

Zihao Wang

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Research Highlight

The overarching aim of my research is to develop rigorous and trustworthy methodologies that can effectively handle the challenge of complex requests and inadequate data

Education

Hong Kong University of Science and Technology

Ph.D. in Computer Science and Engineering, advised by Prof. Yangqiu Song

Hong Kong SAR

Sept 2020 - Current

Tsinghua University

Master of Science in Computer Science and Technology, advised by Prof. Yong Zhang

Beijing, China

Sept 2017 - Sept 2020

Tsinghua University

Bachelor of Science in Pure and Applied Mathematics, advised by Prof. Hao Wu

Beijing, China

Sept 2014 - Sept 2018

Tsinghua University

Bachelor of Science in Energy and Power Engineering, advised by Prof. Shuiqing Li

Beijing, China

Sept 2013 - Sept 2017

Research

INTERESTS I am broadly interested in the three-party interplay of **model**, **query**, and **data**. Here are some related keywords.

model: graph neural networks, representation learning.

query: finite model theory, graph theory and combinatorial optimization, optimal transport.

data: natural language, knowledge graph, weak supervision.

LEADERSHIP I proudly organize a **S**pecial **R**esearch **I**nterest **G**roup of **K**nowledge **G**raph **R**epresentation and **R**easoning (SRIG-KGRR).

The goal of SRIG-KGRR is to build **trustworthy models** for *first-order logic queries* and *incomplete knowledge graph data*.

The steering committee of SRIG-KGRR is Prof. Yangqiu Song from HKUST and Prof. Hao Wu from Tsinghua University.

PUBLICATION

* equal contribution; ◇: junior members of SRIG-KGRR; †: other junior students under my supervision.

Conference papers

- [ACL'23] Wasserstein-Fisher-Rao Embedding: Logical Query Embeddings with Local Comparison and Global Transport
Zihao Wang, Weizhi Fei, Hang Yin, Yangqiu Song, Ginny Wong, Simon See
Findings of the Association for Computational Linguistics: ACL 2023, 2023, Toronto, Canada
TL;DR: A better representation space for complex queries in the middle of *global transport* and *local comparison*.
- [ICLR'23] Logical Message Passing Networks with One-hop Inference on Atomic Formulas
Zihao Wang, Yangqiu Song, Ginny Wong, Simon See
The Eleventh International Conference on Learning Representations, 2023
TL;DR: Simple knowledge graph embeddings can solve complex queries if you passes the correct message.
- [ICML'23] spread: Solving L1 Penalty with SGD
Liu Ziyin, Zihao Wang
Proceedings of the 40th International Conference on Machine Learning, 2023
TL;DR: We succeeded solve L_1 regularization with SGD by introducing a simple reparameterization.
- [NAACL'22] Query2Particles: Knowledge Graph Reasoning with Particle Embeddings
Jiaxin Bai, Zihao Wang, Hongming Zhang, Yangqiu Song
Findings of the Association for Computational Linguistics: NAACL 2022, 2022, Seattle, United States
TL;DR: Modeling complex queries with non-parameterized particles.
- [CIKM'22] Gromov-Wasserstein Guided Representation Learning for Cross-Domain Recommendation
Xinhang Li, Zhaopeng Qiu, Xiangyu Zhao, Zihao Wang, Yong Zhang, Chunxiao Xing, Xian Wu
Proceedings of the 31st ACM International Conference on Information & Knowledge Management, 2022, Atlanta, GA, USA
TL;DR: We using Gromov-Wasserstein to align user and item features.

- [EMNLP'22] A Neural-Symbolic Approach to Natural Language Understanding
Zhixuan Liu, Zihao Wang, Yuan Lin, Hang Li
Findings of the Association for Computational Linguistics: EMNLP 2022, 2022, Abu Dhabi, United Arab Emirates
TL;DR: Generating symbolic programs with LLM, then solving problems by program execution.
- [EMNLP'22] MICO: A Multi-alternative Contrastive Learning Framework for Commonsense Knowledge Representation
Ying Su, Zihao Wang, Tianqing Fang, Hongming Zhang, Yangqiu Song, Tong Zhang
Findings of the Association for Computational Linguistics: EMNLP 2022, 2022, Abu Dhabi, United Arab Emirates
TL;DR: A contrastive learning approach for commonsense knowledge representation.
- [COLING'22] Unsupervised Sentence Textual Similarity with Compositional Phrase Semantics
Zihao Wang, Jiaheng Dou, Yong Zhang
Proceedings of the 29th International Conference on Computational Linguistics, 2022, Gyeongju, Republic of Korea
TL;DR: **[Selected as oral]** Measuring the sentence similarity via optimal transport on parsing trees recursively.
- [NeurIPS'22] Posterior Collapse of a Linear Latent Variable Model
Zihao Wang, Liu Ziyin
Advances in Neural Information Processing Systems, 2022
TL;DR: **[Selected as oral]** Characterizing posterior collapse of VAE by analytical solutions of linear Bayesian model.
- [VTC'21] TC-MIMONet: A Learning-based Transceiver for MIMO Systems with Temporal Correlations
Chunhui Chen, Zihao Wang, Yuyi Mao, Hao Wu, Bo Bai, Gong Zhang
2021 IEEE 93rd Vehicular Technology Conference (VTC2021-Spring), 2021
TL;DR: A autoencoding framework for temporal encoding.
- [NeurIPS'21] Benchmarking the Combinatorial Generalizability of Complex Query Answering on Knowledge Graphs
Zihao Wang, Hang Yin, Yangqiu Song
Proceedings of the Neural Information Processing Systems Track on Datasets and Benchmarks, 2021
TL;DR: Investigating the combinatorial space of tree-formed complex queries.
- [ICCT'21] Autoencoder-based MIMO Communications with Learnable ADCs
Wenhao Ye, Boxiang Ren, Zihao Wang, Huihui Wu, Hao Wu, Bo Bai, Gong Zhang
2021 IEEE 21st International Conference on Communication Technology (ICCT), 2021
TL;DR: **[Outstanding paper award]** A differentiable framework for ADC design for autoencoder-based MIMO.
- [ACML'20] Robust Document Distance with Wasserstein-Fisher-Rao metric
Zihao Wang, Datong Zhou, Ming Yang, Yong Zhang, Chenglong Rao, Hao Wu
Proceedings of The 12th Asian Conference on Machine Learning, 2020
TL;DR: Wasserstein-Fisher-Rao metric is better for document matching, confirmed again.
- [EMNLP'20] Semi-Supervised Bilingual Lexicon Induction with Two-way Interaction
Xu Zhao, Zihao Wang, Hao Wu, Yong Zhang
Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP), 2020, Online
TL;DR: Bootstrapping procedures to align two distributions with optimal transport
- [ACL'20] A Relaxed Matching Procedure for Unsupervised BLI
Xu Zhao, Zihao Wang, Yong Zhang, Hao Wu
Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics, 2020, Online
TL;DR: Wasserstein-Fisher-Rao metric is robust to noises when align distributions
- [DASFAA'20] Instance Explainable Multi-instance Learning for ROI of Various Data
Xu Zhao, Zihao Wang, Yong Zhang, Chunxiao Xing
Database Systems for Advanced Applications, 2020, Cham
TL;DR: A permutation invariant operator for multi-instance learning.
- [APWeb-WAIM'19] Reducing wrong labels for distant supervision relation extraction with selective capsule network
Zihao Wang, Yong Zhang, Chunxiao Xing
Asia-Pacific Web (APWeb) and Web-Age Information Management (WAIM) Joint International Conference on Web and Big Data, 2019
TL;DR: A capsule network for weak supervision relation extraction.
- [DASFAA'18] Modeling Patient Visit Using Electronic Medical Records for Cost Profile Estimation
Kangzhi Zhao, Yong Zhang, Zihao Wang, Hongzhi Yin, Xiaofang Zhou, Jin Wang, Chunxiao Xing
Database Systems for Advanced Applications, 2018, Cham
TL;DR: A Probabilistic Graphical Model (PGM) for patient cost estimation.

Journal papers

- Automatic analysis of lateral cephalograms based on high-resolution net
Qiao Chang, Zihao Wang, Fan Wang, Jiaheng Dou, Yong Zhang, Yuxing Bai
American Journal of Orthodontics and Dentofacial Orthopedics 163.4 (2023) pp. 501–508. Mosby, 2023
- Fast Sinkhorn I: An $O(N)$ algorithm for the Wasserstein-1 metric
Qichen Liao, Jing Chen, Zihao Wang, Bo Bai, Shi Jin, Hao Wu
Communications in Mathematical Sciences (2022). 2022
- Logical Queries on Knowledge Graphs: Emerging Interface of Incomplete Relational Data

Zihao Wang, Hang Yin, Yangqiu Song

Bulletin of the Technical Committee on Data Engineering 45.4 (2022) pp. 3–18. 2022

In situ laser diagnostics of nanoparticle transport across stagnation plane in a counterflow flame

Yiyang Zhang, Zihao Wang, Xinxin Wu, Libin Sun, Zhengming Zhang, Huiting Zhang, Shuiqing Li

Journal of Aerosol Science 105 (2017) pp. 145–150. Elsevier, 2017

Technical reports

SEAL: Simultaneous Label Hierarchy Exploration And Learning

Zhiquan Tan, Zihao Wang, Yifan Zhang

arxiv: 2304.13374, 2023

EFO_k-CQA: Towards Knowledge Graph Complex Query Answering beyond Set Operation

Hang Yin, Zihao Wang, Weizhi Fei, Yangqiu Song

arxiv: 2307.13701, 2023

Rethinking Existential First Order Queries and their Inference on Knowledge Graphs

Hang Yin, Zihao Wang, Yangqiu Song

arxiv: 2304.07063, 2023

The Double Regularization Method for Capacity Constrained Optimal Transport

Tianhao Wu, Qihao Cheng, Zihao Wang, Chaorui Zhang, Bo Bai, Zhongyi Huang, Hao Wu

arxiv: 2212.00354, 2022

An investigation of how label smoothing affects generalization

Blair Chen, Liu Ziyin, Zihao Wang, Paul Pu Liang

arxiv: 2010.12648, 2020

Volumization as a Natural Generalization of Weight Decay

Liu Ziyin, Zihao Wang, Makoto Yamada, Masahito Ueda

arxiv: 2003.11243, 2020

Internships

Bytedance AI Lab

Beijing, China

Machine Learning Intern

Feb 2021 - Aug 2021

- Design a reinforcement algorithm for event extraction to detect fake news.
- The algorithm has been part of the Chinese fake news detection pipeline in Toutiao

Achievements

2020 **Hong Kong Ph.D Fellowship,**

2020 **Excellent Research Award,**

HKUST

2018 **First Prize,** Bytedance AI Camp

2017 **Second Prize,** China Post-Graduate Mathematical Contest in Modeling

2017 **Excellent Graduate,**

Tsinghua University

2014,2016 **Academic Excellence Award,**

Tsinghua University

2015 **Professional Excellence Award,**

Tsinghua University

2014 **National Scholarship,**

MOE

References available upon request.