ZEYU (ALBAN) LI

AI Integration Engineer · Applied Scientist · Full-Stack AI Product Builder

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SUMMARY

Cornell Ph.D. candidate in Biological & Environmental Engineering with a Computer Science background, specializing in integrating AI and data systems into complex, real-world scientific and operational workflows. Over 5 years of experience spanning **environmental science, biomedical engineering, architecture, materials science, and nucleic acid engineering** — shipping AI tools that reduced grading turnaround from days to under 24 hours, achieved 78% first-match precision in a production semantic search system, and won Best Hardware Prize at Cornell's AI Health Hackathon. Shipped 3 production AI applications (multilingual healthcare voice pipeline, researcher matching platform, relationship reconciliation app), engineered end-to-end data pipelines for a DoD-funded 11 km² field campaign, and built human-in-the-loop LLM evaluation workflows actively used in live coursework for 45+ students. Author of 4 publications (3 published, 1 under review at *Nature*) and 2 granted patents.

SKILLS

AI & LLM Integration: LLM API integration (Claude, Gemini); prompt & context engineering; agentic workflow design; RAG pipelines (FAISS, BM25, Reciprocal Rank Fusion); human-in-the-loop evaluation; AI-assisted development (Copilot, Cursor, Claude Code)

Data Engineering & Pipelines: Python (Pandas, NumPy, Seaborn, GeoPandas); automated multi-source data pipelines; geospatial analytics; time-series synchronization; schema enforcement; OpenCV

Full-Stack & Deployment: React 18/19; Firebase Auth & Realtime DB; Vercel; Streamlit; WebSocket; SMS/notification APIs; REST APIs; web scraping & indexing

ML & Modeling: TensorFlow/Keras; PyTorch; XGBoost; semantic embeddings (SPECTER2); hybrid retrieval systems; image classification

Scientific Instrumentation & Lab: qPCR; DNA/RNA extraction & purification; SEM/EDS; rheometry; DLS; fluorometry (Qubit); spectrophotometry (NanoDrop); bio-cleanroom; microfluidics; 3D printing (DIW, SLA, FDM)

Languages: Python · Java · JavaScript (React) | English (fluent) · Mandarin (native) · Cantonese (proficient)

AI PRODUCTS & INTEGRATION PROJECTS

ER Companion — Healthcare AI Voice Pipeline & Wearable Integration

Cornell AI Health Hackathon · Best Hardware Prize · React 19, Gemini Live API, WebSocket, Firebase, Wearable Hardware

- **Problem addressed:** 155M U.S. ED visits/year; non-English-speaking patients experience 5.4 min longer to be roomed and 15.6 min longer for disposition — a direct result of real-time communication gaps between patients and clinical staff.
- **Built a continuous-listening, multilingual voice pipeline in 8 languages** that transcribes patient speech in real time, flags clinically relevant changes the moment they occur, and puts the patient's exact words — not an AI paraphrase — directly in front of the nurse via a live dashboard.
- **Integrated a wristband hardware layer** feeding fall-detection signals and patient vitals into the same real-time data stream, enabling proactive nurse alerts without requiring patient-initiated interaction.
- **Designed to meet WCAG AA accessibility standards** across all 8 supported languages. · GitHub: github.com/AlbanLi0314/er-companion

Resonance — AI-Powered Researcher Matching Platform

Google DeepMind Gemini Hackathon · Deployed on Streamlit · RAG, FAISS, BM25, Gemini API

- **Designed and deployed a hybrid semantic search system** indexing 230 Cornell researchers: web-scraped and vectorized publication abstracts, combined FAISS vector search with BM25 keyword retrieval via Reciprocal Rank Fusion, achieving 77.8% first-match precision on 45 human-labeled test queries.
- **Integrated Gemini API** for paper analysis, conversational interest discovery, query expansion, and natural-language match explanation — enabling users to find collaborators through dialogue rather than keyword search. · Live: resonance-aounkapvlodwxrz2n49wye.streamlit.app

Echo — Full-Stack AI Consumer App

Production · Vercel · React 18, Firebase Auth, Gemini API, NVC Analysis

- **Independently designed and shipped a production consumer web app end-to-end:** double-blind matching logic ensures mutual intent is confirmed before revealing a connection, eliminating unilateral vulnerability in reconciliation scenarios.
- **Integrated Gemini API for NVC (Nonviolent Communication) message analysis**, evaluating tone, safety, and communication quality before message delivery; embedded 988 crisis resources with contextual routing. Bilingual EN/中文, SMS verification, real-time Firebase sync. Live: echo-app-ebon.vercel.app

Automated Field Campaign Data Pipeline — DoD-Funded Environmental Intelligence

Python, Pandas, GeoPandas, Seaborn · 33-hour field deployment, 11 km² lake, 278 sampling stations

- **Engineered a multi-source data integration pipeline** for a DoD SERDP-funded 33-hour field campaign: ingested ~1,000 qPCR measurements from 278 geographically distributed sampling stations and ~1,400 GPS drifter coordinates, applied automated signal validation, temporal synchronization, and coordinate standardization, outputting structured multi-table datasets for hydrodynamic model benchmarking.
- **Built a modular geospatial visualization framework** (~20 Python scripts) with strict schema enforcement enabling zero-touch regeneration of publication-ready geospatial maps and statistical plots directly from raw data. Engineered procedural 3D visualization workflows in Blender using Geometry Nodes and Python scripting, replacing manual illustration with code-driven pipelines for manuscript figures.

Human-in-the-Loop Grading & Evaluation Pipeline — Claude API + OpenCV

Claude API, OpenCV, Python · Cornell BEE 3400 (~45 students)

- **Engineered a confidence-gated handwritten exam grading workflow:** scanned PDFs segmented by question via OpenCV, scored by Claude API with confidence flags; high-confidence results auto-log to spreadsheet with per-question scores and deduction reasons; ambiguous cases route to manual override UI. Reduced grading turnaround from days to under 24 hours.
- **Built automated computational notebook assessment pipeline:** batch-ingests Google Colab submissions, executes student code headlessly, generates structured feedback reports — eliminating manual file handling across 45 students.

RESEARCH EXPERIENCE

Graduate Research Assistant   *Feb 2021 – Present*

DNA Materials Lab, Advisor: Prof. Dan Luo · Cornell University, Ithaca, NY

Environmental Science · Hydrology · Field Instrumentation

DNA-Barcoded PLGA Microparticle Tracers — DoD-Funded Lake-Scale Field Deployment

- **Led design, fabrication, and deployment of synthetic eDNA tracers** (DNA-barcoded PLGA microspheres) across 11 km² of Cayuga Lake, coordinating 4 disciplines and 7 research groups; conducted rigorous qPCR detection in a positive-pressure bio-cleanroom, achieving detection 7 km downstream from <1 mg DNA release.
- **First-author, Environmental Science & Technology (IF = 11.3), 2025.** DOI: 10.1021/acs.est.5c11071. Supported by DoD SERDP. Seminars at ACS Fall 2023 (San Francisco), UIUC, Penn State, and Cornell.

Architecture · Materials Science · Computational Design

Self-Healing DNA–Al^{3+} Hydrogel Composites for Structural Repair (PolyTile 4.0)

- **Developed 3D-printable biomass-DNA hydrogel platform** with three independent crosslinking modes (thermal, UV-reversible psoralen, ionic Al^{3+}), enabling time-programmed shape locking and repeatable self-healing across 50+ formulations; integrated as embedded adhesive in 3D-printed vascular ceramic tiles for autonomous crack repair.
- **Co-first-author, ACADIA 2024** (premier international conference in computational design & digital fabrication). DOI: 10.52842/conf.acadia.2024.1.089. Supported by Cornell SPROUT Awards.

Biochemical Engineering · Nucleic Acid Technology · Process Engineering

Espresso Machine–Inspired Nucleic Acid Extraction Platform

- **Invented a pod-based continuous-flow nucleic acid extraction system** using a regenerable perfluorocarbon capture medium; achieved ~200 mg DNA per pod and >90% capture efficiency across 0.01–4 M salinity, reducing consumables cost by ~91% vs. conventional ethanol precipitation while yielding enzyme-compatible, sequencing-ready outputs.

Bioengineering · Microfluidics · Nucleic Acid Engineering

NucleoMesh — Continuous Nucleic Acid Production Platform (Nature, Under Review)

- **Co-designed and fabricated microfluidic chip reactors** for perpetual enzymatic nucleic acid amplification in a closed-loop system; performed all materials characterization (SEM, rheology) and developed a bead-based RNA purification method achieving up to 94% recovery.
- **2nd author — Wang, D., Li, Z., et al.,** "A Chip Reactor for Perpetual Nucleic Acid Production and On-chip Information Processing." Nature, under review (2026).

Undergraduate Research Assistant & Senior Research Assistant   *Jun 2017 – Jan 2021*

Microfabrication & Surface Materials Lab, Supervisor: Prof. Kangning Ren · Hong Kong Baptist University

Materials Science · Surface Engineering · Anti-Icing

Durable Superhydrophobic Polymer Surfaces for Icing Control
- **Engineered all-perfluoropolymer superhydrophobic surfaces** via thermal pressing with master molds from photolithography, two-photon lithography, and etching; validated durability under abrasion (1,500 cycles, contact angle ≥150°), UV, hydraulic pressure, and 100,000+ folds. Led experimental study demonstrating ~27% reduction in droplet contact time at −10°C using electrostatic pre-charging.
- **3rd-author, The Innovation (Cell Press, IF = 33.2), 2023.** Co-inventor, US Patent 11,839,998 (granted 2023). Best Undergraduate Thesis Award, HKBU 2019.

Research Exchange Trainee   *Jun 2018 – Aug 2018*

Molecular Basis of Disease Program · Georgia State University, Atlanta, GA

- **Characterized transcription factor–DNA binding kinetics** (PU.1) via LSPR assays, quantifying sequence-specific binding affinities in real time. Best Poster Presentation Award.

TEACHING & AI CURRICULUM

Co-Instructor & Teaching Assistant | Cornell University, BEE Department   *Feb 2021 – Present*

- **BEE 3400 — Design and Analysis of Biomaterials (Co-Instructor, ~50% of content, ~45 students):** Designed and delivered a 6-lecture AI Tooling Module covering LLM fundamentals, prompt & context engineering, agentic workflow design, and AI-assisted data processing. Organized and led a 40-student Biomaterials Hackathon with structured deliverables and oral defense format; recruited and managed student assistant team.
- **Guest lecturer on AI-assisted engineering workflows** for 2 additional undergraduate courses; topics included transformer attention, context engineering, the 40-20-40 rule, and practical agent design patterns.
- **Teaching assistant across 7 courses:** BEE 7600 (Nucleic Acid Engineering), BEE 5600/3600 (Molecular & Cellular Bioengineering), BEE 3400, BEE 2600, ENGRI 1337, ENGRG 5330 (Engineering Professionalism), BEE 5730/4730 (Watershed Engineering).
- **Directly supervised 3 undergraduate researchers** on end-to-end wet-lab protocols and data analysis workflows.

EDUCATION

Cornell University   *Ithaca, NY*

Biological and Environmental Engineering · Concentration: Materials Science, Biological Engineering, Bioenvironmental Engineering

Ph.D. — DNA Materials Lab, Advisor: Prof. Dan Luo · Expected May 2026

M.S. · Aug 2024

M.Eng. · May 2020

Hong Kong Baptist University   *Kowloon, Hong Kong*

Chemistry (Major) · Computer Science (Minor)

B.Sc. (Hons) — Microfabrication & Surface Materials Lab, Supervisor: Prof. Kangning Ren · Nov 2019

PUBLICATIONS

Wang, D., Li, Z., Li, J., Han, Y., Sun, T., Li, F., Liu, P. "A Chip Reactor for Perpetual Nucleic Acid Production and On-chip Information Processing." Nature, under review (2026).

Li, Z., Ramón, C. L., Koeberle, A., et al. "Tracing Environmental DNA Transport in Large Lakes with Synthetic DNA Microparticles and Hydrodynamic Modeling." Environmental Science & Technology (IF = 11.3), 2025. DOI: 10.1021/acs.est.5c11071

He, C.*, Li, Z.*, Wang, L. X., et al. "PolyTile 4.0: Self-healing Ceramic Tiles." ACADIA 2024. DOI: 10.52842/conf.acadia.2024.1.089

Li, W., Chan, C. W., Li, Z., et al. "All-perfluoropolymer, nonlinear stability-assisted monolithic surface combines topology-specific superwettability with ultradurability." The Innovation (IF = 33.2), 4(2), 100389, 2023. DOI: 10.1016/j.xinn.2023.100389

PATENTS

Ren, K., Wu, H., Wang, Z., Yao, S., Ong, B., Li, W., Li, Z., Sun, H., & Chan, C.W. "Crack engineering as a new route for the construction of arbitrary hierarchical architectures." US Patent 11,839,998 (granted 2023).

Li, Q., Li, Z., & Lin, Z. "Reactor and method of spiral propulsion biomass continuous thermal cracking." Chinese Patent 201711214139.6 (granted 2017).