JINWOO KIM

jw9730.github.io jinwoo-kim@kaist.ac.kr

Research Interest

My focus is in making deep learning models generalize better beyond their training data so that they can be used to solve challenging problems, such as those in scientific domains. I am studying this problem from the complementary perspectives of invariance and equivariance, parallel neural processing, and Solomonoff induction. I often use tools from theories of graphs, manifolds, (semi)groups and categories, as well as Markov processes such as random walks, diffusions, and flows. Recently, I am focused on flow language models, latent reasoning, synthetic data, and vision pretraining.

Academic Placement and Employment

KAIST, Postdoctoral Researcher 03/2026 – 02/2027
New York University, Visiting Scholar (host: Kyunghyun Cho, Rajesh Ranganath) 11/2025 – 01/2026
LG AI Research, Research Intern (host: Moontae Lee, Honglak Lee) 01/2022 – 07/2022

Education

KAIST, M.S./Ph.D. in Computer Science (advisor: Seunghoon Hong) 03/2021 – 02/2026
- Ph.D. Thesis: Architecture-Agnostic Invariances for Deep Learning
KAIST CoE Best Ph.D. Dissertation Award

KAIST, B.S. in Brain Engineering and Computer Science (double major) 03/2016 – 02/2021
- GPA 4.05/4.3 (Summa Cum Laude)

Publications

C: conference, J: journal, W: workshop, P: preprint, *: equal contribution, †: equal advising

P6. **Look Back: Reinforcement Learning with Counterfactual World Models**
Jinwoo Kim*, Toghrul Abbasov*, Lucius E.J. Bynum, Aahlad Manas Puli, Stephanie Milani, Hyunwoo Ryu, Seunghoon Hong, Kyunghyun Cho†, Rajesh Ranganath†
Under review

P5. **Why Does Rewriting Pretraining Data Improve Generalization?**
Jiyun Park*, Jinwoo Kim*, Kyungbin Min, Hoyeon Chang, Sohee Yang, Kyunghyun Cho†, Seunghoon Hong†
Under review

P4. **Generalization in Continuous Flows for Categorical Data**
Manan Agarwal, Jinwoo Kim
Under review

P3. **Asynchronous Flow Map Language Models**
Chanhyuk Lee, Wonjung Kim, Patrick Pynadath, Jaehoon Yoo, Satoshi Hayakawa, Ruqi Zhang, Jinwoo Kim†, Seunghoon Hong†
arXiv 2026

P2. **Large Flow Language Models**
Arnav Chavan*, Chanhyuk Lee*, Udbhav Bamba*, Jaehoon Yoo, Seunghoon Hong, Aditi Raghunathan†, Jinwoo Kim†
arXiv 2026

P1. **Thinking with Looped Flows**
Ayhan Suleymanzade, Chanhyuk Lee, Floor Eijkelboom, Nicholas M. Boffi, İsmail İlkan Ceylan†, Jinwoo Kim†
arXiv 2026

C17. **MUX: Continuous Reasoning via Multiplexed Tokens**
Ayhan Suleymanzade, Halil Alperen Gozeten, Michael Bronstein, İsmail İlkan Ceylan†, Jinwoo Kim†
NeurIPS 2026 **Spotlight (292/30709=0.95%)**

C16. **Flow Map Language Models: One-step Language Modeling via Continuous Denoising**
Chanhyuk Lee, Jaehoon Yoo, Manan Agarwal, Sheel Shah, Jerry Huang, Aditi Raghunathan, Seunghoon Hong, Nicholas M. Boffi†, Jinwoo Kim†
NeurIPS 2026 / COLM 2026 NonAR-LM Workshop **Spotlight**

C15. **Multi-View Relational Distillation for Spatial Reasoning with Vision-Language Models**
Kiet T. Nguyen, Hanbo Shim, Jinwoo Kim†, Seunghoon Hong†
NeurIPS 2026

C14. **RelAgent: LLM Agents as Data Scientists for Relational Learning**
Xingyue Huang, Louis Tichelman, Jinwoo Kim, Krzysztof Olejniczak, İsmail İlkan Ceylan
NeurIPS 2026

W6. **To Learn is to Wander: Learning Across Graphs and Tasks with Random Walks**
Louis Tichelman, Xingyue Huang, Jinwoo Kim, İsmail İlkan Ceylan
NeurIPS 2026 GDDL Workshop

W5. **One-step Generation via Riemannian Wasserstein Gradient Flows**
David Li, Chanhyuk Lee, Jaehoon Yoo, Nikita Gushchin, Floor Eijkelboom, Eric Moulines, Maxim Panov, Alexander Korotin, Seunghoon Hong†, Jinwoo Kim†
NeurIPS 2026 DiffuLM Workshop

W4. **Self-conditioned Flow Map Language Models via Fixed-point Flows**
Jaehoon Yoo*, Wonjung Kim*, Floor Eijkelboom, Chanhyuk Lee, Nicholas M. Boffi, Seunghoon Hong†, Jinwoo Kim†
COLM 2026 NonAR-LM Workshop **Oral**

W3. **Posterior Refinement: Fast Language Generation via Any-Order Flow Maps**
Manan Agarwal*, Sheel Shah*, Chanhyuk Lee, Jaehoon Yoo, Jerry Huang, Seunghoon Hong, Aditi Raghunathan, Jinwoo Kim†, Nicholas M. Boffi†
COLM 2026 NonAR-LM Workshop **Spotlight**

W2. **What are the Right Symmetries for Formal Theorem Proving?**
Krzysztof Olejniczak, Radoslav Dimitrov, Xingyue Huang, Bernardo Cuenca Grau, Jinwoo Kim†, İsmail İlkan Ceylan†
ICML 2026 AI4Math Workshop

C13. **Inverting Data Transformations via Diffusion Sampling**
Jinwoo Kim*, Sékou-Oumar Kaba*, Jiyun Park, Seunghoon Hong†, Siamak Ravanbakhsh†
ICML 2026

C12. **Flock: A Knowledge Graph Foundation Model via Learning on Random Walks**
Jinwoo Kim*, Xingyue Huang*, Krzysztof Olejniczak, Kyungbin Min, Michael Bronstein, Seunghoon Hong, İsmail İlkan Ceylan
ICLR 2026

C11. **Sequence Modeling with Spectral Mean Flows**
Jinwoo Kim, Max Beier, Petar Bevanda, Nayun Kim, Seunghoon Hong
NeurIPS 2025

C10. **Revisiting Random Walks for Learning on Graphs**
Jinwoo Kim, Olga Zaghen*, Ayhan Suleymanzade*, Youngmin Ryou, Seunghoon Hong
ICLR 2025 **Spotlight (380/11672=3.26%)** / ELLIS Mobility Grant, ICML 2024 GRaM Workshop

C9. **3D Denoisers are Good 2D Teachers: Molecular Pretraining via Denoising and Cross-Modal Distillation**
Sungjun Cho, Dae-Woong Jeong, Sung Moon Ko, Jinwoo Kim, Sehui Han, Seunghoon Hong, Honglak Lee, Moontae Lee
AAAI 2025 **Oral**

C8. **Simulation-Free Training of Neural ODEs on Paired Data**
Semin Kim*, Jaehoon Yoo*, Jinwoo Kim, Yeonwoo Cha, Saehoon Kim, Seunghoon Hong
NeurIPS 2024

W1. **Learning Symmetrization for Equivariance with Orbit Distance Minimization**
Tien Dat Nguyen*, Jinwoo Kim*, Hongseok Yang, Seunghoon Hong
NeurIPS 2023 NeurReps Workshop

C7. **Learning Probabilistic Symmetrization for Architecture Agnostic Equivariance**
Jinwoo Kim, Tien Dat Nguyen, Ayhan Suleymanzade, Hyeokjun An, Seunghoon Hong
NeurIPS 2023 **Spotlight (378/12345=3.06%)**

C6. **Universal Few-shot Learning of Dense Prediction Tasks with Visual Token Matching**
Donggyun Kim, Jinwoo Kim, Seongwoong Cho, Chong Luo, Seunghoon Hong
ICLR 2023 **Outstanding Paper Award (4/4955=0.08%)** / Silver Prize, Samsung Humantech Paper Award, 2023

C5. **Pure Transformers are Powerful Graph Learners**
Jinwoo Kim, Tien Dat Nguyen, Seonwoo Min, Sungjun Cho, Moontae Lee, Honglak Lee†, Seunghoon Hong†
NeurIPS 2022

C4. **Transformers meet Stochastic Block Models: Attention with Data-Adaptive Sparsity and Cost**
Sungjun Cho, Seonwoo Min, Jinwoo Kim, Moontae Lee, Honglak Lee, Seunghoon Hong
NeurIPS 2022

C3. **Equivariant Hypergraph Neural Networks**
Jinwoo Kim, Saeyoon Oh, Sungjun Cho, Seunghoon Hong
ECCV 2022

C2. **Transformers Generalize DeepSets and Can be Extended to Graphs and Hypergraphs**
Jinwoo Kim, Saeyoon Oh, Seunghoon Hong
NeurIPS 2021 / Qualcomm Innovation Fellowship Korea, 2021

C1. **SetVAE: Learning Hierarchical Composition for Generative Modeling of Set-Structured Data**
Jinwoo Kim*, Jaehoon Yoo*, Juho Lee, Seunghoon Hong
CVPR 2021

J1. **Spontaneous Retinal Waves Can Generate Long-Range Horizontal Connectivity in Visual Cortex**
Jinwoo Kim*, Min Song*, Jaeson Jang, Se-Bum Paik
The Journal of Neuroscience 40(34) 2020

Honors

Awards

Best Ph.D. Dissertation Award, KAIST College of Engineering	2026
Outstanding Researcher Award, KAIST-Mila Prefrontal AI Research Center	2024
ELLIS Mobility Grant [C10], ICML 2024 GRaM Workshop	2024
Outstanding Paper Award [C6], ICLR 2023	2023
Silver Prize, Samsung Humantech Paper Award [C6]	2023
Qualcomm Innovation Fellowship Korea [C2]	2022
KAIST Engineering Innovator Award (five recipients), KAIST College of Engineering	2020

Scholarships and Fellowships

Kwanjeong Education Foundation Scholarship	2022 – 2023
Korea National Science & Technology Scholarship	2018 – 2019
KAIST Alumni Fellowship	2017 – 2020
KAIST Presidential Fellowship	2016 – 2020
Hansung Scholarship for Gifted Students	2015 – 2016

Invited Talks

Flow Language Models [C11, C16, W3, W4, W5, P1, P2, P3, P4]

• MIT CSAIL (host: Hyunwoo Ryu)	12/2026 (planned)
• Yonsei University (host: Albert No)	11/2026 (planned)
• POSTECH IME (host: Sangwoo Mo)	10/2026
• Unannounced startup	09/2026
• SNU IPAI Seminar (host: Jaesik Park, Pierre Musacchio)	07/2026
• Discrete Diffusion Reading Group (host: Subham Sahoo, Zhihan Yang)	04/2026
• Ben-Gurion University of the Negev (host: Ilan Naiman)	12/2025

Architecture-Agnostic Invariances for Deep Learning [C7, W1, C10, C12, C13]
- Mila - Quebec AI Institute (host: Minsu Kim, Junyeob Baek) 07/2025
- KAIST AI899 Geometric DL (host: Sungsoo Ahn) 05/2025
- Mila - Quebec AI Institute (host: Siamak Ravanbakhsh, Sékou-Oumar Kaba) 12/2024
- KAIST-Mila Prefrontal AI Research Center (host: Sungjin Ahn) 11/2024
- Sungkyunkwan University (SKKU) (host: Chang Woo Myung) 08/2024
- Pohang University of Science and Technology (POSTECH) (host: Sungsoo Ahn) 11/2023

Visual Token Matching [C6]
- KAIST–Samsung Electronics DS Division Exchange Meetup (host: Chulmoo Kang) 08/2023

Transformers for Sets, Graphs, and Hypergraphs [C1, C2, C5]
- Microsoft USA (host: Nabiha Asghar) 01/2023
- Qualcomm Korea (host: Jaewon Choi) 01/2023
- NeurIPS 2022 at KAIST (host: Dongkwan Kim) 11/2022
- Learning on Graphs and Geometry Reading Group (LoGaG) (host: Hannes Stärk) 08/2022
- KAIST AI Workshop 21/22 (host: Dongkwan Kim) 01/2022
- NeurIPS 2021 Social: ML in Korea (host: Jung-Woo Ha) 12/2021
- Naver AI Author Meetup for CVPR 2021 (host: Jung-Woo Ha) 09/2021
- Korean Conference on Computer Vision 2021 (host: Jongwoo Lim) 09/2021

Retinal Waves and Prenatal Wiring of Primary Visual Cortex [J1]
- Society for Neuroscience, Chicago, IL, US 10/2019

Academic Services

Area Chair: ICML 2027, ICLR 2027, ICML 2026 GFM
Conference Reviewer: NeurIPS, ICLR, ICML, CVPR, ICCV, AISTATS, LoG, TAG-DS, IJCNN, ACCV
Journal Reviewer: TMLR, Neural Networks, IJCV

Teaching

Teaching Assistant, KAIST School of Computing
Undergraduate Research Program (URP) 2022, 2024
Introduction to Deep Learning (CS492I) 2021, 2022, 2023
Computer Vision (CS576) 2022, 2023
School of Computing Colloquium (CS966, CS986) 2021

Teaching Assistant, Samsung Electronics
Samsung Research AI Expert Program 2021 – 2024

Mentoring
Chanwoo Kim, M.S. student @ KAIST 2026
David Li, Ph.D. student @ MBZUAI [W5] 2026
Toghrul Abbasov, B.S. student @ KAIST [P6] 2026
Kiet T. Nguyen, Ph.D. student @ KAIST [C14] 2026
Manan Agarwal, M.S. student @ CMU [C16, W3, P4] 2025 – 2026
Sheel Shah, M.S. student @ CMU [C16, W3] 2025 – 2026
Chanhyuk Lee, M.S. student @ KAIST [C16, W3, W4, W5, P1, P2, P3] 2025 – 2026
Kyungbin Min, B.S. student @ KAIST [C12] → M.S. student @ KAIST [P5] 2025 – 2026
Jiyun Park, B.S. student @ KAIST [C13] → M.S. student @ KAIST [P5] 2024 – 2026
Nayun Kim, B.S. student @ KAIST [C11] → M.S. student @ KAIST 2024 – 2026
Ayhan Suleymanzade, B.S. student @ KAIST [C7, C10] → Ph.D. student @ EPFL [C17, P1] 2023 – 2026
Youngmin Ryou, B.S. student @ KAIST [C10] → M.S. Student @ KAIST 2023 – 2026
Nicole Shen, B.S. student @ MIT → Intern @ MIT LIDS 2024
Semin Kim, M.S. student @ KAIST [C8] → Ph.D. student @ KAIST 2023 – 2024
Olga Zaghen, M.S. student @ UniTrento [C10] → Ph.D. student @ UvA Amsterdam 2023
Tien Dat Nguyen, B.S. student @ KAIST [C5, C7, W1] → M.S. student @ UWaterloo 2021 – 2023

Daniel Sungho Jung, B.S. student @ Penn State → Ph.D. student @ SNU 2021
Saeyoon Oh, B.S. student @ KAIST [C2, C3] → Engineer @ FuriosaAI 2021

Projects

Korea National Research Foundation (NRF), Physical Reasoning in Language Models 2024 – 2025
Korea Ministry of Science and ICT, Visual Commonsense Reasoning 2021 – 2023
Korea National Research Foundation (NRF), Cooperative Robotic Intelligence 2021 – 2023

References

Seunghoon Hong, Associate Professor at KAIST seunghoon.hong@kaist.ac.kr
İsmail İlkan Ceylan, Associate Professor at TU Wien ismail.ceylan@tuwien.ac.at
Nicholas M. Boffi, Assistant Professor at Carnegie Mellon University nboffi@andrew.cmu.edu
Kyunghyun Cho, Full Professor at New York University kyunghyun.cho@nyu.edu
Siamak Ravanbakhsh, Associate Professor at McGill University siamak.ravanbakhsh@mcgill.ca
Moontae Lee, Head of Superintelligence Lab at LG AI Research moontae.lee@lgresearch.ai