Yeonju Lee

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RESEARCH INTEREST

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

Georgia Institute of Technology (Expected) 2027
Ph.D. in Machine Learning, Advisor: Dr. Jing Li
(Home Department: ISyE)

Yonsei University 2022
M.S. in Industrial Engineering, Advisor: Dr. Chang Ouk Kim

Yonsei University 2021
B.S. in Information and Industrial Engineering

HONORS & SELECTED AWARDS

- **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

(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 *Bioengineering & Translational Medicine*.

(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. Submitted to *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, The Role of Root Zone Soil Moisture in Predicting Irrigated Sugar Beet Yields: Insights from Research Plots and On-Farm Fields.

(W2) 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

(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

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

- **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

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

GRANT WRITING EXPERIENCE

- 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

- 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 Sep 2025.