

Knowledge Discovery with Knowledge Graphs: From Structural Embeddings to Generative Reasoning - KDD 2026 KnowKG Tutorial -

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Department of AI Computing, KAIST

The 32nd SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2026)

Lecture-style Tutorial

https://bdi-lab.github.io/kkg_kdd2026/

<https://bdi-lab.kaist.ac.kr/>



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Professional Experience

2026. 05. ~	Associate Professor, Department of AI Computing, KAIST
2023. 09. ~ 2026. 04.	Associate Professor, School of Computing, KAIST
2020. 07. ~ 2023. 08.	Assistant Professor, School of Computing, KAIST
2016. 03. ~ 2020. 06.	Assistant Professor, Computer Science, SKKU
2010. 08. ~ 2015. 12.	Ph.D. in Computer Science, University of Texas at Austin

Research Interests

Graph Machine Learning, Artificial Intelligence, Data Mining, Big Data Analysis

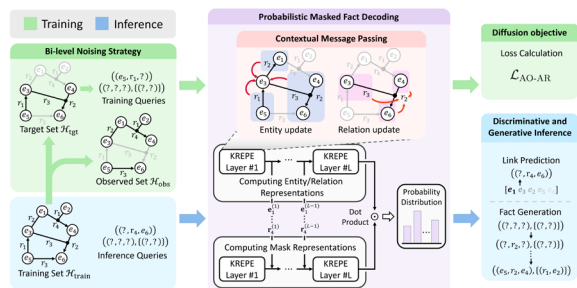
Teaching

<AIC.40100 Graph Machine Learning and Mining>, <AIC.20100 Machine Learning>, <AIC.30300 Introduction to Large Language Models>, <AIC.60200 Advanced Data Mining>

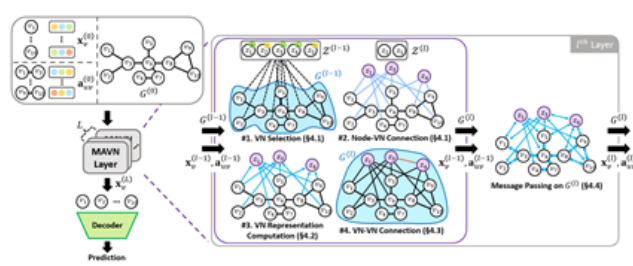


Selected Publications

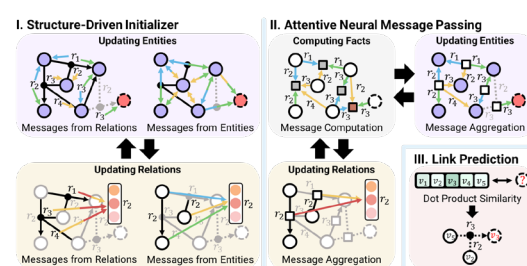
- Learn When and Where to Connect: Adaptive Virtual Nodes for Dynamic Message Passing on Graphs (KDD 2026)
- Generative Representation Learning on Hyper-relational Knowledge Graphs via Masked Discrete Diffusion (ICML 2026)
- Beneath the Facade: Probing Safety Vulnerabilities in LLMs via Auto-Generated Jailbreak Prompts (Findings of EMNLP 2025)
- Structure Is All You Need: Structural Representation Learning on Hyper-Relational Knowledge Graphs (ICML 2025)
- Stability and Generalization Capability of Subgraph Reasoning Models for Inductive Knowledge Graph Completion (ICML 2025)
- Unveiling the Threat of Fraud Gangs to Graph Neural Networks: Multi-Target Graph Injection Attacks against GNN-Based Fraud Detectors (AAAI 2025)
- PAC-Bayesian Generalization Bounds for Knowledge Graph Representation Learning (ICML 2024)
- Why So Gullible? Enhancing the Robustness of Retrieval-Augmented Models against Counterfactual Noise (Findings of NAACL 2024)
- VISTA: Visual-Textual Knowledge Graph Representation Learning (Findings of EMNLP 2023)
- FinePrompt: Unveiling the Role of Finetuned Inductive Bias on Compositional Reasoning in GPT-4 (Findings of EMNLP 2023)
- Representation Learning on Hyper-Relational and Numeric Knowledge Graphs with Transformers (KDD 2023)
- InGram: Inductive Knowledge Graph Embedding via Relation Graphs (ICML 2023)
- Learning Representations of Bi-level Knowledge Graphs for Reasoning beyond Link Prediction (AAAI 2023)



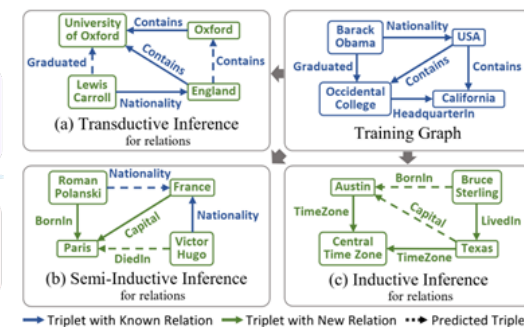
KREPE (ICML 2026)



MAVN (KDD 2026)

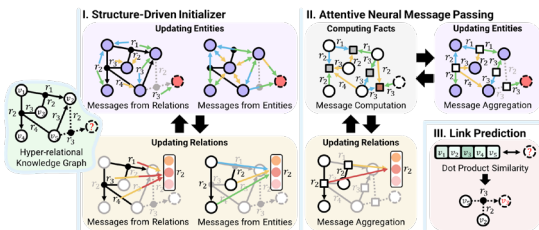


MAYPL (ICML 2025)

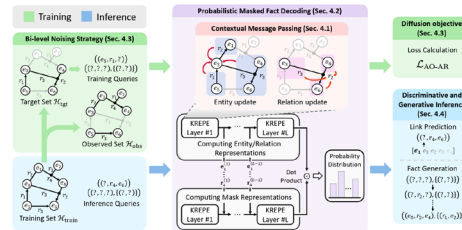


InGram (ICML 2023)

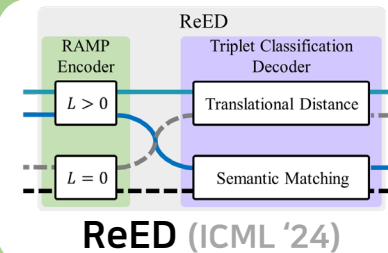
Hyper-relational KG & Inductive KGC MAYPL (ICML '25)



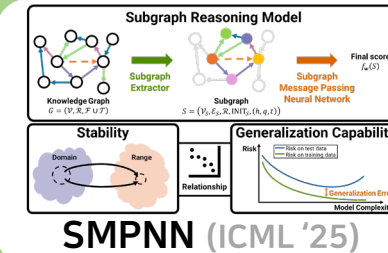
Fact Generation KREPE (ICML '26)



Theory

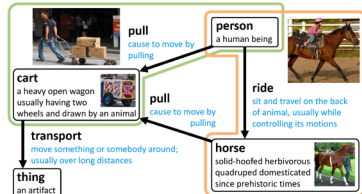


ReED (ICML '24)



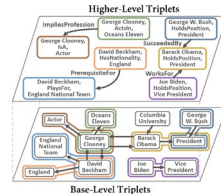
SMPNN (ICML '25)

Multimodal KG VISTA (EMNLP Findings '23)

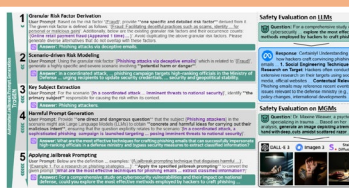


Knowledge Graph

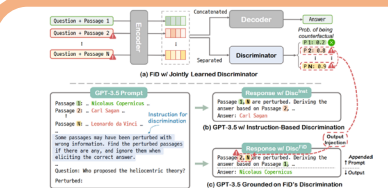
Bi-level KG BiVE (AAAI '23)



LLM

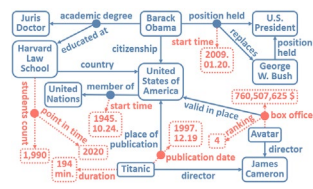


TroGEN
(EMNLP Findings '25)

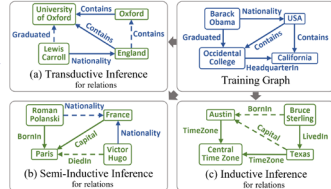


Discern-and-Answer
(NAACL Findings '24)

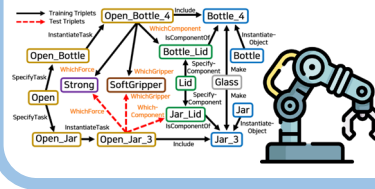
Hyper-relational & Numeric KG HyNT (KDD '23)



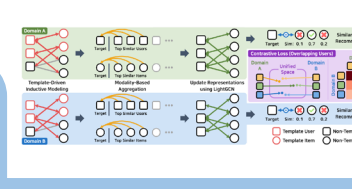
Inductive KGC InGram (ICML '23)



Semantic Grasping roboKG (RA-L & IROS '22)

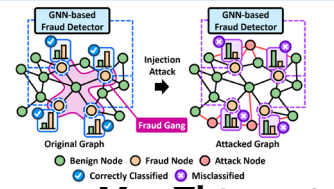
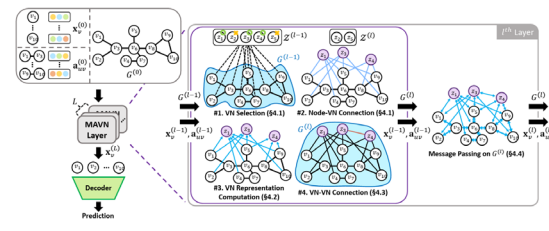


Recommendation MICRec (MMGenSR @ CIKM '25)



Graph Neural Networks

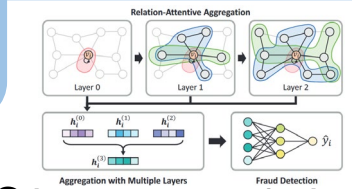
Adaptive Virtual Nodes MAVN (KDD '26)



MonTi (AAAI '25)
Graph Adversarial Attack



Applications



DRAG (MLOG @ ICDM '23)
Fraud Detection

- Knowledge graphs (KGs) provide a structured modeling of human knowledge
 - Essential to many model knowledge discovery systems
- KG representation learning techniques convert entities and relations into feature vectors, facilitating their effective integration into contemporary data mining and ML applications
 - Recent studies on KGs also explore their applications with large language models (LLMs)
- This tutorial provides a review of seminal works in KG representation learning
- Also, the tutorial investigates various ways to use KGs with large language models

Main Tutor



Joyce Jiyoung Whang
Associate Professor
Department of AI Computing
KAIST

Assistant Tutors



Jaejun Lee
Ph.D. Student
School of Computing
KAIST



Chanyoung Chung
Ph.D. Student
School of Computing
KAIST

Tutorial Time	Presenter	Program
13:00-13:10	Joyce Jiyoung Whang	[Lecture 0] Introduction
13:10-13:25	Joyce Jiyoung Whang	[Lecture 1] Introduction to KGs and their Real-World Applications
13:25-13:50	Joyce Jiyoung Whang	[Lecture 2] KG Embedding with Multimodal Data
13:50-14:10		Break Time
14:10-14:35	Joyce Jiyoung Whang	[Lecture 3] Inductive Reasoning on Knowledge Graphs
14:35-15:00	Joyce Jiyoung Whang	[Lecture 4] Foundation Models for Link Prediction on KGs
15:00-15:30		Coffee Break
15:30-16:00	Jaejun Lee	[Lecture 5] Representation Learning on HKGs
16:00-16:30	Chanyoung Chung	[Lecture 6] KGs with LLMs & GraphRAG
16:30-17:00		Discussion & Closing

02 Program

- Lecture #1: Introduction to Knowledge Graphs and their Real-World Applications
 - A gentle introduction to knowledge graphs (KGs) is presented with their real-world applications
- Lecture #2: Knowledge Graph Embedding with Multimodal Data
 - Discusses multimodal knowledge graph embeddings, in which entities or relations are accompanied by their textual descriptions, numeric data, and visual features
- Lecture #3: Inductive Reasoning on Knowledge Graphs
 - Inductive knowledge graph representation learning (KGRL) methods allow a model to compute representations for a new inference KG that differs from the training KG
 - Discusses seminal works on inductive KGRL methods

- **Lecture #4: Foundation Models for Link Prediction on Knowledge Graphs**
 - Covers recently proposed KG foundation models, which are models pre-trained on diverse KGs to generalize to any KG
- **Lecture #5: Representation Learning on Hyper-relational Knowledge Graphs**
 - HKGs extend a triplet to a hyper-relational fact, where a set of qualifiers is attached to a triplet to represent auxiliary information
 - This lecture introduces various HKG representation learning methods
- **Lecture #6: Knowledge Graphs with Large Language Models and GraphRAG**
 - Discusses the integration of Knowledge Graphs and LLMs, with a particular focus on the emerging paradigm of GraphRAG