

Cheng Xin

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Bio: Cheng Xin is a postdoctoral researcher, advised by Dr. Jie Gao, in the computer science department at Rutgers University, with publications in top-tier AI and computational geometry conferences including **NeurIPS, ICML, CVPR, SOCG**. His research focuses on the intersection of **computational topology, geometry, machine learning, and artificial intelligence**. Dr. Xin earned his Ph.D. in Computer Science from Purdue University, advised by Dr. Tamal Dey, where his doctoral research centered on **topological data analysis and graph representations learning**. His work explores innovative approaches to data representation and analysis, seeking to uncover hidden patterns and structures in complex datasets. His recent projects include developing topological frameworks for **interpretable AI**, advancing **AI for Science** through **generative AI** techniques, and contributing to the DL3DV benchmark for **3D/video generation**. Through his research, Dr. Xin develops novel mathematical frameworks and algorithms that leverage the power of topology and geometry to enhance machine learning and AI models. By bridging the gap between theoretical foundations and practical applications, he delivers robust and reliable AI solutions that both address real-world challenges and drive business impact across scientific domains and industry applications.

EDUCATION

Purdue University, West Lafayette, Indiana, USA

- Ph.D. in Computer Science Aug 2020 – Aug 2023
 - Adviser: Prof. Tamal K. Dey
 - Focus: Topological data analysis, Graph representation learning
 - Thesis: Decomposition and Stability of Multiparameter Persistence Modules

The Ohio State University, Columbus, Ohio, USA

- Ph.D. in Computer Science Aug 2016 – Aug 2020
 - Adviser: Prof. Tamal K. Dey
 - Focus: Computational topology, Topological data analysis

Lehigh University, Bethlehem, Pennsylvania, USA

- M.S. in Computer Science Jan 2014 – May 2016
 - Advisor: Prof. Xiaolei Huang
 - Thesis: Machine Learning Techniques for Cervigram Image Analysis

Tongji University, Shanghai, China

- B.Eng. in Software Engineering Sep 2009 – Jul 2013

PROFESSIONAL EXPERIENCE

Department of Computer Science, Rutgers University

- Postdoctoral Researcher, Advisor: Prof. Jie Gao Oct 2023 – Present
- Topics: **Graph Learning**, Topological Data Analysis, Non-Euclidean Geometry Representation, **3D/Video Generation**, **Vision Language Model**, AI4Science

Department of Computer Science, Purdue University

- Research Assistant, Advisor: Prof. Tamal K. Dey Aug 2020 – Aug 2023
- Teaching Assistant: Computational Geometry, Data Structures and Algorithms

Department of Computer Science and Engineering, The Ohio State University

- Research Assistant, Advisor: Prof. Tamal K. Dey Jan 2017 – May 2020

TEACHING EXPERIENCE

- Teaching Assistant of undergraduate course, Data Structures and Algorithms, 2023 spring (200 students)
- Teaching Assistant of graduate course, Computational Geometry, 2020 fall (30 students)

INDUSTRIAL EXPERIENCE

Machine Learning Scientist Intern, Big data group

- Electronic Arts, Redwood City, CA, USA May 2018 – Aug 2018
 - **Large-scale Machine Learning** Models on **Spark**
 - **Graph Learning** on relational database, attributes evaluation and selection, dataset compress.

Software Development Engineer Intern, AWS infrastructure group

- Amazon, Seattle, Washington, USA May 2015 – Aug 2015
 - **Data management system** of network messages which supports receiving, parsing, storing, and retrieving messages.

Develop Engineer, Platform group

- Koal, Shanghai, China Jul 2013 – Dec 2013
 - **Fullstack Engineer**: designed and implemented **back-end** database, business logic, interfaces, **front-end UI** ;
 - **Natural Language Process** (Chinese and English),

Developer Support Intern, Database business intelligence group

- Microsoft, Shanghai, China
 - Trouble shooting cases of SQL server problems.

Jul 2012 – Nov 2012

SKILLS

- Python, Pytorch, Keras, Spark, Java, C, C++, MATLAB, R

HONERS AND REWARDS

- The first place winner of 2017 Microsoft's college code competition at the Ohio State University
- The first place winner of 2015 Microsoft's college code competition at Lehigh University
- Third Prize of 2013 Tongji coding competition
- Third Prize Scholarship of Tongji University

PUBLICATIONS

- [1] **Cheng Xin**, Fan Xu, Xin Ding, Jie Gao, and Jiaxin Ding. *TopInG: Topologically Interpretable Graph Learning via Persistent Rationale Filtration (to appear in the 42nd International Conference on Machine Learning ICML)*. 2025.
- [2] Chengyuan Deng, Jie Gao, Kevin Lu, Feng Luo, Hongbin Sun, and **Cheng Xin**[†]. "Neuc-MDS: Non-Euclidean Multidimensional Scaling Through Bilinear Forms". In: *Advances in Neural Information Processing Systems (NeurIPS)*. Vol. 37. 2024, pp. 121539–121569. **(Main contributions: problem define, theoretical framework and main theorem proofs, and main paper writing)**.
- [3] Shahrzad Haddadan, **Cheng Xin**, and Jie Gao. "Optimally Improving Cooperative Learning in a Social Setting". In: *Proceedings of the 41st International Conference on Machine Learning (ICML)*. Vol. 235. Proceedings of Machine Learning Research. PMLR, 21–27 Jul 2024, pp. 17148–17188.
- [4] Lu Ling, Yichen Sheng, Zhi Tu, Wentian Zhao, **Cheng Xin**, Kun Wan, Lantao Yu, Qianyu Guo, Zixun Yu, Yawen Lu, et al. "DI3dv-10k: A large-scale scene dataset for deep learning-based 3d vision". In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2024, pp. 22160–22169.
- [5] Simon Zhang, **Cheng Xin**, and Tamal K. Dey. "Expressive Higher-Order Link Prediction through Hypergraph Symmetry Breaking". In: *Transactions on Machine Learning Research* (2024). ISSN: 2835-8856.
- [7] **Cheng Xin**, Soham Mukherjee, Shreyas N. Samaga, and Tamal K. Dey. "GRIL: A 2-parameter Persistence Based Vectorization for Machine Learning". In: vol. 221. Proceedings of Machine Learning Research. PMLR, 28 Jul 2023, pp. 313–333.
- [8] Tamal K. Dey and **Cheng Xin**[†]. "Generalized persistence algorithm for decomposing multiparameter persistence modules". In: *Journal of Applied and Computational Topology* 6.3 (Sept. 2022), pp. 271–322. ISSN: 2367-1734. DOI: 10.1007/s41468-022-00087-5. **(Main contributions: algorithm design, theoretical framework and most theorem proofs, and most of the paper writing)**.
- [10] Tamal K. Dey and **Cheng Xin**[†]. "Computing Bottleneck Distance for 2-D Interval Decomposable Modules". In: *34th International Symposium on Computational Geometry (SoCG)*. Vol. 99. Leibniz International Proceedings in Informatics (LIPIcs). 2018, 32:1–32:15. **(Main contributions: algorithms design, theoretical framework and main theorem proofs, and most of the paper writing)**.
- [11] Tao Xu, Han Zhang, **Cheng Xin**, Edward Kim, L Rodney Long, Zhiyun Xue, Sameer Antani, and Xiaolei Huang. "Multi-feature based benchmark for cervical dysplasia classification evaluation". In: *Pattern recognition* 63 (2017), pp. 468–475.
- [12] Tao Xu, **Cheng Xin**^{*}, L. Rodney Long, Sameer Antani, Zhiyun Xue, Edward Kim, and Xiaolei Huang. "A New Image Data Set and Benchmark for Cervical Dysplasia Classification Evaluation". In: *Machine Learning in Medical Imaging*. Cham: Springer International Publishing, 2015, pp. 26–35. ISBN: 978-3-319-24888-2.

[†] indicates authors are alphabetically ordered; * represents co-first author.

TALKS

- Understanding through Shape of Data: Topological Data Analysis for Interpretable AI, MSIS Seminar, Rutgers University, Oct. 2024
- Exploring Representations Beyond Euclidean Geometry, JHC Seminar, Shanghai Jiao Tong University, June 2024
- Generalized persistence algorithm for decomposing multi-parameter persistence modules, Applied Algebraic Topology Network Seminar, July 2020

INTERESTS

- Climbing, Hiking, GO

REFERENCES

- **Dr. Jie Gao**
Professor of Computer Science Department, Rutgers University
email: jg1555@cs.rutgers.edu
- **Dr. Tamal K. Dey**
Professor of Computer Science Department, Purdue University
email: tamaldey@purdue.edu
- **Dr. Feng Luo**
Professor of Department of Mathematics, Rutgers University
email: fluo@math.rutgers.edu

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