

JunYoung Lee

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About Me

As an undergraduate in Materials Science and Engineering at Yonsei University, my research is driven by a central question: *what does it truly take for AI and its users to become genuinely integrated?* My interest lies at the intersection of **multimodal learning** and **agent systems** – building models that unify text, images, and structured data within a single representation space to produce outputs precisely aligned with user intent.

My ultimate goal is to **train and develop domain-specialized foundation models from the ground up, and to build systems capable of serving them in real-world settings**. I aim to close the gap between general-purpose AI and domain-specialized, genuinely personalized assistance.

Rather than merely adopting existing AI tools, I place equal weight on **redesigning model architectures, training pipelines, and serving infrastructure** from scratch to meet the demands of each domain – pursuing research that allows AI to integrate efficiently into human life.

Education

Yonsei University, Seoul, B.S. in Materials Science and Engineering Mar 2020 – Present

- GPA: 4.02 / 4.3

Incheon Science High School Mar 2017 – Feb 2020

Honors & Awards

• **Grand Prize (Minister of Trade, Industry and Energy Award)** Nov 2025

KoMaP Digital Data Platform – AI Model Development Competition

Ceramic track: Developed a Transformer-based regression model that predicts polarization resistance (R_p), ohmic resistance (R_o), and maximum power density (MPD) of SOFC electrode materials from multi-layered compositional and multi-stage process variables.

Achieved top performance by combining domain-informed feature engineering with a multi-task learning strategy.

Chemical track: Extended the same backbone to property prediction of lightweight composite materials for future mobility, applying domain adaptation across material families.

• **1st Place – Samsung AI Challenge** in Visually-rich Document Understanding Aug – Sep 2025

Designed a two-stage VLM pipeline that decouples layout detection from content recognition, with module fusion dynamically reweighted by LLM-driven confidence scores. Centered on leveraging the visual-language alignment capability of VLMs for document understanding.

• **Best Overall – Yonsei × Upstage AGI Agent Application Hackathon** May 2025

Built an agent framework that normalizes free-text radiology reports into SNOMED CT standard concepts.

• **Commendation – Namdong Senior Club, Website Volunteer Development** Dec 2025

Recognized for pro-bono full-stack development of the official Namdong Senior Club website.

Scholarships

• High Honor – Yonsei University Aug 2024

• University Innovation Support Scholarship Oct 2024

Research Experience

Yonsei tAI LAB, Research Intern Jun 2025 – Present

• **VLM-based Clinical Decision Support for Pressure Ulcer Care** Apr 2026 – Present, manuscript in preparation

Domain-specialized VLM research targeting automated stage classification of pressure ulcers from clinical images and automated generation of nursing records.

- LoRA-based parameter-efficient fine-tuning of Qwen2.5-VL as the backbone for clinical image understanding

- Applied **Direct Preference Optimization (DPO)** using human preference data collected from licensed clinical nurses
- Improvements observed in both **reasoning quality** and **clinical adequacy**, beyond classification accuracy alone

- **BioMatAI – Biocompatible Materials Predictive Modeling**

Oct 2025 – Present, manuscript in preparation

End-to-end pipeline for predicting properties of biocompatible materials, spanning data acquisition, structural docking, and tabular ML modeling.

- **Data acquisition:** Automated crawling and curation pipeline producing a literature-derived database of ~1,100 biocompatible materials
- **Protein–surface docking:** Implemented an automated CIF → slab → PDB pipeline based on the Rosetta SurfRosetta protocol, with custom metal parameter files for TiO₂, TiAlV, and calcite surfaces
- **Tabular modeling:** Currently structuring docking outputs into tabular form to serve as training data for downstream ML models

- *Tools:* Python, C++ , PyTorch, Rosetta Framework, Matminer, Hugging Face Transformers

AI Agent System, Product Manager and Developer

Jan 2026 – Present

- **AI Agent System** – LLM agent platform for domain-specialized research assistance

End-to-end architecture and development, with primary contribution to backend infrastructure.

- **Backend architecture (primary focus):** Custom agent backend built on Hono + Bun with Vercel AI SDK; designed a multi-stage tool-call pipeline (tool invocation → sandboxed execution → result verification)
- Implemented per-user isolated code-execution sandbox and a memory-context management module for cross-session knowledge retention and retrieval
- **Domain-specialized lab agent (under development):** Materials-science-focused agent integrating TabPFN foundation models for property prediction and SHAP-based interpretability
- **Frontend (secondary):** Next.js-based user interface

- *Tools:* Python, TypeScript, Next.js, Hono, Bun, Vercel AI SDK, PostgreSQL, TabPFN, SHAP

Independent Research

Unified Multimodal Parsing System for Automated Domain Data Construction

Manuscript in preparation

- **Motivation:** Training domain-specialized ML models requires clean, structured datasets, yet real-world data is fragmented across heterogeneous modalities (PDFs, tables, figures, charts), making automated dataset construction non-trivial.
- **Approach:** A single-system agentic pipeline that integrates multiple multimodal parsers (VLM, OCR, table-extraction models) and fuses their outputs via an LLM into coherent structured records.
 - End-to-end pipeline: automated crawling → multimodal parsing → LLM-based fusion → **self-verification** → quality assessment
 - **Downstream validation:** Constructed datasets are validated for real usability by measuring downstream task performance via an AutoML pipeline
- **Contribution:** A closed-loop methodology that goes beyond data collection by automatically verifying *task-utility* of the constructed data.

Other Projects

Namdong Senior Club Website, Full-stack Developer (Volunteer)

Jun 2025 – Present

- Built and maintaining the official website using Next.js 15 App Router, Supabase, and AWS S3; board system, banner/popup management, and admin interfaces
- *Tools:* Next.js, Supabase, AWS S3

Deepfake Detection, Team D.K – AI Factory Competition

2025

- CLIP ViT-L/14 backbone with D2ST temporal adapter; multi-stage training pipeline (classification → GradCAM-based pseudo-mask → joint detection)

- *Tools:* Python, PyTorch, CLIP, GradCAM

Talks

Yonsei Artificial Intelligence – Single-Session Seminar

Aug 2025

- *Current Trends in 3D Vision Research: Integrating Foundations with Transformers*

Extracurricular

NFC Team, Yonsei University Social Innovation Town Program

Sep 2024 – Jan 2025

- Led a project on eco-friendly thermal-insulation wallpaper; responsible for research and promotional planning as team leader

Skills

Programming: Python, JavaScript/TypeScript, C++

Frameworks: PyTorch, Hugging Face Transformers, Next.js, Hono/Bun, Rosetta

Tools: Git, Docker, Linux, Supabase, AWS, Matminer, SHAP, TabPFN, Vercel AI SDK

Languages: Korean (native), English (proficient)