarezi, J. Li, G. Lu, Y. Chen, Modular, On-Site Solutions with Lightweight Anomaly Detection for Sustainable Nutrient Management in Agriculture. Major Revision in *Environmental Science & Technology*.
- (P4) **Y. Lee**, M.G. Kwak, R.Q. Chen, H. Yan, M. Mupparapu, F. Lure, F.C. Setzer, J. Li, Oral-Anatomical Knowledge-Informed Semi-Supervised Learning for 3D Dental CBCT Segmentation and Lesion Detection. *IEEE Transactions on Automation Science and Engineering*, 22, 11205 - 11218, 2025.
- (P5) R.Q. Chen, **Y. Lee**, H. Yan, M. Mupparapu, F. Lure, J. Li, F.C. Setzer, Leveraging Pretrained Transformers for Efficient Segmentation and Lesion Detection in Cone-Beam Computed Tomography Scans. *Journal of Endodontics*, 50(10), 1505-1514, 2024.
- (P6) **Y. Lee**, Y. Kim, B. Lee, C.O. Kim, Discovery of Fault-Introducing Tool Groups with Numerical Association Rule Mining in a Printed Circuit Board Manufacturing Line. *International Journal of Production Research*, 62(9), 3305-3319, 2024.
- (Working Paper)
- (W1) **Y. Lee**, P. N. Su, Y. Shi, W. Liang, Y. Chen, X. Qiao, J. Li, Knowledge-informed sugar beet forecasting.
- (W2) **Y. Lee**, P. N. Su, Y. Shi, W. Liang, Y. Chen, X. Qiao, J. Li, The Role of Root Zone Soil Moisture in Predicting Irrigated Sugar Beet Yields: Insights from Research Plots and On-Farm Fields.
- (W3) M.G. Kwak, **Y. Lee**, H. Wang, J. Li, BrainNormalizer: Reconstructing Healthy Brain Images from Tumor MRIs using Masked ControlNet with Edge Conditioning.

## CONFERENCE TALKS

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- (C1) Knowledge-Informed Deep Learning for Periapical Lesion Diagnosis in Cone Beam Computed Tomography Scans. *INFORMS Annual Meeting*, Oct 2025, Atlanta, USA (invited).
- (C2) Sugar Beet Yield Prediction Using Partial Least Square Regression on Root Zone Soil Moisture Patterns. *Quad-AI ENGAGE Workshop on AI and Digital Agriculture*, Jun 2025, Atlanta, USA.
- (C3) Comparison of automated versus clinician-based outcome assessment after endodontic surgery. *Penn Dental Medicine Advances in Clinical Care and Education (ACCE) Day*, May 2025, Pennsylvania, USA.
- (C4) Deep Learning for Three-Dimensional Semantic Segmentation for Periapical Lesion Detection on Cone-Beam Computed Tomography. *SIIM Annual Meeting*, Jun 2024, Maryland, USA.
- (C5) Oral-Anatomical Knowledge-Informed Semi-Supervised Learning for 3D Dental CBCT Segmentation and Lesion Detection. *IISE Annual Conference*, May 2024, Montréal, Canada (**IISE DAIS Best Paper Finalist**).
- (C6) Discovery of Fault-Introducing Tool Groups considering Tool Aging in a Printed Circuit Board Manufacturing Line. *KIIE Fall Conference*, Nov 2021, Virtual.

(C7) Identifying Equipment Group causing Low Yields by using Machine Learning method. *KIIE Fall Conference*, Nov 2019, Seoul, South Korea (**KIIE Undergraduate Project Finalist**).

## RESEARCH PROJECTS

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### **Soil Moisture Pattern Recognition and Anomaly Detection.**

Aim: Detect irrigation events and anomalies in soil moisture data without any training data.

- Developed a LLM framework for soil moisture pattern recognition and anomaly detection.

*This research is in collaboration with the University of Nebraska–Lincoln and Georgia Institute of Technology and has been deployed as an application feature.*

### **Lettuce Nutrient Deficiency Early Detection.**

Aim: Provide early detection of nutrient stress in lettuce through non-destructive monitoring.

- Developed a modular pipeline combining multispectral imaging (MSI) with lightweight autoencoder-based anomaly detection and ML/DL models for nutrient status estimation, enabling early detection of deficiencies within the first two weeks of growth.

*This research is in collaboration with Civil & Environment Department at Georgia Tech.*

### **Sugar Beet Yield and Sucrose Content Forecasting.**

Aim: Forecast sugar beet yield and sucrose content and identify the relationship between management factors and the outcomes to help maximize them.

- Developed an early crop yield prediction ML model by integrating multi-modal data, including spatio-temporal sensor data and high-resolution drone imagery.

*This research is in collaboration with Civil & Environment Department at University of Nebraska-Lincoln and Georgia Tech.*

### **Differential Diagnosis of Dental Periapical Lesion.**

Aim: Classify the subtypes of periapical lesion aiding in noninvasive diagnosis.

- Developing an DL model for differentiating subtypes of lesions in dental CBCT images. This innovation represents a potential breakthrough in the dental field.

*This research is in collaboration with Upenn Dental School, ASU, and MS Technologies.*

### **Dental CBCT Segmentation and Automation Detection of Dental Periapical Lesion.**

Aim: Automate dental CBCT image segmentation process accurately by imitating how clinicians segment periapical lesions in CBCT image.

- Developed a knowledge-informed segmentation DL model, informed by plausible lesion locations. Significantly improved the ability to detect small-sized lesions.

*This research was in collaboration with Upenn Dental School, ASU, and MS Technologies and in the process of provisional patent application.*

### **Data-Driven Optimization of Pricing Strategies in the Semiconductor Market.**

Aim: Optimize NAND flash price that maximizes profit in next quarter by predicting NAND demands in competitive markets.

- Developed a dynamic pricing optimization algorithm for the NAND flash memory market, simulating market dynamics with a PSO algorithm and a machine learning model.

*This research was sponsored by SK Hynix.*

## TEACHING

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- **Guest Lecturer** at Georgia Tech Spring 2025  
Basic Statistics Method (ISYE 3030)  
Overall Rating: 4.8/5.0, delivered 3 lectures on statistics introduction and advanced ML methods
- **Tutor** at Georgia Tech Fall 2022, Spring 2023  
Regression and Forecasting (ISYE 4031)
- **Teaching Assistant** at Yonsei University Spring 2022  
Machine Learning 2 (DSS 6017)
- **Guest Lecturer** sponsored by SK Hynix Winter 2022  
Deep Learning with Python
- **Teaching Assistant** at Yonsei University Fall 2021  
Production Process Control (IIE 3104)

## BOOKS & BOOK CHAPTERS

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(B1) Artificial Intelligence in Dentistry. THE SCIENCE BEHIND MACHINE LEARNING, DEEP LEARNING AND ACTIVE LEARNING, APPLICATIONS IN CLINICAL PRACTICE, ELSEVIER, 2025.

## GRANT WRITING EXPERIENCE

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- NSF TTP: DeepYield-TR: An AI-driven sucrose prediction, practice benchmarking, and decision support system for Sugar Beet Growers  
*Assisted Ph.D. advisor in NSF TTP-T proposal preparation, including drafting the prior work section to highlight translation of our research, literature review, and section writing.*

## SERVICES

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- Member in Institute of Industrial and Systems Engineers (IISE)
- Member in Institute for Operations Research and the Management Sciences (INFORMS)
- Reviewer for IEEE TASE

Last updated Oct 2025.