

# Sejin Kim

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## RESEARCH PROFILES

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## RESEARCH SUMMARY

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My research focuses on developing human-like reasoning capabilities in artificial intelligence, with an emphasis on abstraction, compositional generalization, and alignment. I use the Abstraction and Reasoning Corpus (ARC) as a testbed for studying general intelligence, and investigate how models can acquire structured reasoning through program synthesis, trajectory-based learning, and neuro-symbolic approaches. My work spans three main directions: (1) understanding human reasoning processes via trajectory data, (2) designing learning algorithms that leverage structured exploration and feedback, and (3) improving alignment between model behavior and human reasoning patterns. Through this line of research, I aim to build AI models that can generalize beyond training distributions and adapt to novel tasks in a human-like manner.

## RESEARCH INTERESTS

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- Human-like reasoning and abstraction
- Program synthesis and neuro-symbolic learning
- Reinforcement learning with trajectory modeling
- Human-AI alignment through reasoning augmentation

## SELECTED PUBLICATIONS

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- ARCTraj: A Dataset and Benchmark of Human Reasoning Trajectories for Abstract Problem Solving (**KDD 2026, FA**)
- TRACED: Transition-aware Regret Approximation with Co-learnability for Environment Design (**ICLR 2026, CA**)
- Addressing and Visualizing Misalignments in Human Task-Solving Trajectories (**KDD 2025, FA**)
- Reasoning Abilities of Large Language Models: In-Depth Analysis on the Abstraction and Reasoning Corpus (TIST, 2025, **SCIE Q1, top 10% in CS-IS**)
- Solution Augmentation for ARC Problems Using GFlowNet: A Probabilistic Exploration Approach (TMLR, 2025, **SCOPUS, CA**)

## EDUCATION

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Mar. 2017 ~ Feb. 2023	<b>Korea Advanced Institute of Science and Technology</b> School of Computing	Daejeon, Korea
	Thesis: Region-Level Spatio-Temporal Prediction Based on Transfer Learning for Data-Poor Cities <i>Advisor: Jae-Gil Lee (Co-Advisor: Kyu-Young Whang)</i>  <i>Ph.D. in Computer Science</i> GPA: 3.11 / 4.3	
Sep. 2013 ~ Aug. 2016	<b>Korea Advanced Institute of Science and Technology</b> School of Computing	Daejeon, Korea
	Thesis: Design and implementation of cost-based query optimization for Odysseus/OOSQL <i>Advisor: Kyu-Young Whang</i>  <i>M.S. in Computer Science</i> GPA: 3.2 / 4.3	
Feb. 2009 ~ Aug. 2013	<b>Korea Advanced Institute of Science and Technology</b> School of Computing	Daejeon, Korea
	<i>B.S. in Computer Science</i> GPA: 2.98 / 4.3	

## TEACHING EXPERIENCE

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- Lecturer
  1. **Intensive Python Course (40h)** for M.S. students, KNU, Feb. 2026
  2. **Korea Olympiad in Informatics (KOI)**, WITLab, Mar. 2017 – Feb. 2023
- Teaching Assistant, KAIST
  1. **CS101 Introduction to Programming**, School of Computing
  2. **CS360 Introduction to Databases**, School of Computing
  3. **CS560 Database Systems**, School of Computing
  4. **CS664 Advanced Database Systems**, School of Computing
  5. **KSE525 Data Mining and Knowledge Discovery**, Dept. of KSE
  6. **KSE625 Analytical Methodologies for Big Data**, Dept. of KSE

## ACADEMIC EXPERIENCES

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- **GIST Department of AI Convergence** - Postdoctoral Researcher, Apr. 2023 - Present
- **GraphAI Labs** - AI Reseracher, Feb. 2023 - Mar. 2023
- **KAIST AITRC** - DB Researcher, Sep. 2016 - Aug. 2017

## GRANTS & FUNDING

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- National Research Foundation of Korea (NRF), Postdoctoral Fellowship (PI)  
- Project: Developing abstraction and reasoning capabilities for AI models  
- Sep. 2024 - Aug. 2026, KRW 120M

- Korea Institute of Science and Technology Information (KISTI), R&D Innovation Program (PI)  
- Project: Representation learning for intention-driven generalization and adaptation  
- Jan. 2026 – Dec. 2026, GPU resources (Neuron system, 10 nodes)

## PATENTS

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1. Cho, G., Im, J., Kim, S., **Kim, S.**, "METHODS AND SYSTEMS FOR LEARNING BASED ON DIFFICULTY AND MUTUAL LEARNING", KR-Application No. 10-2025-0160737
2. Park, J., Kim, S., **Kim, S.**, Kim, Y., "METHOD FOR TRAINING AN ADAPTIVE RE-EVALUATION-BASED EXECUTION SYSTEM", KR-Application No. 10-2025-0148979
3. Kim, Y., Kim, S., **Kim, S.**, Kim, H., Park, J., "METHOD AND SYSTEM FOR RULE-BASED SYNTHETIC DATA GENERATION OFFLINE REINFORCEMENT LEARNING", KR-Application No. 10-2025-0148978
4. **Kim, S.**, Lee, H., Kim, S., "METHOD AND SYSTEM FOR AN INTENTION ESTIMATION IN HUMAN PROBLEM-SOLVING TRAJECTORIES", KR-Application No. 10-2025-0135338
5. Lee, H., **Kim, S.**, Kim, S., "METHOD AND SYSTEM FOR IMPLEMENTING A REINFORCEMENT LEARNING ENVIRONMENT CAPABLE OF SOLVING ABSTRACTION AND REASONING CHALLENGE", KR-Application No. 10-2024-0101165
6. Lee, J.-G., Lee, C., Kim, J., **Kim, S.**, "RETRIEVAL SYSTEM FOR GEOSOCIAL NETWORKS AND METHOD OF THE SAME", KR-Registration No. 10-2055900-0000

## INVITED TALKS

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- Korea Software Congress (KSC), Early-Career Researcher Session, Korea, 2025.
- Sunchon National University (SCNU), Colloquium, Korea, 2025.
- Gwangju Institute of Science and Technology (GIST), AI Colloquium, Korea, 2025.
- Ulsan National Institute of Science and Technology (UNIST), Korea, 2025.
- Gwangju Institute of Science and Technology (GIST), AXEL Camp, Korea, 2025.
- Korea Disease Control and Prevention Agency (KDCA), DIDCS Workshop, Korea, 2025.
- University of British Columbia (UBC), EECE Seminar, Canada, 2024.

## AWARDS AND HONORS

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- **Outstanding Reviewer**, KDD 2025  
*Selected as a Top 10% reviewer for the ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2025.*
- **Excellence Award**, GIST  
*Recognized for outstanding research achievements among postdoctoral researchers, Gwangju Institute of Science and Technology, Korea, 2024.*

## ACADEMIC SERVICES

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- **Area Chair**, *KDD 2026 Datasets and Benchmark Track*
- **Session Chair**, *KDD 2025*
- **Program Committee Member**, *ICML (2026), NeurIPS (2024; 2026), ICLR (2025), AAAI (2025; 2026), KDD (2025; 2026), ECML-PKDD (2026)*
- **Journal Reviewer** (ACM Transactions on Intelligent Systems and Technology) 2025; 2026

- **Journal Reviewer** (IEEE Transactions on Knowledge and Data Engineering) 2022; 2023

## CONFERENCES (\* FIRST OR EQUAL, † CORR.)

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1. **Kim, S.\***, Choi, H., Lee, S., Kim, S.† (2026), "ARCTraj: A Dataset and Benchmark of Human Reasoning Trajectories for Abstract Problem Solving", KDD Datasets and Benchmarks. (*top conference*)
2. Liyew, W.\* , Oh, D., Lee, S., **Kim, S.**, Kim, S.† (2026), "Semantic Mutation via LLMs: A Hybrid Approach to Evolutionary Program Synthesis", GECCO Companion.
3. Kim, Y.\* , Park, J., Kim, H., **Kim, S.†**, Lee, B.-J.†, Kim, S.†, "On the Role of Proposal Support in Diffusion-Based Offline RL for Sequential Decision-Making", ICML DEMO Workshop.
4. Cho, G.\* , Im, J., Lee, J., Yi, H., **Kim, S.†**, Kim, S.† (2026), "TRACED: Transition-aware Regret Approximation with Co-learnability for Environment Design", ICLR. (*top conference*)
5. Rusli, M.\* , Shin, D., **Kim, S.**, Kim, S.† (2026), "Tracing and Correcting Programs: Critic-Guided Synthesis for Visual Reasoning", AAAI LMReasoning Bridge Workshop.
6. Park, J.\* , Park, J., Shim, J., **Kim, S.**, Vennemann, P., Kim, S.† (2025), "Composed Program Induction with Latent Program Lattice", NeurIPS NeurReps Workshop.
7. Park, J.\* , Kim, Y., **Kim, S.**, Lee, B.-J., Kim, S.† (2025), "Diffusion-model-guided Implicit Q-learning with Adaptive Revaluation", CoRL LEAP Workshop.
8. **Kim, S.\***, Lee, H., Kim, S.† (2025), "Addressing and Visualizing Misalignments in Human Task-Solving Trajectories", KDD. (*top conference*)
9. **Kim, S.\***, Lee, H., Kim, S.† (2025), "Addressing and Visualizing Misalignments in Human Task-Solving Trajectories", ICLR Bi-Align Workshop.
10. **Kim, S.\***, Kim, S.† (2024), "System-2 Reasoning via Generality and Adaptation", NeurIPS S2R Workshop.
11. Lee, S.\* , Sim, W.\* , Shin, D., **Kim, S.**, Kim, S.† (2024), "Reasoning Abilities of Large Language Models through the Lens of Abstraction and Reasoning", NeurIPS S2R Workshop.
12. Shim, S.\* , Ko, D.\* , Lee, H., Lee, S., Song, D., Hwang, S., **Kim, S.**, Kim, S.† (2024), "O2ARC 3.0: A Platform for Solving and Creating ARC Tasks", IJCAI Demo.
13. Lee, J.\* , Sim, W.\* , **Kim, S.†**, Kim, S.† (2024), "Enhancing Analogical Reasoning in the Abstraction and Reasoning Corpus via Model-Based RL", IJCAI IARML Workshop.
14. Lee, H.\* , **Kim, S.\***, Lee, S., Hwang, S., Lee, J., Lee, B.-J.†, Kim, S.† (2024), "ARCLE: The Abstraction and Reasoning Corpus Learning Environment for Reinforcement Learning", CoLLAs.
15. Park, J.\* , Im, J.\* , Hwang, S.\* , Lim, M.\* , Ualibekova, S., **Kim, S.**, Kim, S.† (2023), "Unraveling the ARC Puzzle: Mimicking Human Solutions with Object-Centric Decision Transformer", ICML ILHF Workshop.
16. Kim, S.\* , Song, H., **Kim, S.**, Lee, J.-G.† (2020), "Revisit Prediction by Deep Survival Analysis", PAKDD.
17. Yea, S.-G.\* , **Kim, S.**, TO, J.-M., Lee, J.-G.† (2016), "SentiWorld: Understanding Emotions between Countries Based on Tweets", ICWSM Demo.

## JOURNALS (\* FIRST OR EQUAL, † CORR.)

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1. Lee, S.\* , Sim, W.\* , Shin, D., Hwang, S., Seo, W., Park, J., Lee, S., **Kim, S.**, Kim, S.† (2025), "Reasoning Abilities of Large Language Models: In-Depth Analysis on the Abstraction and Reasoning Corpus", *ACM Transactions on Intelligent Systems and Technology*, 16(6), 1–52.
2. Hwang, S.\* , Lee, S., **Kim, S.†**, Kim, S.† (2025), "Solution Augmentation for ARC Problems Using GFlowNet: A Probabilistic Exploration Approach", *Transactions on Machine Learning Research*.

3. Whang, K.-Y.\* , Na, I., Yun, T.-S., Park, J.-A., Cho, K.-H., **Kim, S.**, Yi, I., Lee, B.-S. (2020), "Building Social Networking Services Systems using the Relational Shared-Nothing Parallel DBMS", *Data & Knowledge Engineering*, 125, 101756.

## PREPRINTS (\* FIRST OR EQUAL, † CORR.)

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1. **Kim, S.\*** , Kim, S.† (2026), "System 2 Reasoning for Human-AI Alignment: Generality and Adaptivity via ARC-AGI", NeurIPS 2026. (*submitted*)
2. Jeon, J.\* , Shim, S., **Kim, S.†** , Kim, S.† , Lee, B.-J.† (2026), "Neural MCTS with LLM Guidance for Effective Program Synthesis on Abstraction and Reasoning Corpus". Machine Learning Journal. (*submitted*)
3. Kim, Y.\* , Park, J., Kim, H., **Kim, S.†** , Lee, B.-J., Kim, S. (2026), "On the Role of Proposal Support in Diffusion-Based Offline Reinforcement Learning for ARC-AGI Sequential Decision-Making", Machine Learning Journal. (*submitted*)

## DOMESTIC CONFERENCES (\* FIRST OR EQUAL, † CORR.)

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1. Lee, J.\* , Lee, S., **Kim, S.†** , Kim, S.† (2023), "Extracting the Core Knowledge of ARC with the World Model", Korea Software Congress.
2. Gu, G.\* , Sim, W., Im, J., **Kim, S.** , Kim, S.† (2023), "Using Contrastive Learning for Abstraction and Reasoning Task", Korea Software Congress.
3. Lee, H.\* , **Kim, S.** , Kim, S.† (2023), "ARCLE: Gymnasium Environment for Abstraction and Reasoning Corpus", Korea Software Congress.
4. Park, J.\* , Im, J., Lee, Y., Shin, D., **Kim, S.** , Kim, S.† (2023), "Abstraction and Reasoning Challenge with Decision Transformer", Korea Computer Congress.
5. Sim, W.\* , Jin, H., **Kim, S.** , Kim, S.† (2023), "The Possibility of Prompt Engineering for ARC Problem Solving", Korea Computer Congress.
6. Shin, Y.\* , Park, D., Kang, J., **Kim, S.†** (2022), "Contrastive Learning with Segment Supervision for Semi-Supervised Time Series Classification", Korea Software Congress.
7. Kim, B.\* , Na, J., Byun, Y., **Kim, S.** , Lee, J.-G.† (2022), "Autoencoder ODEs for Time Series Anomaly Detection", Korea Software Congress.
8. Kim, J.\* , Kim, D., **Kim, S.** , Kang, J., Park, D., Lee, J.-G.† (2022), "Performance Comparison of Self-Driving Models With and Without LIDAR Sensors Based on Reinforcement Learning in AWS DeepRacer Platform ", Korea Computer Congress.
9. Trirat, P.\* , Shin, Y., **Kim, S.†** , Kim, M.† (2021), "Generating a Machine Learning Model with a Few Sentences", Korea Software Congress.
10. Kim, B.\* , Kim, S., **Kim, S.** , Lee, J.-G.† (2019), "Customer Revisit Prediction Using Macroscale Mobility Information", Korea Software Congress.
11. **Kim, S.\*** (2018), "A Comparison of Implementation Method of Spatial Operator in Spatial OLAP ", Korea Computer Congress.

## DOMESTIC JOURNALS (\* FIRST OR EQUAL, † CORR.)

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1. Sim, W.\* , Jin, H., **Kim, S.** , Kim, S.† (2024), "The Possibility of Prompt Engineering for ARC Problem Solving", KIISE Transactions on Computing Practices.