

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 structured search problems such as drug design, retrosynthesis for molecules/polymers, SAT/SMT solving, theorem proving, neural symbolic learning, and path planning. In general, I am interested in problems related to learning over graph or other discrete structures, symbolic reasoning, deep learning, reinforcement learning.

EDUCATION

Georgia Institute of Technology, College of Computing, Atlanta, US *08/2017 - present*
Ph.D. Candidate, Machine Learning
Advisor : [Prof. Le Song](#)
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

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

- Learning to analyze/optimize code.

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

- A member of Machine Learning Group, advised by Prof. Le Song.
- Developed deep learning guided search algorithms with novel neural networks for drug design, retrosynthesis, path planning, theorem proving, and SAT solving.
 - **Drug Design** : Developed an EM-like algorithm for multi-objective molecule optimization with a novel GNN-based principled explainable model and a GraphRNN-based generative model. It produces drug candidates 34% better in quality and novelty than previous SOTA. Presented at ICLR 2021.
 - **Retrosynthesis** : Designed a neural-based A*-like algorithm that efficiently finds high-quality synthetic routes for molecules. Compared to previous SOTA, our algorithm increases the success rate from 55.26% to 86.84% on a challenging benchmark dataset. Presented at ICML 2020.
 - **Path Planning** : Designed a meta path planning algorithm with a novel attention-based neural module which learns promising search directions from problem structures. The proposed algorithm outperforms SOTA, improving sample efficiency by 20×. Spotlight presentation at ICLR 2020.
 - Developed the first learning-based method for **polymer retrosynthesis**.
 - Improved learning-based methods for **theorem proving** and **SAT solving**.
- Proposed neural symbolic approaches for (common sense) **visual QA**.
 - Introduced end-to-end **neural symbolic learning** methods by differentiating through the symbolic program generation process in the DARTS style.
 - Combined logic reasoning (e.g., Datalog) with deep learning (e.g., ResNets) to answer questions involving images and **common sense** knowledge bases.
- Developed learning-based algorithms for sparse graph recovery.

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.

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.

PUBLICATIONS	Molecule Optimization by Explainable Evolution Binghong Chen, Tianzhe Wang, Chengtao Li, Hanjun Dai, Le Song <i>International Conference on Learning Representations (ICLR) 2021</i> [paper]	
	ARBITRAR : User-Guided API Misuse Detection Ziyang Li, Aravind Machiry, Binghong Chen , Ke Wang, Mayur Naik, Le Song <i>IEEE Symposium on Security and Privacy (IEEE S&P) 2021</i>	
	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. <i>International Joint Conference on Neural Networks (IJCNN) 2021</i>	
	Retro* : Learning Retrosynthetic Planning with Neural Guided A* Search Binghong Chen, Chengtao Li, Hanjun Dai, Le Song <i>International Conference on Machine Learning (ICML) 2020</i> [paper] [slide] [talk] [github]	
	Learning to Plan in High Dimensions via Neural Exploration-Exploitation Trees Binghong Chen, Bo Dai, Qinjie Lin, Guo Ye, Han Liu, Le Song <i>International Conference on Learning Representations (ICLR) 2020, spotlight</i> [paper] [slide] [talk] [github]	
	GLAD : Learning Sparse Graph Recovery Harsh Shrivastava, Kinshi Chen, Binghong Chen, Guanghui Lan, Srinivas Aluru, Le Song <i>International Conference on Learning Representations (ICLR) 2020</i> [paper]	
	Learning Neural Retrosynthetic Planning Binghong Chen, Chengtao Li, Hanjun Dai, Le Song <i>AI Powered Drug Discovery and Manufacturing Conference (AIDM) 2020</i>	
	Learning Retrosynthetic Planning with Chemical Reasoning Binghong Chen, Chengtao Li, Hanjun Dai, Le Song <i>Bridge Between Perception and Reasoning : GNN & Beyond Workshop (ICML) 2020, spotlight</i>	
	Learning to Plan via Neural Exploration-Exploitation Trees Binghong Chen, Bo Dai, Le Song <i>Learning Transferable Skills Workshop (NeurIPS) 2019</i>	
	PREPRINTS	PolyRetro : Few-shot Polymer Retrosynthesis via Domain Adaptation Binghong Chen , Chengtao Li, Hanjun Dai, Rampi Ramprasad, Le Song
Differentiable End-to-End Program Executor for Sample and Computationally Efficient VQA Karan Samel, Zelin Zhao, Kuan Wang, Robin Luo, Binghong Chen , Le Song		
Scallop : Combining Neural Perception and Deductive Reasoning for VQA Jiani Huang, Binghong Chen , Xujie Si, Karan Samel, Le Song, Mayur Naik		
TEACHING EXPERIENCE	Graduate Teaching Assistant CSE/ISYE 6740 Computational Data Analysis, Georgia Institute of Technology	Fall 2019
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 SERVICE	Program Committee/Reviewer NeurIPS 2021/2020, ICML 2021/2020, ICLR 2021/2020, AISTATS 2021, IJCAI 2021, AAAI 2021/2020/2019	
	Organizer of Machine Learning Reading Group Main organizer of a weekly machine learning reading group at Georgia Tech.	

PROFESSIONAL
OUTREACH

Google Brain Team

- Collaborating with [Dr. Hanjun Dai](#) on learning retrosynthesis planning and drug design.
- Collaborated with [Dr. Bo Dai](#) on learning to plan for path planning.

Galixir (AI + Pharma Company)

- Collaborating with [Dr. Chengtao Li](#) on learning retrosynthesis planning and drug design.

Prof. Mayur Naik's Research Group at UPenn

- Collaborating with [Prof. Xujie Si](#) on learning theorem proving and SAT solving.
- Collaborating with Prof. Xujie Si and Jiani Huang on common sense logic reasoning.
- Collaborating with Ziyang Li on active 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.

Last update : 05/18/2021