

Tong Zhao

Senior Research Scientist · Snap Inc., Bellevue, WA

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Education

University of Notre Dame, Notre Dame, IN

Aug. 2017 - Apr. 2022

PH.D. IN COMPUTER SCIENCE & ENGINEERING (GPA:3.7/4.0) (ADVISOR: PROF. MENG JIANG)

Case Western Reserve University, Cleveland, OH

Aug. 2013 - May 2017

B.A. IN MATHEMATICS (GPA:3.6/4.0)

Professional Experience

Senior Research Scientist

June 2022 - present

SNAP INC.

Bellevue, WA

- I work on user modeling and personalization research with state-of-the-art machine learning paradigms such as graph machine learning, sequence modeling, etc. I also prototype and apply my research on real-world recommendation systems at Snap.

Applied Scientist Intern

June 2021 - Sept. 2021

AMAZON

Palo Alto, CA

- Led a research project on automated graph data augmentation. The work is published at LoG 2022 [C17].

Research Intern

Jan. 2020 - Aug. 2020

SNAP INC.

Santa Monica, CA

- Led a research project on graph data augmentation for graph machine learning. The work is published at AAAI 2021 [C7].
- Co-developed a large scale graph neural network-based system for (un)supervised user representation learning at Snap.

Graduate Teaching Assistant

Aug. 2018 - Dec. 2019

UNIVERSITY OF NOTRE DAME

Notre Dame, IN

- Data Science (Fall 2018, Fall 2019).

Honors & Awards

- 2021 **Amazon Post-Intern Fellowship** Amazon.
- 2020 **Snap Research Fellowship** Snap Inc.
- 2020 **SIGIR Student Travel Grant** the 29th ACM CIKM.
- 2020 **Best Paper Award** DLG-KDD 2020.
- 2019 **Outstanding Teaching Assistant Honorable Mention** University of Notre Dame.

Publications

REFEREED JOURNAL PUBLICATIONS

- [J7] **Tong Zhao**, Wei Jin, Yozen Liu, Yingheng Wang, Gang Liu, Stephan Günnemann, Neil Shah, and Meng Jiang. "Graph Data Augmentation for Graph Machine Learning: A Survey." IEEE Data Engineering Bulletin (**DEBULL**), 2023.
- [J6] Daheng Wang, **Tong Zhao**, Wenhao Yu, Nitesh Chawla, and Meng Jiang. "Deep Multimodal Complementarity Learning." IEEE Transactions on Neural Networks and Learning Systems (**TNNLS**), 2022.
- [J5] Yihao Hu, **Tong Zhao**, Shixin Xu, Zhiliang Xu, and Lizhen Lin. "Neural-PDE: A RNN based Neural Network for Solving Time Dependent PDEs." Communications in Information and Systems (**CIS**), 2022.
- [J4] Meng Jiang, Taeho Jung, Ryan Karl, and **Tong Zhao**. "Federated Dynamic Graph Neural Networks with Secure Aggregation for Video-based Distributed Surveillance." ACM Transactions on Intelligent Systems and Technology (**TIST**), 2021.
- [J3] **Tong Zhao**, Tianwen Jiang, Neil Shah, and Meng Jiang. "A Synergistic Approach for Graph Anomaly Detection with Pattern Mining and Feature Learning." IEEE Transactions on Neural Networks and Learning Systems (**TNNLS**), 2021.

- [J2] Daheng Wang, Zhihan Zhang, Yihong Ma, **Tong Zhao**, Tianwen Jiang, Nitesh V. Chawla, and Meng Jiang. “Modeling Co-evolution of Attributed and Structural Information in Graph Sequence.” *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 2021.
- [J1] Tianwen Jiang, Qingkai Zeng, **Tong Zhao**, Bing Qin, Ting Liu, Nitesh Chawla, and Meng Jiang. “Biomedical Knowledge Graphs Construction from Conditional Statements.” *IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB)*, 2020.

REFEREED CONFERENCE PUBLICATIONS

- [C38] Jing Zhu, Yuhang Zhou, Shengyi Qian, Zhongmou He, **Tong Zhao**, Neil Shah, and Danai Koutra. “Mosaic of Modalities: A Comprehensive Benchmark for Multimodal Graph Learning.” In *Conference on Computer Vision and Pattern Recognition (CVPR)*. 2025.
- [C37] Xinyi Wu, Donald Loveland, Runjin Chen, Yozen Liu, Xin Chen, Leonardo Neves, Ali Jadbabaie, Mingxuan Ju, Neil Shah, and **Tong Zhao**. “GraphHash: Graph Clustering Enables Parameter Efficiency in Recommender Systems.” In *International World Wide Web Conference (WWW)*. 2025.
- [C36] Donald Loveland, Xinyi Wu, **Tong Zhao**, Danai Koutra, Neil Shah, and Mingxuan Ju. “Understanding and Scaling Collaborative Filtering Optimization from the Perspective of Matrix Rank.” In *International World Wide Web Conference (WWW)*. 2025.
- [C35] Jingzhe Liu, Haitao Mao, Zhikai Chen, **Tong Zhao**, Neil Shah, and Jiliang Tang. “Towards Neural Scaling Laws on Graphs.” In *Learning on Graphs Conference (LoG)*. 2024.
- [C34] Mingxuan Ju, William Shiao, Zhichun Guo, Yanfang Ye, Yozen Liu, Neil Shah, and **Tong Zhao**. “How Does Message Passing Improve Collaborative Filtering?” In *Conference on Neural Information Processing Systems (NeurIPS)*. 2024.
- [C33] Pau Kung, Zihao Fan, **Tong Zhao**, Yozen Liu, Lucas Lai, Jiahui Shi, Yan Wu, Jun Yu, Neil Shah, and Ganesh Venkataraman. “Improving Embedding-Based Retrieval in Friend Recommendation with ANN Query Expansion.” In *SIGIR Symposium on IR in Practice (SIRIP)*. 2024.
- [C32] Runjin Chen, **Tong Zhao**, Ajay Jaiswal, Neil Shah, and Zhangyang Wang. “LLaGA: Large Language and Graph Assistant.” In *International Conference on Machine Learning (ICML)*. 2024.
- [C31] Haitao Mao, Zhikai Chen, Wenzhuo Tang, Jianan Zhao, Yao Ma, **Tong Zhao**, Neil Shah, Michael Galkin, and Jiliang Tang. “Graph Foundational Models.” In *International Conference on Machine Learning (ICML)*. 2024.
- [C30] **Tong Zhao**, Neil Shah, and Elham Ghazizadeh. “Learning From Graphs Beyond Message Passing.” In *International Conference on Learning Representations, Tiny Paper Track (ICLR)*. 2024.
- [C29] Haitao Mao, Juanhui Li, Harry Shomer, Bingheng Li, Wenqi Fan, Yao Ma, **Tong Zhao**, Neil Shah, and Jiliang Tang. “Revisiting Link Prediction: a Data Perspective.” In *International Conference on Learning Representations (ICLR)*. 2024.
- [C28] Yu Wang, **Tong Zhao**, Yuying Zhao, Yunchao Liu, Xueqi Cheng, Neil Shah, and Tyler Derr. “A Topological Perspective on Demystifying GNN-based Link Prediction Performance.” In *International Conference on Learning Representations (ICLR)*. 2024.
- [C27] Mingxuan Ju, **Tong Zhao**, Wenhao Yu, Neil Shah, and Yanfang Ye. “GraphPatcher: Mitigating Degree Bias for Graph Neural Networks via Test-time Augmentation.” In *Conference on Neural Information Processing Systems (NeurIPS)*. 2023.
- [C26] Gang Liu, Eric Inae, **Tong Zhao**, Jiaxin Xu, Tengfei Luo, and Meng Jiang. “Data-Centric Learning from Unlabeled Graphs with Diffusion Model.” In *Conference on Neural Information Processing Systems (NeurIPS)*. 2023.
- [C25] Haitao Mao, Zhikai Chen, Wei Jin, Haoyu Han, Yao Ma, **Tong Zhao**, Neil Shah, and Jiliang Tang. “Demystifying Structural Disparity in Graph Neural Networks: Can One Size Fit All?” In *Conference on Neural Information Processing Systems (NeurIPS)*. 2023.
- [C24] Gang Liu, **Tong Zhao**, Eric Inae, Tengfei Luo, and Meng Jiang. “Semi-supervised Graph Imbalanced Regression.” In *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD)*. 2023.
- [C23] William Shiao, Uday Singh Saini, Yozen Liu, **Tong Zhao**, Neil Shah, and Evangelos E Papalexakis. “CARL-G: Clustering-Accelerated Representation Learning on Graphs.” In *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD)*. 2023.
- [C22] Zhichun Guo, William Shiao, Shichang Zhang, Yozen Liu, Nitesh Chawla, Neil Shah, and **Tong Zhao**. “Linkless Link Prediction via Relational Distillation.” In *International Conference on Machine Learning (ICML)*. 2023.
- [C21] Wei Jin, **Tong Zhao**, Jiayuan Ding, Yozen Liu, Jiliang Tang, and Neil Shah. “Empowering Graph Representation Learning with Test-Time Graph Transformation.” In *International Conference on Learning Representations (ICLR)*. 2023.
- [C20] Xiaotian Han, **Tong Zhao**, Yozen Liu, Xia Hu, and Neil Shah. “MLPinit: Embarrassingly Simple GNN Training Acceleration with MLP Initialization.” In *International Conference on Learning Representations (ICLR)*. 2023.
- [C19] Mingxuan Ju, **Tong Zhao**, Qianlong Wen, Wenhao Yu, Neil Shah, Yanfang Ye, and Chuxu Zhang. “Multi-task Self-supervised Graph Neural Networks Enable Stronger Task Generalization.” In *International Conference on Learning Representations (ICLR)*. 2023.

- [C18] William Shiao, Zhichun Guo, **Tong Zhao**, Evangelos E Papalexakis, Yozen Liu, and Neil Shah. “Link Prediction with Non-Contrastive Learning.” In International Conference on Learning Representations (**ICLR**). 2023
- [C17] **Tong Zhao**, Xianfeng Tang, Danqing Zhang, Haoming Jiang, Nikhil Rao, Yiwei Song, Pallav Agrawal, Karthik Subbian, Bing Yin, and Meng Jiang. “AutoGDA: Automated Graph Data Augmentation for Node Classification.” In Learning on Graphs Conference (**LoG**). 2022.
- [C16] Yiwei Wang, Bryan Hooi, Yozen Liu, **Tong Zhao**, Zhichun Guo, and Neil Shah. “Flashlight: Scalable Link Prediction with Effective Decoders.” In Learning on Graphs Conference (**LoG**). 2022.
- [C15] Mingxuan Ju, Wenhao Yu, **Tong Zhao**, Chuxu Zhang, and Yanfang Ye. “Grape: Knowledge Graph Enhanced Passage Reader for Open-domain Question Answering.” In Findings of Empirical Methods in Natural Language Processing (**EMNLP**). 2022.
- [C14] Gang Liu, **Tong Zhao**, Jiaxin Xu, Tengfei Luo, and Meng Jiang. “Graph Rationalization with Environment-based Augmentations.” In ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (**KDD**). 2022.
- [C13] **Tong Zhao**, Gang Liu, Daheng Wang, Wenhao Yu, and Meng Jiang. “Learning from Counterfactual Links for Link Prediction.” In International Conference on Machine Learning (**ICML**). 2022.
- [C12] Wenhao Yu, Chengguang Zhu, Lianhui Qin, Zhihan Zhang, **Tong Zhao**, and Meng Jiang. “Diversifying Content Generation for Commonsense Reasoning with Mixture of Knowledge Graph Experts.” In Findings of Annual Meeting of the Association for Computational Linguistics (**ACL**). 2022.
- [C11] Daheng Wang, **Tong Zhao**, Nitesh Chawla, and Meng Jiang. “Dynamic Attributed Graph Prediction with Conditional Normalizing Flows.” In IEEE International Conference on Data Mining (**ICDM**). 2021.
- [C10] Wenhao Yu, Chengguang Zhu, **Tong Zhao**, Zhichun Guo, and Meng Jiang. “Sentence-Permuted Paragraph Generation.” In the Conference on Empirical Methods in Natural Language Processing (**EMNLP**). 2021.
- [C9] **Tong Zhao***, Bo Ni*, Wenhao Yu, Zhichun Guo, Neil Shah, and Meng Jiang. “Action Sequence Augmentation for Early Graph-based Anomaly Detection.” In ACM International Conference on Information and Knowledge Management (**CIKM**). 2021.
- [C8] Yao Ma, Xiaorui Liu, **Tong Zhao**, Yozen Liu, Jiliang Tang, and Neil Shah. “A Unified View on Graph Neural Networks as Graph Signal Denoising.” In ACM International Conference on Information and Knowledge Management (**CIKM**). 2021.
- [C7] **Tong Zhao**, Yozen Liu, Leonardo Neves, Oliver Woodford, Meng Jiang, and Neil Shah. “Data Augmentation for Graph Neural Networks.” In AAAI Conference on Artificial Intelligence (**AAAI**). 2021.
- [C6] **Tong Zhao**, Chuchen Deng, Kaifeng Yu, Tianwen Jiang, Daheng Wang, and Meng Jiang. “Error-bounded Graph Anomaly Loss for GNNs.” In ACM International Conference on Information and Knowledge Management (**CIKM**). 2020.
- [C5] Wenhao Yu, Mengxia Yu, **Tong Zhao**, and Meng Jiang. “Identifying Referential Intention with Heterogeneous Contexts.” In International World Wide Web Conference (**WWW**). 2020.
- [C4] Tianwen Jiang, Zhihan Zhang, **Tong Zhao**, Bing Qin, Ting Liu, Nitesh V. Chawla, and Meng Jiang. “CTGA: Graph-based Biomedical Literature Search.” In IEEE International Conference on Bioinformatics and Biomedicine (**BIBM**). 2019.
- [C3] Tianwen Jiang, **Tong Zhao**, Bing Qin, Ting Liu, Nitesh V. Chawla, and Meng Jiang. “Multi-input Multi-output Sequence Labeling for Joint Extraction of Fact and Condition Tuples from Scientific Text.” In the Conference on Empirical Methods in Natural Language Processing (**EMNLP**). 2019.
- [C2] Tianwen Jiang, **Tong Zhao**, Bing Qin, Ting Liu, Nitesh V. Chawla, and Meng Jiang. “The Role of ‘Condition’: A Novel Scientific Knowledge Graph Representation and Construction Model.” In ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (**KDD**). 2019.
- [C1] **Tong Zhao**, Matthew Malir, and Meng Jiang. “Actionable Objective Optimization for Suspicious Behavior Detection on Large Bipartite Graphs.” In IEEE International Conference on Big Data (**BigData**). 2018.

REFEREED WORKSHOP PUBLICATIONS

- [W11] William Shiao, Mingxuan Ju, Zhichun Guo, Xin Chen, Evangelos Papalexakis, **Tong Zhao**, Neil Shah, and Yozen Liu. “Improving Out-of-Vocabulary Handling in Recommendation Systems.” In REL workshop at International World Wide Web Conference (WWW). 2024.
- [W10] Matthew Kolodner, Mingxuan Ju, Zihao Fan, **Tong Zhao**, Elham Ghazizadeh, Yan Wu, Neil Shah, and Yozen Liu. “Robust Training Objectives Improve Embedding-based Retrieval in Industrial Recommendation Systems.” In RobustRecSys Workshop at ACM Conference on Recommender Systems (RecSys). 2024.

- [W9] Pau Kung, Zihao Fan, **Tong Zhao**, Yozen Liu, Lucas Lai, Jiahui Shi, Yan Wu, Neil Shah, and Jun Yu. “Improving Embedding-Based Retrieval in Friend Recommendation with ANN Query Expansion.” In DCAI Workshop at International World Wide Web Conference (WWW). 2024.
- [W8] Mingxuan Ju, **Tong Zhao**, Wenhao Yu, Neil Shah, and Yanfang Ye. “GraphPatcher: Mitigating Degree Bias for Graph Neural Networks via Test-time Augmentation.” In DCAI Workshop at International World Wide Web Conference (WWW). 2024.
- [W7] Gang Liu, **Tong Zhao**, Eric Inae, Tengfei Luo, and Meng Jiang. “Semi-supervised Graph Imbalanced Regression.” In GLFrontiers Workshop at Conference on Neural Information Processing Systems (NeurIPS). 2023.
- [W6] Songtao Liu, Shixiong Jing, **Tong Zhao**, Zengfeng Huang, and Dinghao Wu. “Enhancing Multi-hop Connectivity for Graph Convolutional Networks.” In Workshop on Pre-training at International Conference on Machine Learning (ICML). 2022.
- [W5] **Tong Zhao**, Chuchen Deng, Kaifeng Yu, Tianwen Jiang, Daheng Wang, and Meng Jiang. “GNN-based Graph Anomaly Detection with Graph Anomaly Loss.” In DLG-KDD Workshop at ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD). 2020.
- [W4] **Tong Zhao***, Bo Ni*, Wenhao Yu, and Meng Jiang. “Early Fraud Detection with Augmented Graph Learning.” In DLG-KDD Workshop at ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD). 2020.
- [W3] Daheng Wang, Zhihan Zhang, Yihong Ma, **Tong Zhao**, Tianwen Jiang, Nitesh V. Chawla, and Meng Jiang. “Learning Attribute-Structure Co-Evolutions in Dynamic Graphs.” In DLG-KDD Workshop at ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD). 2020. (**Best Paper Award**)
- [W2] Yang Zhou, **Tong Zhao**, and Meng Jiang. “A Probabilistic Model with Commonsense Constraints for Pattern-based Temporal Fact Extraction.” In FEVER Workshop at Annual Meeting of the Association for Computational Linguistics (ACL), 2020.
- [W1] Tianwen Jiang, **Tong Zhao**, Bing Qin, Ting Liu, Nitesh V. Chawla, and Meng Jiang. “Constructing Information-Lossless Biological Knowledge Graphs from Conditional Statements.” In BioKDD Workshop at ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD). 2019.

REFEREED CONFERENCE TUTORIALS

- [T5] Yu Wang, Yijun Tian, **Tong Zhao**, Xiaorui Liu, Jian Kang, and Tyler Derr. “Data Quality-Aware Graph Machine Learning” In the SIAM International Conference on Data Mining (**SDM**). 2024.
- [T4] Rui Xue, Haoyu Han, **Tong Zhao**, Neil Shah, Jiliang Tang, and Xiaorui Liu. “Large-scale Graph Neural Networks: the Past and New Frontiers” In SIAM International Conference on Data Mining (**SDM**). 2024.
- [T3] Rui Xue, Haoyu Han, **Tong Zhao**, Neil Shah, Jiliang Tang, and Xiaorui Liu. “Large-scale Graph Neural Networks: the Past and New Frontiers” In AAAI Conference on Artificial Intelligence (**AAAI**). 2024.
- [T2] Rui Xue, Haoyu Han, **Tong Zhao**, Neil Shah, Jiliang Tang, and Xiaorui Liu. “Large-scale Graph Neural Networks: the Past and New Frontiers” In ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (**KDD**). 2023.
- [T1] **Tong Zhao**, Kaize Ding, Wei Jin, Gang Liu, Meng Jiang, and Neil Shah. “Augmentation Methods for Graph Learning.” In the SIAM International Conference on Data Mining (**SDM**). 2023.

Academic Experience

INVITED TALKS

- 2024 Invited speaker for department seminar at MSU.
- 2024 Keynote for Data-centric AI (DCAI) workshop at TheWebConf.
- 2022 Keynote for Machine Learning on Graphs (MLOG) workshop at ICDM.
- 2022 Panelist for Misinformation and Misbehavior (Mis2-TrueFact) workshop at KDD.
- 2022 Keynote for Misinformation and Misbehavior (Mis2-TrueFact) workshop at KDD.
- 2022 Invited speaker at DGL user group.
- 2022 Invited speaker at shenlanxueyuan.com.
- 2021 Invited speaker for A9 (Amazon Search & Ads) ML research talk.

SERVICE

ORGANIZATION

Organizer for Machine Learning on Graphs (MLOG) Workshop at WSDM, 2024.
Organizer for Machine Learning on Graphs (MLOG) Workshop at ICDM, 2023.
Proceeding Chair for Machine Learning on Graphs Workshop (MLOG) at WSDM, 2022.
Session Chair for “Recommendation Systems” session at KDD, 2022.
Session Chair for “Graphs and Networks” session at ECML-PKDD, 2021.

CONFERENCE PROGRAM COMMITTEE / REVIEWER

International Conference on Machine Learning (ICML): 2022-2025
International Conference on Learning Representations (ICLR): 2022-2025
Conference on Neural Information Processing Systems (NeurIPS): 2020-2024
ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD): 2020-2025
AAAI Conference on Artificial Intelligence (AAAI): 2021-2024
ACM International Conference on Knowledge Management (CIKM): PC 2021, 2022, SPC: 2024
The Web Conference (TheWebConf/WWW): 2021, 2022, 2024, 2025
International Conference on Web Search and Data Mining (WSDM): 2021-2024
International Joint Conference on Artificial Intelligence (IJCAI): 2021-2024
SIAM Conference on Data Mining (SDM): 2022-2025
Learning on Graphs Conference (LoG): 2022
Conference on Language Modeling (COLM): 2024, 2025
European Conf. on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD): 2021, 2022
Association for Computational Linguistics (ACL) Rolling Review: 2023, 2024

JOURNAL REVIEWER

IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
IEEE Transactions on Knowledge and Data Engineering (TKDE)
IEEE Transactions on Big Data (TBD)
Transactions on Machine Learning Research (TMLR)
ACM Transactions on Knowledge Discovery from Data (TKDD)
Pattern Recognition (PR)
Neurocomputing (NEUCOM)
Knowledge-Based Systems (KNOSYS)
Digital Signal Processing (DSP)
Data Mining and Knowledge Discovery (DAMI)
Frontiers in Big Data

MENTORSHIP

Ms. Xinyi Wu (Research Intern at Snap Inc., 2024)
Mr. Ngoc Bui (Research Intern at Snap Inc., 2024)
Ms. Runjin Chen (PhD student at University of Texas at Austin, 2023-2024; Research Intern at Snap Inc., 2024)
Ms. Jing Zhu (PhD student at University of Michigan, 2023-2024; Research Intern at Snap Inc., 2024-2025)
Mr. Haitao Mao (PhD student at Michigan State University, 2023-2024; Research Intern at Snap Inc., 2024)
Mr. Vijay Prakash Dwivedi (Research Intern at Snap Inc., 2023)
Mr. Yushun Dong (Research Intern at Snap Inc., 2023)
Ms. Yunshu Wu (PhD student at University of California Riverside, 2022-2023)
Mr. William Shiao (Research Intern at Snap Inc., 2022-2023)

Ms. Zhichun Guo (PhD student at University of Notre Dame, 2022-2023; Research Intern at Snap Inc., 2022-2023)
Mr. Mingxuan Ju (PhD student at University of Notre Dame, 2022-2023; Research Intern at Snap Inc., 2023)
Mr. Gang Liu (PhD student at University of Notre Dame, 2021-2023)
Mr. Wei Jin (Research Intern at Snap Inc., 2022)
Mr. Xiaotian Han (Research Intern at Snap Inc., 2022)
Mr. Bo Ni (undergraduate student at University of Notre Dame, 2020)
Mr. Chuchen Deng (visiting undergraduate student at University of Notre Dame, 2019)
Ms. Kaifeng Yu (visiting undergraduate student at University of Notre Dame, 2019)

TEACHING

Guest Lecture on CS570 Data Mining at Emory University (2023)
Teaching Assistant for Data Science at University of Notre Dame, by Prof. Meng Jiang (2018, 2019)