Binghong Chen

Contact Information

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Research Interests

My research primarily focuses on developing deep learning models and methodologies for a wide spectrum of problems with discrete structures such as code optimization, drug design, retrosynthesis for molecules/polymers, SAT/SMT solving, theorem proving, neural symbolic reasoning, and path planning. My other interests include pre-training methods on text and graph data, such as BERT and contrastive learning.

Education

Georgia Institute of Technology, College of Computing, Atlanta, US *08/2017 - present*

Ph.D. Candidate, Machine Learning
Advisor : Le Song / Chao Zhang
GPA : 4.0/4.0

Tsinghua University, Department of Computer Science, Beijing, China *08/2013 - 06/2017*

B.Eng., Computer Science
Second degree in Economics
GPA : 93/100, Rank : 3/127

Work Experience

Applied Scientist Intern / Amazon *05/2022 - 08/2022*

- Worked with Bunyamin Sisman and George Trimponias in Search M5 team.
- Developed a dataset distillation method for large-scale BERT pre-training.

Research Intern / Google *01/2022 - 04/2022*

- Worked with Milad Hashemi and Kevin Swersky.
- Proposed a program edit dataset based on Google Code Jam submissions.
- Developed a model to generate diverse program edits that improve the efficiency of the given programs.

Machine Learning Research Intern / JPMorgan Chase *09/2021 - 12/2021*

- A member of the London Machine Learning Centre, advised by Chak Wong.
- Developed neural Hawkes process models for limit order book in Tensorflow.

Research Intern / Google *05/2021 - 08/2021*

- Worked with Milad Hashemi, Kevin Swersky, and Danny Tarlow.
- Implemented Transformers and discrete VAEs in Jax for program runtime prediction and code optimization.

Research Assistant / Georgia Institute of Technology *08/2017 - present*

- A member of Machine Learning Group, co-advised by Le Song and Chao Zhang.
- Developed deep learning guided search algorithms with novel neural networks in PyTorch for drug design, retrosynthesis, path planning, and theorem proving.

Research Intern / Carnegie Mellon University *07/2016 - 09/2016*

- Worked in SAILING lab, advised by Prof. Eric P. Xing.
- Applied diversity-promoting regularizations to Deep Distance Metric Learning.

Undergraduate Research Assistant / Tsinghua University *09/2014 - 06/2017*

- Worked in Tsinghua SAIL Group, advised by Prof. Jun Zhu.
- Developed a distributed algorithm for Group-Lasso with theoretical guarantees.

Conference & Journal

Deep learning driven biosynthetic pathways navigation for natural products with BioNavi-NP
Shuangjia Zheng, Tao Zeng, Chengtao Li, Binghong Chen, Connor W. Coley, Yuedong Yang, Ruibo Wu
Nature Communications 2022
[paper]

Spanning Tree-based Graph Generation for Molecules
Sungsoo Ahn, Binghong Chen, Tianzhe Wang, Le Song
International Conference on Learning Representations (ICLR) 2022, ***spotlight***
[paper]

ProTo : Program-Guided Transformer for Program-Guided Tasks
Zelin Zhao, Karan Samel, Binghong Chen, Le Song
Conference on Neural Information Processing Systems (NeurIPS) 2021
[paper]

Scallop : From Probabilistic Deductive Databases to Scalable Differentiable Reasoning
Jiani Huang, Ziyang Li, Binghong Chen, Karan Samel, Xujie Si, Le Song, Mayur Naik
Conference on Neural Information Processing Systems (NeurIPS) 2021
[paper]

ARBITRAR : User-Guided API Misuse Detection
Ziyang Li, Aravind Machiry, Binghong Chen, Ke Wang, Mayur Naik, Le Song
IEEE Symposium on Security and Privacy (IEEE S&P) 2021
[paper]

Molecule Optimization by Explainable Evolution
Binghong Chen, Tianzhe Wang, Chengtao Li, Hanjun Dai, Le Song
International Conference on Learning Representations (ICLR) 2021
[paper|slide|talk|code]

Speeding up Computational Morphogenesis with Online Neural Synthetic Gradients
Yuyu Zhang, Heng Chi, Binghong Chen, Tsz Ling Elaine T., Lucia M., Le Song, Glaucio H. P.
International Joint Conference on Neural Networks (IJCNN) 2021
[paper]

Retro* : Learning Retrosynthetic Planning with Neural Guided A* Search
Binghong Chen, Chengtao Li, Hanjun Dai, Le Song
International Conference on Machine Learning (ICML) 2020
[paper|slide|talk|code]

Learning to Plan in High Dimensions via Neural Exploration-Exploitation Trees
Binghong Chen, Bo Dai, Qinjie Lin, Guo Ye, Han Liu, Le Song
International Conference on Learning Representations (ICLR) 2020, ***spotlight***
[paper|slide|talk|code]

GLAD : Learning Sparse Graph Recovery
Harsh Shrivastava, Xinshi Chen, Binghong Chen, Guanghui Lan, Srinivas Aluru, Le Song
International Conference on Learning Representations (ICLR) 2020
[paper]

Preprint

Learning to Improve Code Efficiency
Binghong Chen, Daniel Tarlow, Kevin Swersky, Martin Maas, Pablo Heiber, Ashish Naik, Milad Hashemi, Parthasarathy Ranganathan
[paper]

PolyRetro : Few-shot Polymer Retrosynthesis via Domain Adaptation
Binghong Chen, Chengtao Li, Hanjun Dai, Rampi Ramprasad, Le Song

Learning Temporal Rules from Noisy Timeseries Data
Karan Samel, Zelin Zhao, Binghong Chen, Shuang Li, Dharmashankar Subramanian, Irfan Essa, Le Song
[paper]

Workshop

Graph Contrastive Pre-training for Effective Theorem Reasoning
Zhaoyu Li, Binghong Chen, Xujie Si
Self-Supervised Learning for Reasoning and Perception Workshop (ICML) 2021, ***contributed talk***
[paper|poster]

Learning Retrosynthetic Planning with Chemical Reasoning
Binghong Chen, Chengtao Li, Hanjun Dai, Le Song
Bridge Between Perception and Reasoning : GNN & Beyond Workshop (ICML) 2020, ***spotlight***

Professional Service

Program Committee/Reviewer
NeurIPS, ICML, ICLR, AISTATS, IJCAI, AAAI, SIGKDD, Nature Machine Intelligence

Organizer of Machine Learning Reading Group
Main organizer of a weekly machine learning reading group at Georgia Tech in 2020-2021.

Teaching Experience

Graduate Teaching Assistant
CX 4240 Computational Data Analysis, Georgia Institute of Technology *Spring 2022*

Graduate Teaching Assistant
CSE/ISYE 6740 Computational Data Analysis, Georgia Institute of Technology *Fall 2019*

Courses

Computational Data Analytics, Computer Vision, Data and Visual Analytics, Graphical Models in Machine Learning, Machine Learning Theory, Math Foundation in Machine Learning, Natural Language Processing, Nonlinear Optimization, Numerical Linear Algebra, Reinforcement Learning Theory, Statistical Estimation, Machine Learning in Computational Biology.

Awards

Outstanding Graduate, Tsinghua University *06/2017*
National Scholarship (<2%), Ministry of Education of China *11/2016*
Scholarship of Academic Excellence, Tsinghua University *11/2015, 11/2014*
Silver Medal (<0.02%), China Mathematics Olympiad *01/2013*

Professional Outreach

Google Research
- Collaborated with Dr. Milad Hashemi, Dr. Kevin Swersky, and Dr. Danny Tarlow on learning for code.
- Collaborated with Dr. Hanjun Dai on learning retrosynthesis planning and drug design.
- Collaborated with Dr. Bo Dai on learning to plan for path planning.

Amazon Search Science & AI
- Collaborated with Dr. Bunyamin Sisman, and Dr. George Trimponias, on BERT pre-training.

Galixir (AI + Pharma Company)
- Collaborated with Dr. Chengtao Li on learning retrosynthesis planning and drug design.

Prof. Le Song's Research Group at MBZUAI
- Collaborating with Dr. Sungsoo Ahn on molecule generative modelling and optimization.

Prof. Mayur Naik's Research Group at UPenn
- Collaborating with Jiani Huang on common sense neural symbolic reasoning.
- Collaborating with Ziyang Li on acitive learning for API misuse detection.

Prof. Han Liu's Research Group at Northwestern University
- Collaborated with Qinjie Lin and Guo Ye on learning to plan for path planning.

Prof. Xujie Si's Research Group at McGill University
- Collaborating with Zhaoyu Li on learning theorem proving and SAT solving.