Li Junzhe

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About Me

I am a first-year CUHK CSE PhD student at the CUHK Wave Intelligence Lab, supervised by Prof. Shengchao Liu. My work develops mathematical and algorithmic foundations for generative models and latent world models in physical and biological systems, with a focus on RNA co-design, biological pathway dynamics, and virtual cells.

Education

The Chinese University of Hong Kong — *Hong Kong, China*
PhD in Computer Science and Engineering — *Aug 2026 - Present*
Expected graduation: Jul 2030. Advisor: Prof. Shengchao Liu, Wave Intelligence Lab.

The University of Hong Kong — *Hong Kong, China*
Bachelor of Engineering in Computer Science (Minor in Finance) — *Sept 2022 – June 2026*
First Class Honours, GPA: 3.7/4.3

University of Waterloo (Exchange) — *Waterloo, Canada*
Exchange Student in Computer Science — *Jan 2025 – Apr 2025*

Research Experience

PhD Student — *Hong Kong*
CUHK Wave Intelligence Lab — *Aug 2026 - Present*
Previously a Research Assistant (Dec 2025 - Jul 2026); transitioned to the PhD program in Aug 2026. Supervised by Prof. Shengchao Liu.

DuetRNA: Base-and-Sugar Dual-Frame Flow Matching for RNA Co-Design

- Developed DuetRNA, a dual-frame SE(3) flow-matching model for joint RNA sequence-structure generation; identified a single-frame representation bottleneck through analysis of 11,497 RNA chains and 31,432 multi-state relation groups.
- Designed coupled base- and sugar-centered coordinate frames with inter-frame geometric supervision, enabling atom-level reconstruction and direct sequence-structure co-generation.
- Achieved 48.67% inverse-folded scTM-validity and 38.83% direct RhoFold-based scTM-validity.

Research Assistant — *Hong Kong*
HKU CDS BioAI Lab — *Mar 2025 - Jul 2026*
Worked as a research assistant and FYP student to improve Clair3, a deep learning-based long-read variant calling model, by incorporating methylation signals for better read phasing, precision, and recall. Selected for the **HKU CDS Summer Research Internship Program**.

Part-time Research Internship — *Hong Kong*
HKU InfoBodied AI Lab — *June 2025 – July 2025*
Contributed to a 4D indoor human-object interaction dataset by processing depth-video data, reconstructing scenes, and applying diffusion models to denoise action data and complete object trajectories.

Publications & Posters

- **Junzhe Li**, Lijian Peng, Yuhao Li, Yize Zhou, Hanqun Cao, Cheng Tan, Shengchao Liu. "DuetRNA: Base-and-Sugar Dual-Frame Flow Matching for RNA Co-Design." Under review at *ICLR 2027*. Workshop version accepted at *ICML 2026 GenBio Workshop*. Project.
- **Junzhe Li**, Zhenxian Zheng, Ruibang Luo. "Aggregating Epigenetic Methylation Signals for Improved Long-Read Genetic Variant Calling." *GIW ISCB-Asia 2025* (poster).

- Zhenxian Zheng, Minggao He, Xian Yu, Lei Chen, **Junzhe Li**, Jingcheng Zhang, Ruibang Luo. "Telomere-to-telomere CHM13 reference reveals missing truth variants and improves deep learning-based variant calling in long-read sequencing data." *Quantitative Biology*, e70051, 2026. DOI.
- Zhenxian Zheng, Minggao He, Xian Yu, **Junzhe Li**, Lei Chen, Angel On Ki Wong, Jingcheng Zhang, Yekai Zhou, Ruibang Luo. "Accelerated long-read variant calling with Clair3 for whole-genome sequencing." *Bioinformatics*, 42(5), btag181, 2026. DOI.
- Lei Chen, Zhenxian Zheng, Minggao He, Angel On Ki Wong, Xian Yu, **Junzhe Li**, Jingcheng Zhang, Yekai Zhou, Ruibang Luo. "Clair-Mosaic: A deep-learning method for long-read mosaic small variant calling." *bioRxiv*, 2025 (preprint). DOI.
- Zhenxian Zheng, Ruibang Luo, Xian Yu, **Junzhe Li**, Minggao He, Lei Chen. "Clair3-RNA: A deep learning-based small variant caller for long-read RNA sequencing data." *GIW ISCB-Asia 2025* (poster).

Work Experience

Backend Developer Intern *Hang Zhou, China*
Hangzhou NengGong Technology Ltd. *July 2024 – Aug 2024*
Internship at an industry-leading pharmaceutical warehouse control technology company.
- Developed backend solutions for IoT-based warehouse monitoring systems.
- Enhanced system efficiency and precision in pharmaceutical warehouse control.

Data Analyst Intern *Hang Zhou, China*
Hangzhou Lispo Sports Co., Ltd. *Dec 2023 – Jan 2024*
Use data analytic methods to formulate the company's future development plan.
- Analyze and report on company's annual performance metrics from 2016 to 2022.
- Conduct market research on the European hunting and indoor exercise equipment market.

Projects

[**Wat2Eat – Android App for Healthy Living**] *Jan 2024 – May 2024*
An android application offering recipe discovery, nutritional tracking, and AI-driven health recommendations.
- Utilized Kotlin and database design to create a user-friendly UI/UX.
- Integrated multimodal AI agents for health advice.

[**Soccer Robot Car – Computer Vision Robot**] *Sept 2023 – Jan 2024*
Designed and built a competitive soccer robot car utilizing computer vision and 3D printing.
- Achieved championship in robot soccer competition.
- Applied CAD design and real-time environment detection capabilities.

[**Human Society Analogy Model**] *June 2023 – Sept 2023*
A machine learning-based simulation to model human societal interactions in isolated environments.
- Explored social dynamics using Python and machine learning algorithms.
- Proposed as a foundational model for future societal construction studies.

Skills

Programming & Tools: Python, C++, Java/Kotlin, Linux, LaTeX.
Research: Flow Matching, Diffusion Models, Representation Learning, Geometric Deep Learning.
Languages: English (IELTS 7.5), Mandarin (native), Cantonese (conversational).

Activities & Interests

- Volunteer at Hong Kong Mainland Volunteer Team.
- Love cooking and hiking. Passionate about all sorts of ball games.