Kun Gao

Contact Info

Email: kungao@pku.edu.cn　　　　　Mobile: (+65) 8694-4563　　　　　Web: Personal Page

Skills

Programming languages: Python, C++, SQL, Java, PHP, etc.
Softwares: TensorFlow, PyTorch, MATLAB, LaTeX, Linux, Wireshark, etc.
Research topics: Neuro-Symbolic Methods, Knowledge Representation and Learning, Deep Learning

Education

Peking University (PKU), Ph.D. in Computer Software and Theory, Beijing, China　　　　July 2018 – July 2023
　　Advisors: Prof. Hanpin Wang, Prof. Yongzhi Cao
　　Courses: Machine Learning, Knowledge Representation, Software Analyze, Formal Language and Automata, etc.
　　Research Topic: Neuro-Symbolic Inductive Logic Programming
　　Dissertation: Research on Inductive Logic Programming with Neuro-Symbolic Methods

National Institute of Informatics, Researcher Intern, Tokyo, Japan　　　　Sept. 2019 – Mar. 2020
　　Advisors: Prof. Katsumi Inoue
　　Research Topic: Knowledge Representation and Reasoning, Inductive Logic Programming

University of Science and Technology Beijing (USTB), B.E. in Computer Science, Beijing, China
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　Sept. 2014 – June 2018
　　Courses: Computer Organization, Operating System, The Mathematic Foundation for Information Security,
　　　　Assemble Language, Data Structure and Algorithm, etc.

Research Experience

Differentiable Inductive Logic Programming　　　　　　　　　　　　　　　Aug. 2019 – Now

- Designed a method to learn symbolic first-order rules from knowledge graphs. Using the learned rules on the corresponding knowledge graphs to perform link prediction tasks. Compared the results with embedding-based link prediction model and GNN-based models.

- Designed a method to learn symbolic propositional rules from tabular data. Compared the proposed model with state-of-the-art rule learning model such as RIPPER and decision trees.

- Learned the foundation of logic programming, the symbolic and non-symbolic inductive logic programming methods, logic programming software such as Prolog, and probabilistic logic programming models such as Markov Logic Networks.

- Designed a method to use large language models to perform inductive tasks from data. For example, let the model learn relations given existing relational facts.

Blockchain and Cloud Storage   Aug. 2018 – Aug.2019

- Learned the data structure of blockchain system and the smart contract in the blockchain system.

- Using formal logic to describe the atomic operations in block-based cloud storage systems.

Working Experience

Institute of High Performance Computing, Agency for Science, Technology, and Research, Singapore

Research Scientist   Aug. 2023 – Now

Projects and Research Topics:

- Perform the research in inductive logic programming. Design the model to learn semantics of data. For example, the model can learn knowledge represented by rules from time-series and image data.

- Design a neural network with embedded symbolic rules as prior knowledge to finish the classification tasks.

- Perform the research of explainable AI on time series data and image data, using local explanation and global explanation results to explain the model's predictions based on existing features in the data.

Data, Knowledge, and Intelligence team, Microsoft Research Asia (MSRA), Beijing, China

Research Scientist Intern   June 2022 – Oct. 2022

Research Topic: Learning interpretable rules from industry time series data in cloud source allocation problems.

Intel, Beijing, China

Software Engineer Intern   Sept. 2017 – Mar. 2018

Job Scope: Maintain open source projects such as OpenStack Swift system with Python.

Publication

1. Gao, K., Inoue, K., Cao, Y., and Wang, H. (2024): A differentiable first-order rule learner for inductive logic programming. *Artificial Intelligence*. (IF: 14.4)

2. Gao, K., Inoue, K., Cao, Y., and Wang, H. (2022): Learning First-Order Rules with Differentiable Logic Program Semantics. IJCAI 2022: 3008-3014. (Long Presentation, rank **top 3.75%** among IJCAI 2022 accepted papers.)

3. Gao, K., Wang, H., Cao, Y., and Inoue, K. (2022). Learning from interpretation transition using differentiable logic programming semantics. *Machine Learning*, 111(1), 123-145. (IF: 7.5)

4. Yang, C., Wang, L., Gao, K., and Li, S. (2023). Reinforcement Logic Rule Learning for Temporal Point Processes. arXiv preprint arXiv:2308.06094.

5. Jin, Z., Wang, H., Zhang, L., Zhang, B., Gao, K., and Cao, Y. (2019). Reasoning about Block-based Cloud Storage Systems. arXiv preprint arXiv:1904.04442.

Awards

National Award at PKU   2022
Excellent Merit Student at PKU and USTB   2022, 2017, 2016

Outstanding Graduates at USTB	2018
Top-Class Scholarships at USTB	2016
Programming Contest Third-Class Award at USTB	2015

Academic Service

Peer-reviewed Journals

| IEEE Transactions on Knowledge and Data Engineering | 2024 |

Presentations

| IJCAI-22, Long presentation. | 2022 |
| IJCLR-21, Long presentation. | 2021 |

Volunteers

| AAAI-21, Student volunteer. | 2021 |

University Services

Mathematical Logic, spring semester, teaching assistant at PKU.	2019,2022
Set Theory and Graph Theory, fall semester, teaching assistant at PKU.	2018, 2021
Probability and Statistics, student lecturer at USTB.	Step. 2015 – June 2016