

# Ayhan Suleymanzade

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## Education

<b>Korea Advanced Institute of Science and Technology (KAIST)</b> <i>B.S. in Computer Science and Electrical Engineering - cGPA 4.17/4.30 (98.70/100)</i>	<i>South Korea</i>
<b>Technical University of Munich (TUM)</b> <i>Exchange Program in Informatics - cGPA 1.0/5.0 (100/100)</i>	<i>Sep 2021 - Dec 2025</i>
	<i>Germany</i>

*Apr 2025 - Aug 2025*

## Publications

(P: preprint, C: conference, J: journal, W: workshop, \*: equal contribution)

- [P1] **Limits of Continuous Chain-of-Thought in Multi-Step and Multi-Chain Reasoning**  
**Ayhan Suleymanzade\***, Andreas Bergmeister\*, Stefanie Jegelka  
*Preprint; To Appear in AAAI 2026 Bridge on Logical and Symbolic Reasoning in Language Models*
- [C3] **Diffusion Models Through a Global Lens: Are They Culturally Inclusive?**  
Zahra Bayramli\*, **Ayhan Suleymanzade\***, Na Min An, Huzama Ahmad, Eunsu Kim, Junyeong Park, James Thorne, Alice Oh  
*ACL 2025 (Oral Presentation)*
- [C2] **Revisiting Random Walks for Learning on Graphs**  
Jinwoo Kim, Olga Zagheni\*, **Ayhan Suleymanzade\***, Youngmin Ryou, Seunghoon Hong  
*ICLR 2025 (Spotlight Presentation)*
- [C1] **Learning Probabilistic Symmetrization for Architecture Agnostic Equivariance**  
Jinwoo Kim, Tien Dat Nguyen, **Ayhan Suleymanzade**, Hyeokjun An, Seunghoon Hong  
*NeurIPS 2023 (Spotlight Presentation)*

## Research Experience

<b>AITHYRA</b> <i>Visiting Research Intern (Mentors: Prof. Ismail Ceylan, Prof. Micheal Bronstein)</i>	<i>Austria</i>
• Expected to develop latent-reasoning and hybrid continuous–discrete generative models for biomolecular structures.	<i>Dec 2025 - Aug 2026</i>
<b>TUM Foundation of Deep Neural Networks Lab</b> <i>Visiting Research Intern (Mentor: Prof. Stefanie Jegelka)</i>	<i>Germany</i>
• Designed depth and diversity controlled reasoning benchmarks showing that continuous and implicit CoT models collapse by up to 80–95% accuracy as reasoning depth or chain multiplicity increases [P1]. • Identified credit-assignment and mode-collapse failures in latent alignment and proposed intermediate supervision to sustain multimodal reasoning dynamics [P1].	<i>Apr 2025 - present</i>
<b>KAIST System Intelligence Lab</b> <i>Undergraduate Research Intern (Mentors: Minsu Kim, Prof. Jinkyoo Park )</i>	<i>South Korea</i>
• Developed the Learnable Local Search GFlowNet (LLS-GFN), introducing a joint training objective combining Maximum Likelihood Estimation and full Trajectory Balance to improve local search and mode-seeking capabilities. • Achieved 2.3% stronger reward accumulation across tasks such as DNA, molecule, fragment, and RNA optimization.	<i>Jul 2024 - Dec 2024</i>
<b>KAIST Vision and Learning Lab</b> <i>Undergraduate Research Intern (Mentors: Jinwoo Kim, Prof. Seunghoon Hong)</i>	<i>South Korea</i>
• Proposed an automorphism-invariant graph learning pipeline using random walk embeddings and analyzed its expressive power theoretically and empirically [C2]. • Developed a probabilistic symmetrization method for real-world graphs and adapted Vision Transformer insights for graph tasks, yielding competitive benchmarks (0.1355 → 0.3287 Hits@1) in PCQM-Contact [C1].	<i>Feb 2023 - Jul 2024</i>

## Work Experience

<b>Mercari Inc.</b> <i>Machine Learning Engineer Intern</i>	<i>Japan</i>
• Built a scalable text embedding pipeline with Apache Beam and GCS, improving storage efficiency by 5.3x, speed by 11.4x, and search reranking NDCG by 2.46%.	<i>Jan 2025 – Mar 2025</i>
• Contributed to migrating the training pipeline from TensorFlow to PyTorch Lightning, deployed new features via Kubernetes, improved experimentation with Hydra, and optimized Docker builds 6.7x.	
<b>StoneLab Inc.</b> <i>AI Researcher and Developer</i>	<i>South Korea</i>
• Developed text-constrained music generation models for content creation on music platforms and engineered a high-	<i>Jan 2024 - July 2024</i>

performance streamer for MusicGen, achieving a 9x increase in inference speed.

- Migrated codebases to Keras 3 and enabled multi-framework deployment using FastAPI and Flask.

## **EverEx Inc.**

*Computer Vision Research Intern (Mentor: [Byung-Hoon Kim](#))*

*South Korea*

*Dec 2022 - Feb 2023*

- Replicated and extended prior work by Gong et al. and Choi et al., proposing a hybrid model combining Diffusion and Graph Convolutional Networks.
- Achieved state-of-the-art MPJPE of 8.93 mm (Walking) and 12.22 mm (Jogging) on HumanEva-I, improving baseline by 1.4 mm and 0.9 mm.

## **Awards**

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- KAIST Q-day Award [Advanced Research] (2025)
  - KAIST Dean's List (Fall 2024)\*
  - KAIST Dean's List (Spring 2024)\*
  - KAIST Alumni Fellowship (2024)
  - KAIST Presidential Fellowship (2024)
  - KAIST College of Engineering Leadership Award (2024)
  - KAIST Dean's List (Fall 2023)\*
  - KAIST Global Leadership Award [Challenge] (2023)
  - KAIST Dean's List (Fall 2022)\*
  - International Physics Olympiad (IPhO) – 1 Bronze & 1 HM (2020–2021)
  - National Physics Olympiad – 2 Gold (2020–2021)
  - International Olympiad on Astronomy and Astrophysics (IOAA) – 1 HM (2020)
  - International Junior Science Olympiad (IJSO) – Silver Medal (2019)

\*: Top 3% of College of Engineering in four semesters.

## **Professional Service**

### **Ministry of Education of Azerbaijan**

*National Coach, Coordinator, Leader*

*Azerbaijan*

*Sep 2021 - Present*

- Conducting intensive training camps, preparing handouts, proposing problems, and teaching various topics.
- Serving as a Leader at International venues (IPhO, EuPhO) and as jury member in Azerbaijan National Physics Olympiad, preparing and grading exams for national exams and team selection tests.

### **Teaching Assistant (TA), KAIST**

- Foundations of Big Data Analytics (EE412)
- Introduction to Deep Learning (CS492I)

*Fall 2024*

*Fall 2023*

## **Projects**

### **GFN-Check: Diverse Valid Test Inputs with Generative Flow Networks**

*Fall 2024*

*AI Based Software Engineering*

- Designed GFlowNet-based framework for diverse, valid input generation, addressing RL overfitting and storage issues.
- Outperformed RLCheck in diversity metrics on BST and Maven POM XML tasks.

### **Bridging Soft RL and GFlowNets**

*Spring 2024*

*Deep Reinforcement Learning and Game AI*

- Uncovered theoretical link between Soft RL and GFlowNets, enabling principled integration of advanced RL techniques within GFlowNets framework.
- Developed dynamic regularization and integrated PCL/Multi-step PCL methods, improving convergence stability, achieving 60x efficiency gains, and increasing mode coverage by 4%.

### **Exploring Mental Well-Being in Gaming**

*Spring 2024*

*Computational Social Science*

- Developed tree-based models (RF, GBM, EBM) on data from 13k+ gamers, achieving 80% accuracy in detecting mental well-being and delivering 30–35% performance gains over regression-based baselines.
- Validated findings through a KAIST survey and analyzed feature importance, identifying gaming hours and motivation to play as key mental health factors.

### **Scaling Transformers to Large Graphs**

*Spring 2023*

*Graph ML and Mining*

- Applied pure Transformer for node classification via distillation from a pretrained GNN.
- Outperformed GCN/GAT on Cora-ML, DBLP, PubMed, Wiki-CS by 1-3% node classification accuracy while alleviating oversmoothing and oversquashing.

### **Semi-Supervised Semantic Segmentation with CCT**

*Fall 2022*

*Introduction to AI*

- Developed CCT-based segmentation model with shared encoder and 40 auxiliary decoders.
- Integrated Temporal Ensembling and GAN regularization, improving PASCAL VOC mIoU from 73.2 to 73.5.

## References

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**Prof. Stefanie Jegelka**, Humboldt Professor at TUM  
**Prof. Seunghoon Hong**, Associate Professor at KAIST  
**Prof. Alice Oh**, Professor at KAIST

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