Jinheon Baek

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RESEARCH INTEREST

My research interest lies in machine learning for languages, knowledge, and their intersections at scale. Previous work includes modeling interconnected data structures (texts and graphs), and retrieving them to augment language models, while verifying and personalizing their outputs, for practical natural language applications.

EDUCATION

KAIST   Daejeon, South Korea
Ph.D. in Artificial Intelligence   Mar 2022 – Present
M.S. in Artificial Intelligence   Mar 2020 – Feb 2022
    Thesis: Toward Accurate Learning of Graph Representations, GPA: 4.22/4.30

Korea University   Seoul, South Korea
B.S. in Computer Science and Engineering   Mar 2016 – Feb 2020
B.E. in Software Technology and Enterprise Program (Interdisciplinary Program)
    GPA: 4.40/4.50, GPA of Computer Science and Engineering: 4.48/4.50

EMPLOYMENT

Research Intern, IBM Research   May 2024 - Aug 2024
- Conducting research on foundation models for structured data in enterprise data lakes over cloud services.

Research Assistant, KAIST (Advisor: Prof. Sung Ju Hwang)   Jul 2019 - Present
- Conducting research on machine learning for graphs (representation, reconstruction, generation, and retrieval), and their applications to natural language (knowledge graphs) and computer vision (object graphs).

Research Intern, Microsoft Research   Jun 2023 - Sep 2023
- Conducted research on augmenting large language models for personalization for search query suggestions.

Applied Scientist II Intern, Alexa AI, Amazon   Aug 2022 - Nov 2022
- Conducted research on knowledge-augmented large language models with retrieval from knowledge graphs.

Chief Technology Officer (CTO), Jobshopper   Jul 2018 - Feb 2020
- Co-founded an education-technology startup for student careers, led a research & development group, exited the big-data-based university information platform (Majormap), and now only advising technical directions.

Undergrad. Research Assistant, Korea University (Advisor: Prof. Jaewoo Kang)   Mar 2018 - Jun 2019
- Conducted research on representing interconnected knowledge (food ingredients and academic majors) for their recommendations, and research on investigating the spatial reasoning ability of neural models.

Research Intern, Smart Data Research Group, ETRI   Jan 2019 - Feb 2019
- Researched an open data distribution platform with the international standard (DCAT), and utilized DevOps tools (Ansible, AWX, and Traefik) to manage nodes on a cloud, in a National AI Research Institute in Korea.

PUBLICATIONS

International Publications (∗: equal contribution; †: corresponding author)

[29] Large Language Model-Powered Research Proposal Generation
<u>Jinheon Baek</u>, Sujay Kumar Jauhar, Silviu Cucerzan, and Sung Ju Hwang
In preparation

[28] Retrieval-Augmented Data Augmentation for Low-Resource Domain Tasks
Minju Seo*, <u>Jinheon Baek*</u>, James Thorne, and Sung Ju Hwang
In submission

[27] Adaptive-RAG: Learning to Adapt Retrieval-Augmented Large Language Models through Question Complexity
Soyeong Jeong, <u>Jinheon Baek</u>, Sukmin Cho, Sung Ju Hwang, and Jong C. Park
Conference of the North American Chapter of the Association for Computational Linguistics **(NAACL)**, 2024

[26] Knowledge-Augmented Large Language Models for Personalized Contextual Query Suggestion
<u>Jinheon Baek</u>, Nirupama Chandrasekaran, Silviu Cucerzan, Allen Herring, and Sujay Kumar Jauhar
The Web Conference **(WWW)**, 2024

[25] Knowledge-Augmented Language Model Verification
<u>Jinheon Baek</u>, Soyeong Jeong, Minki Kang, Jong C. Park, and Sung Ju Hwang
Empirical Methods in Natural Language Processing **(EMNLP)**, 2023

[24] Test-Time Self-Adaptive Small Language Models for Question Answering
Soyeong Jeong, <u>Jinheon Baek</u>, Sukmin Cho, Sung Ju Hwang, and Jong C. Park
Findings of Empirical Methods in Natural Language Processing **(Findings of EMNLP)**, 2023

[23] Knowledge-Augmented Reasoning Distillation for Small Language Models in Knowledge-Intensive Tasks
Minki Kang, Seanie Lee, Jinheon Baek, Kenji Kawaguchi, and Sung Ju Hwang
Conference on Neural Information Processing Systems **(NeurIPS)**, 2023

[22] Direct Fact Retrieval from Knowledge Graphs without Entity Linking
Jinheon Baek[†], Alham Fikri Aji, Jens Lehmann, and Sung Ju Hwang
Annual Meeting of the Association for Computational Linguistics **(ACL)**, 2023

[21] Phrase Retrieval for Open-Domain Conversational Question Answering
with Conversational Dependency Modeling via Contrastive Learning
Soyeong Jeong, Jinheon Baek, Sung Ju Hwang, and Jong C. Park
Findings of the Association for Computational Linguistics **(Findings of ACL)**, 2023

[20] Knowledge-Augmented Language Model Prompting for Zero-Shot Knowledge Graph Question Answering
Jinheon Baek[†], Alham Fikri Aji, and Amir Saffari
Natural Language Reasoning and Structured Explanations Workshop at ACL **(NLRSE @ ACL)**, 2023 **(Best Paper)**
Matching from Unstructured and Structured Data Workshop at ACL **(MATCHING @ ACL)**, 2023 **(Oral)**

[19] Personalized Subgraph Federated Learning
Jinheon Baek*, Wonyong Jeong*, Jiongdao Jin, Jaehong Yoon, and Sung Ju Hwang
International Conference on Machine Learning **(ICML)**, 2023

[18] Realistic Conversational Question Answering with Answer Selection
based on Calibrated Confidence and Uncertainty Measurement
Soyeong Jeong, Jinheon Baek, Sung Ju Hwang, and Jong C. Park
Conference of the European Chapter of the Association for Computational Linguistics **(EACL)**, 2023

[17] Graph Self-supervised Learning with Accurate Discrepancy Learning
Dongki Kim*, Jinheon Baek*, and Sung Ju Hwang
Conference on Neural Information Processing Systems **(NeurIPS)**, 2022

[16] Object Detection in Aerial Images with Uncertainty-Aware Graph Network
Jongha Kim, Jinheon Baek, and Sung Ju Hwang
Visual Object-oriented Learning meets Interaction Workshop at ECCV **(VOLI @ ECCV)**, 2022

[15] Knowledge-Consistent Dialogue Generation with Knowledge Graphs
Minki Kang*, Jin Myung Kwak*, Jinheon Baek*, and Sung Ju Hwang
Knowledge Retrieval and Language Models Workshop at ICML **(KRLM @ ICML)**, 2022

[14] KALA: Knowledge-Augmented Language Model Adaptation
Minki Kang*, Jinheon Baek*, and Sung Ju Hwang
Conference of the North American Chapter of the Association for Computational Linguistics **(NAACL)**, 2022 **(Oral)**

[13] Augmenting Document Representations for Dense Retrieval with Interpolation and Perturbation
Soyeong Jeong, Jinheon Baek, Sukmin Cho, Sung Ju Hwang, and Jong C. Park
Annual Meeting of the Association for Computational Linguistics **(ACL)**, 2022 **(Oral)**

[12] Edge Representation Learning with Hypergraphs
Jaehyeong Jo*, Jinheon Baek*, Seul Lee*, Dongki Kim, Minki Kang, and Sung Ju Hwang
Conference on Neural Information Processing Systems **(NeurIPS)**, 2021

[11] Task-Adaptive Neural Network Retrieval with Meta-Contrastive Learning
Wonyong Jeong*, Hayeon Lee*, Geon Park*, Eunyoung Hyung, Jinheon Baek, and Sung Ju Hwang
Conference on Neural Information Processing Systems **(NeurIPS)**, 2021 **(Spotlight)**

[10] Unsupervised Document Expansion for Information Retrieval with Stochastic Text Generation
Soyeong Jeong, Jinheon Baek, ChaeHun Park, and Jong C. Park
Scholarly Document Processing Workshop at NAACL **(SDP @ NAACL)**, 2021 **(Oral)**

[9] Accurate Learning of Graph Representations with Graph Multiset Pooling
Jinheon Baek*, Minki Kang*, and Sung Ju Hwang
International Conference on Learning Representations **(ICLR)**, 2021

[8] Exploring The Spatial Reasoning Ability of Neural Models in Human IQ Tests
Hyunjae Kim*, Yookyung Koh*, Jinheon Baek, and Jaewoo Kang
Neural Networks, 2021

[7] Learning to Extrapolate Knowledge: Transductive Few-shot Out-of-Graph Link Prediction
Jinheon Baek, Dong Bok Lee, and Sung Ju Hwang
Conference on Neural Information Processing Systems **(NeurIPS)**, 2020

Domestic Publications, mostly written in Korean

[6] Artificial Intelligence-Based High School Course and University Major
Recommendation System for Course-Related Career Exploration
<u>Jinheon Baek</u>, Hayeon Kim, and Kiwon Kwon
KIPS Transactions on Software and Data Engineering (KTSDE), 2021

[5] Graph Representation Learning with Attention-based Set Pooling
<u>Jinheon Baek</u>, Minki Kang, and Sung Ju Hwang
Conference of Korean Artificial Intelligence Association (CKAIA), 2020 **(Best Paper)**

[4] Embedding Academic Majors and Lectures for Analyzing Departments in University
<u>Jinheon Baek</u>, Gwanghoon Jang, Soyeong Jeong, Donghyeon Park, Kiwon Kwon, and Jaewoo Kang
Korea Computer Congress (KCC), 2019 **(Oral)**

[3] Embedding Food Ingredients Based on Chemical Combination in Dense Vector Space
Donghyeon Park, Yonggyu Park, Buru Chang, <u>Jinheon Baek</u>, and Jaewoo Kang
Korea Computer Congress (KCC), 2018 **(Best Paper)**

[2] Multimodal Approach for Blocking Obscene and Violent Contents
<u>Jinheon Baek</u>, Dakyeong Lee, Chaeyeon Hong, and Byeongtae Ahn
Journal of Convergence for Information Technology (JCIT), 7(6), 2017

Thesis

[1] Toward Accurate Learning of Graph Representations
<u>Jinheon Baek</u>
Master's Thesis, KAIST, 2022

PATENTS

[5] Contextualization of Generative Language Models Based on Entity Resource Identifiers
Sujay Kumar Jauhar, Silviu Cucerzan, Nirupama Chandrasekaran, Allen Herring, and <u>Jinheon Baek</u>
USSN: 18/529,910, filed on Dec 05, 2023

[4] Entity-Based Personalization of Generative Language Models
Sujay Kumar Jauhar, Silviu Cucerzan, Nirupama Chandrasekaran, Allen Herring, and <u>Jinheon Baek</u>
USSN: 63/545,909, filed on Nov 03, 2023

[3] Electronic Apparatus and Method for Controlling Thereof
Sung Ju Hwang, <u>Jinheon Baek</u>, Wonyong Jeong, Hyeonuk Kim, Jiongdao Jin, and Jaehong Yoon
Korean patent number: 10-2022-0175165, filed on Dec 14, 2022

[2] Method for Building an Artificial Intelligence based Research Topics Database
Kiwon Kwon, and <u>Jinheon Baek</u>
Korean patent number: 10-2021-0017765, filed on Feb 08, 2021, and registered on Apr 19, 2022

[1] Method for Consulting on Exploration Activities
based on Target Departments and Curriculum Achievement Standards
Kiwon Kwon, and <u>Jinheon Baek</u>
Korean patent number: 10-2021-0017764, filed on Feb 08, 2021, and registered on Jun 17, 2022

HONORS AND AWARDS		
Awarded the Travel Grant from KAIST-Google Partnership Program for WWW 2024		2024
Received the Best Poster Presentation Award at Samsung AI Forum 2023		2023
Received the Best Paper Award at NLRSE Workshop in ACL 2023		2023
Awarded the ICML Grant for ICML 2023		2023
Awarded the Google Travel Grant for NeurIPS 2022		2022
Selected as One of the Top Reviewers (Top 10%) of NeurIPS 2022		2022
Selected as One of the Highlighted Reviewers (Top 10%) of ICLR 2022		2022
Selected as One of the Best Reviewers (Top 10%) of ICML 2021		2021
Received the Best Paper Award at CKAIA 2020		2020
Awarded the Samsung Dream Scholarship		2016-2020
Received the First Prize in the Graduation Project Competition Among Around 20 Teams, Computer Science and Engineering Department at Korea University		2019
Received the Academic Excellence Award (highest GPA) at Korea University		2019
Received the Second Prize for Excellence in the Microsoft Student Partners Activities, Among Around 10 Teams as a Team Leader, Microsoft Student Partners		2018
Nominated as a Representative of Korean for Excellence in Microsoft Student Partners Activities, Among Around 50 Members on a Global Summit Program, Microsoft Student Partners		2017

ACADEMIC SERVICES	Reviewer of **NeurIPS** (Conference on Neural Information Processing Systems)	2021-2023
	Reviewer of **ICML** (International Conference on Machine Learning)	2021-2024
	Reviewer of **ICLR** (International Conference on Learning Representations)	2022-2024
	Reviewer of **ACL ARR** (Association for Computational Linguistics Rolling Review)	2023-2024
	Reviewer of **WWW** (The Web Conference)	2024
	Reviewer of **TMLR** (Transactions on Machine Learning Research)	2022-2024
	Reviewer of **COLM** (Conference on Language Modeling)	2024
	Reviewer of **EACL** (Conference of the European Chapter of the Association for Computational Linguistics)	2023
	Reviewer of **LoG** (Learning on Graphs Conference)	2022-2023
	Reviewer of **SMCA** (IEEE Transactions on Systems, Man and Cybernetics: Systems)	2024
	Reviewer of **TPAMI** (IEEE Transactions on Pattern Analysis and Machine Intelligence)	2023
	Reviewer of **TKDE** (IEEE Transactions on Knowledge and Data Engineering)	2023
	Reviewer of **TNNLS** (IEEE Transactions on Neural Networks and Learning Systems)	2023
	Reviewer of **TETCI** (IEEE Transactions on Emerging Topics in Computational Intelligence)	2023
	Reviewer of **Big Data Research**	2023

VOLUNTEERING EXPERIENCE

Oxford COVID-19 Government Response Tracker (OxCGRT) — Jan 2022 - Mar 2023
- Collected systematic data on policy measures that governments took to tackle COVID-19, aiding decision-makers and citizens in understanding governmental responses over 180 countries. Research papers: [a, b].

WoonWha - Education Volunteer Club, Korea University — Jul 2016 - Jul 2017
- Volunteered for 10 middle school students vulnerable to education twice a week, about 300 hours in total.

5th Volunteering Program, Samsung Dream Scholarship Foundation — Jan 2017
- Volunteered for children in Cambodia by teaching students and exchanging cultures for two weeks.

TALKS AND SEMINARS

Knowledge-Augmented Language Model Verification	
Korea Software Congress (KSC)	Dec 2023
Samsung AI Forum	Nov 2023
Knowledge-Augmented (Large) Language Models	
ETRI	Oct 2023
Microsoft Research	Aug 2023
Direct Fact Retrieval from Knowledge Graphs & Personalized Subgraph Federated Learning	
Korea Software Congress (KSC)	Dec 2023
POSTECH ML Lab	Jul 2023
Representation Learning on Graphs with Their Real-World Applications	
Modulabs	Jul 2022
Edge Representation Learning with Hypergraphs	
KAIST AI Workshop	Jan 2022
Accurate Learning of Graph Representations with Graph Multiset Pooling	
KAIST AI Workshop	Jan 2022
ICLR Social - ML in Korea	May 2021
Introduction of Graph Neural Networks	
Modulabs	Jan 2022
Special Talk in Artificial Intelligence as an Alumnus	
Korea University	Aug 2021
Learning to Extrapolate Knowledge: Transductive Few-shot Out-of-Graph Link Prediction	
Korean Conference on Computer Vision (KCCV)	Aug 2021
NeurIPS Social - ML in Korea	Dec 2020
Basic Algorithms of Machine Learning and Deep Learning with Python Code Challenges	
Microsoft Coding Education Volunteer Group Seminar	Jul 2018
Microsoft Student Partner Newcomer Tech Seminar	May 2018
IaaS (Infrastructure as a Service) in Microsoft Azure	
Microsoft Student Partner Newcomer Tech Seminar	Apr 2018
Phishing Website Detection with Microsoft Azure Machine Learning Studio	
KUSISWALL: Joint Seminar of Korea, Sookmyung and Hanyang Universities	Feb 2018
Basic Algorithms of Machine Learning with Azure Machine Learning Studio	
Microsoft Student Partner Evangelism	Nov 2017, Nov 2016
Azure Cognitive Services with Serverless Cloud Computing using JavaScript and Python	
Microsoft Student Partner Evangelism	Nov 2017
Windows Hello: Microsoft Face Recognition System in Windows 10	
Microsoft Student Partner Inner Tech Seminar	Oct 2016

Lead & Representative of Korea, Microsoft Student Partner   Jul 2016 - Jul 2020
- As a leader, promoted Microsoft products, recruited members, planned programs, and reviewed projects.
- As a representative of Korea on a global summit program, invited to Microsoft Build in 2017 which is the biggest annual conference held by Microsoft, and conducted a role as a technical ambassador.

Chairman, Inc0gnito Hacking Conference   Mar 2018 - Feb 2019
- Organized the information security conference in Korea held by undergraduate students over 10 universities, which covers techs, news, and trends on information security areas.

8th Trainee, SW Maestro   Jul 2017 - Dec 2017
- Researched and developed systems that automatically block obscene and violent movie content with machine learning, within the SW Maestro program that aims to train talented students on software in Korea.

SKILLS   Languages: Korean (mother tongue), English (fluent)
Programming (Coding): Python, JavaScript, Java, and C