Junsu Kim

nurijunsu@gmail.com Homepage Junsu Kim @nurijunsu

Interests

- **Thinking about Thinking** : understanding and unlocking capabilities of thinking models
- **Post-AI Society** : Societal and Economic Consequences of Intelligent Systems

Education

Seoul National University 2021.03 – 2026.07
BA in Mathematics and Economics *Expected*
GPA: 4.12/4.3

Selected Projects

Gemini Deep Think for Mathematical and Scientific Discovery 2026.02
Google DeepMind

- Built Aletheia, a Gemini Deep Think-powered math research agent that iteratively generates, verifies, and revises solutions to professional research problems, solving multiple open problems in mathematics [5].

IMO Gold-Medal Performance with Gemini Deep Think 2025.07
Google DeepMind

- Contributed to the first AI system to reach gold-medal-level performance at IMO 2025 [4], working on Gemini Deep Think and AlphaGeometry2 [2].

LoRA Training Convergence and Low-Rank Global Minima 2025.02
University of California, Los Angeles

- Proved conditions under which LoRA fine-tuning converges to low-rank global minima, work selected as an oral presentation at ICML 2025 [1].

Entropy Dynamics of Clipping in RL Training 2025.09
University of California, Los Angeles

- Analyzed how clip-low and clip-high mechanisms shape entropy dynamics in GRPO-style reinforcement learning for large language models [3].

Research Experience

Google DeepMind 2024.11 – 2026.04
Research Consultant/Student Researcher, Superhuman Reasoning team

- Designed methods for eliciting diverse model behavior in Gemini Deep Think.
- Built reinforcement learning environments for open mathematical problems without ground-truth answers.
- Built automatic verification systems for long-form mathematical reasoning, supporting IMO-Bench [4].
- Developed natural-language-to-AlphaGeometry2 autoformalization, enabling AlphaGeometry2 to operate as an end-to-end natural language geometry system [2].

Department of Mathematics, UCLA 2024.07 – 2025.09
Research Intern, Advised by Ernest K. Ryu

- Led project on LoRA training dynamics as first author, proving rigorous convergence guarantees and characterizing the analytic behavior of zero initialization and weight decay; designed empirical validation [1].
- Conducted theoretical analysis explaining how clipping biases entropy collapse behavior in GRPO-style training, through random-reward analysis [3].

Publications

[1] **J. Kim**, J. Kim, and E. K. Ryu, LoRA Training Provably Converges to a Low-Rank Global Minimum or It Fails Loudly (But it Probably Won't Fail), *Proceedings of the 42nd International Conference on Machine Learning (ICML,* Oral: top 120/12107=1.0% of papers*), 2025.*

[2] Y. Chervonyi, T. H. Trinh, M. Olšák, X. Yang, H. Nguyen, M. Menegali, J. Jung, **J. Kim**, V. Verma, Q. V. Le, and T. Luong, Gold-medalist Performance in Solving Olympiad Geometry with AlphaGeometry2, *Journal of Machine Learning Research*, 26(241):1–39, 2025.

[3] J. R. Park, **J. Kim**, G. Kim, J. Jo, S. Choi, J. Cho, and E. K. Ryu, Clip-Low Increases Entropy and Clip-High Decreases Entropy in Reinforcement Learning of Large Language Models, *arXiv preprint arXiv:2509.26114*, 2025.

[4] T. Luong, **J. Kim**[*], D. Hwang[*], H. Nguyen[*], G. Ghiasi[*], Y. Chervonyi[*], I. Seo[*], G. Bingham, J. Lee, S. Mishra, A. Zhai, H. Hu, H. Michalewski, J. Kim, J. Ahn, J. Bae, X. Song, T. H. Trinh, Q. V. Le, and J. Jung, Towards Robust Mathematical Reasoning, *Proceedings of the 2025 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2025. [*]Core and Equal contribution.

[5] T. Feng, T. H. Trinh, G. Bingham, D. Hwang, Y. Chervonyi, J. Jung, J. Lee, C. Pagano, S.-h. Kim, F. Pasqualotto, S. Gukov, J. N. Lee, **J. Kim**, K. Hou, G. Ghiasi, Y. Tay, Y. Li, C. Kuang, Y. Liu, H. Lin, E. Z. Liu, N. Nayakanti, X. Yang, H.-T. Cheng, D. Hassabis, K. Kavukcuoglu, Q. V. Le, and T. Luong, Towards Autonomous Mathematics Research, *arXiv preprint arXiv:2602.10177*, 2026.

Honors and Awards

61^{st} **International Mathematics Olympiad**, Silver Medal	2020.09
Talent Award of Korea, Minister of Education	2021.10
Presidential Science Scholarship, 9k/year	2021.03 - 2026.06
42^{nd} **Korean College Mathematics Competition**, Gold Medal	2024.12
2025 Simon Marais Mathematics Competition, 7^{th} place (Pairs)	2025.10
Bronze Norwegian Foot March Badge, Norwegian Army	2023.11
1^{st} **Cyberspace Mathematical Competition**, Silver Medal	2020.07
12^{th} **Romanian Masters in Mathematics**, Bronze Medal	2020.02

Additional Experience

Independent Algorithmic Trading Team — *Seoul, South Korea*
ML Researcher — 2024.06 – 2025.07

- Conducted research to build a reinforcement learning agent for decision-making in financial time series environments, building the pipeline for market data ingestion, feature engineering, reward modeling, and model training.

TRACK — *Seoul, South Korea*
Co-founder — 2024.03 – 2024.05

- Built and launched a music-based journaling platform, handling web development, user acquisition, and deployment. Led the full product lifecycle, attracting users and generating $400 in revenue.

United States Forces Korea — *Camp Hovey, South Korea*
Military Service — 2022.09 – 2024.03

- Served as a cavalry scout Sergeant and team leader in a US Army cavalry squadron as a member of the KATUSA (Korean Augmentation to the US Army) program.

Sussex University — *Brighton, UK*
SNU in the UK program — 2022.06 – 2022.07

- Attended a course in "Sustainability and Innovation" and presented a business model proposal, "Agora: A Mobile Deliberation Platform for Everyone."

Department of Mathematics, Seoul National University — *Seoul, South Korea*
Student Vice President — 2021.10 - 2022.09

Korean Mathematical Society — *Gangwon-do, South Korea*
Olympiad summer/winter camp TA — 2021, 2022

Skills and Certifications

Technical Skills: Python, PyTorch, JAX, Weights & Biases, Git, SQL, VBA

Language: Korean (Native), English (Full Proficiency; TOEFL 110)

Certifications: Certified Microsoft Excel-Computer Specialist in Spreadsheet and Database Level-2, Certified Korean FRM (Financial Risk Manager)