Yeongmin Kim

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EDUCATION

Korea Advanced Institute of Science and Technology Daejeon, Republic of Korea *Mar. 2022 - Present*

B.S. in Mathematical Sciences

- GPA: 4.25/4.30 (Major: 4.28/4.30)
- Minor in Industrial & Systems Engineering
- Interdisciplinary Track: Selected coursework in Computer Science & Biological Sciences
- Relevant Coursework
  - Math: Real analysis, Advanced Statistics, PDE, Modern Algebra I, Complex Variables
  - CS/ISE: Graph Machine Learning, Statistical Machine Learning, Optimization, Stochastic Models
  - Bio: Genetics, Molecular Biology, Cell Biology, Cell Biology Lab

Daejeon Science High School for the Gifted Daejeon, Republic of Korea *Mar. 2019 - Feb. 2022*

Graduate of DSHS, the high school for gifted students in science

RESEARCH EXPERIENCE

Biomedical Mathematics Group (Institute for Basic Science) Daejeon, Republic of Korea *Mar. 2026 – Present*

Undergraduate researcher (Advisor: Jae Kyoung Kim)

- **Mathematical structure of single-cell RNA sequencing data**: Project in progress.

Data Science & Artificial Intelligence Lab Daejeon, Republic of Korea *Aug. 2023 – Jul. 2024*

Undergraduate researcher (Advisor: Professor Chanyoung Park)

- **Context-aware Representation Learning for Spatial Transcriptomics (ICML 2025)**: Established the mathematical foundations of the proposed methodology utilizing topology. Provided biological motivation for the model and validated its performance by identifying differentially expressed genes (DEGs) from spatial transcriptomics data.
- **Bi-level Feature Propagation for scRNA-seq**: Validated a novel imputation algorithm for single-cell RNA sequencing data. Conducted biological evaluation by analyzing the algorithm's capability to discriminate between lung carcinoids and normal tissues using real-world datasets.
- **Disentangling Hyperedges via Category Theory (NeurIPS 2025)**: Contributed to the theoretical formulation by refining formal definitions and mathematical equations related to Category Theory. Assisted in designing figures to ensure the rigorous representation of categorical concepts.

Veterinary informatics and Bioinformatics Lab Seoul, Republic of Korea *Aug. 2022 – Jul. 2023*

Undergraduate researcher (Advisor: Professor Younghee Lee)

- **Class Imbalance Resolution via Normalizing Flow:** Proposed a novel machine learning framework utilizing Conditional Normalizing Flow to address extreme class imbalance in Personal Health Records (PHR). Demonstrated superior performance in chronic disease classification compared to conventional oversampling methods (e.g., SMOTE), achieving state-of-the-art results**.**
- **Differential Alternative Splicing Analysis for Neurodegenerative Diseases:** Identified distinct alternative splicing patterns differentiating Alzheimer's disease from Progressive Supranuclear Palsy (PSP). Developed a robust diagnostic classification model through comprehensive machine learning analysis, validating its generalization capability on external datasets.

Knowledge Engineering and Artificial Intelligence Lab Daejeon, Republic of Korea *Mar. 2022 – Jul. 2023*

Undergraduate researcher (Advisor: Professor Ho-Jin Choi)

- AltUB for Anomaly Detection: Expanded a course project into a full paper. Developed an alternating training method for Normalizing Flows, addressing distributional constraints. (Preprint cited 10+ times)

PUBLICATION

Refereed Journals & Conferences

1. Y. Lee, J. Lee, S. Seo, S. Kim, **Y. Kim**, and C. Park, "Disentangling Hyperedges through the Lens of Category Theory," ***Advances in Neural Information Processing Systems (NeurIPS),*** 2025.
2. Y. Oh†, J. Lee†, **Y. Kim**, S. Seo, N. Lee, and C. Park, "Global Context-aware Representation Learning for Spatially Resolved Transcriptomics**,"** ***International Conference on Machine Learning (ICML)*****,** 2025.
3. J. Lee†, S. Yun†, **Y. Kim**, T. Chen, M. Kellis, and C. Park, "Single-cell RNA sequencing data imputation using bi-level feature propagation," ***Briefings in Bioinformatics***, vol. 25, no. 3, 2024.
4. **Y. Kim†,** W. Choi†, W. Choi, G. Ko, S. Han, H. Kim, D. Kim, D. Lee, D. Shin, and Y. Lee., "A machine learning approach using conditional normalizing flow to address extreme class imbalance problems in personal health records," ***BioData Mining***, vol. 16, no. 1, 2023.

Preprints & Working Papers

5. **Y. Kim,** S. Han, and Y. Lee, "Machine learning-based prioritization of disease-informative alternative splicing events in Alzheimer's disease and progressive supranuclear palsy", **Submitted to *BMC Genomics***
6. **Y. Kim†,** H. Jang**†,** D. Lee, and H. Choi, "AltUB: Alternating training method to update base distribution of normalizing flow for anomaly detection," arXiv preprint arXiv:2210.14913, 2022. (11 Citations)

WORK EXPERIENCE

Republic of Korea Navy Headquarters Gyeryong, Republic of Korea *Jul. 2024 – Mar. 2026*

Big Data Analyst (Specialized Technical Personnel)

- Selection: Selected as one of two Big Data Analysts nationwide for the Technical Military Service Program.
- Role: Analyzed operational datasets for mission planning support. Won the **Chief of Naval Operations Award (1st Place)** at the 2025 Navy AI Competition.

AWARDS & HONORS

1st Place (Chief of Naval Operations Award), Navy & Marine Corps AI Competition *2025*

Departmental Honors Scholarship, KAIST (Awarded to **Top 4** students) *2023-2024*

Dean's List, KAIST (Awarded to Top 3%) *Spring 2022, 2023, 2024*

KAIST Presidential Fellowship (KPF) *2023-Present*

Presidential Science Scholarship, Korea Student Aid Foundation *2022-Present*

3rd Place, ECG AI Challenge (Seoul National University Hospital) *2023*

Alumni Scholarship, KAIST Alumni Association *2023-Present*

Top Prize, Joint Data Science Contest (KAIST-POSTECH-UNIST) *2022*

EXTRACURRICULAR ACTIVITIES

Include (KAIST Artificial Intelligence Club) Daejeon, Republic of Korea *Mar. 2022 - Present*

Core Member

- Present Paper Seminars: Led paper review sessions on advanced deep learning architectures, including detailed presentations on Capsule Networks.
- Curriculum Development: Designed and structured the Machine Learning & Deep Learning curriculum to train new members.