

Minghao Liu

Curriculum Vitae

Department of Computer Science
University of Oxford
United Kingdom, OX1 3QD

Email: minghao.liu@cs.ox.ac.uk
Phone: ***
<https://minghao-liu.github.io/>

RESEARCH INTERESTS

Automated reasoning; Constraint programming; SAT/SMT solving; Formal verification; Graph neural networks; Logic programming; Neuro-symbolic AI; Combinatorial optimization.

APPOINTMENT

University of Oxford

Research Associate

Oxford, UK

Oct. 2023 – Now

Supervised by Prof. Marta Kwiatkowska on EPSRC project FAIR (since Oct. 2024).

Supervised by Dr. Andrew Cropper on EPSRC project AutoCS (Oct. 2023 – Sep. 2024).

EDUCATION

University of Chinese Academy of Sciences

Ph.D. in Computer Science

Beijing, China

Sep. 2017 – June 2023

Supervised by Prof. Jian Zhang at Institute of Software, Chinese Academy of Sciences.

Thesis: Symbolic and Neural Methods for Constraint Solving.

Northeast Normal University

B.Sc. in Computer Science

Changchun, China

Sep. 2013 – June 2017

PUBLICATIONS

(indicates equal contribution)*

Conference Papers

1. Weichun Shi*, **Minghao Liu***, Wanting Zhang, Langchen Shi, Fuqi Jia, Feifei Ma, and Jian Zhang. “ConstraintLLM: A Neuro-Symbolic Framework for Industrial-Level Constraint Programming”, *Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2025.

2. **Minghao Liu**, David M. Cerna, Filipe Gouveia, and Andrew Cropper. “Scalable Knowledge Refactoring using Constrained Optimisation”, *AAAI Conference on Artificial Intelligence (AAAI)*, 2025.
3. Fuqi Jia, Yuhang Dong, Rui Han, Pei Huang, **Minghao Liu**, Feifei Ma, and Jian Zhang. “A Complete Algorithm for Optimization Modulo Nonlinear Real Arithmetic”, *AAAI Conference on Artificial Intelligence (AAAI)*, 2025.
4. Fuqi Jia*, Yuhang Dong*, **Minghao Liu**, Pei Huang, Feifei Ma, and Jian Zhang. “Suggesting Variable Order for Cylindrical Algebraic Decomposition via Reinforcement Learning”, *Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2023.
5. **Minghao Liu**, Rui Han, Fuqi Jia, Pei Huang, Feifei Ma, Hantao Zhang, and Jian Zhang. “Investigating the Existence of Holey Latin Squares via Satisfiability Testing”, *Pacific Rim International Conference on Artificial Intelligence (PRICAI)*, 2023.
6. **Minghao Liu***, Kunhang Lv*, Pei Huang, Rui Han, Fuqi Jia, Yu Zhang, Feifei Ma, and Jian Zhang. “NRago: Solving SMT(NRA) Formulas with Gradient-Based Optimization”, *IEEE/ACM International Conference on Automated Software Engineering (ASE), Tool Demonstration Track*, 2023.
7. Fuqi Jia*, Rui Han*, Xutong Ma, Baoquan Cui, **Minghao Liu**, Pei Huang, Feifei Ma, and Jian Zhang. “PSMT: Satisfiability Modulo Theories Meets Probability Distribution”, *IEEE/ACM International Conference on Automated Software Engineering (ASE), NIER Track*, 2023.
8. Fuqi Jia, Rui Han, Pei Huang, **Minghao Liu**, Feifei Ma, and Jian Zhang. “Improving Bit-Blasting for Nonlinear Integer Constraints”, *ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA)*, 2023. [ACM SIGSOFT Distinguished Paper Award]
9. **Minghao Liu**, Pei Huang, Fuqi Jia, Fan Zhang, Yuchen Sun, Shaowei Cai, Feifei Ma, and Jian Zhang. “Can Graph Neural Networks Learn to Solve the MaxSAT Problem?”, *AAAI Conference on Artificial Intelligence (AAAI), Student Abstract and Poster Program*, 2023. [Best Student Abstract Honorable Mention Award]
10. Pei Huang*, Yuting Yang*, **Minghao Liu**, Fuqi Jia, Feifei Ma, and Jian Zhang. “ε-weakened Robustness of Deep Neural Networks”, *ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA)*, 2022.
11. Pei Huang*, Yuting Yang*, Fuqi Jia, **Minghao Liu**, FeiFei Ma, and Jian Zhang. “Word Level Robustness Enhancement: Fight Perturbation with Perturbation”, *AAAI Conference on Artificial Intelligence (AAAI)*, 2022.
12. Pei Huang, Rundong Li, **Minghao Liu**, Feifei Ma, and Jian Zhang. “Efficient SAT-Based Minimal Model Generation Methods for Modal Logic S5”, *International Conference on Theory and Applications of Satisfiability Testing (SAT)*, 2021.

13. **Minghao Liu**, Fan Zhang, Pei Huang, Shuzi Niu, Feifei Ma, and Jian Zhang. “Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks”, *International Conference on Principles and Practice of Constraint Programming (CP)*, 2020.
14. Pei Huang, **Minghao Liu**, Ping Wang, Wenhui Zhang, Feifei Ma, and Jian Zhang. “Solving the Satisfiability Problem of Modal Logic S5 Guided by Graph Coloring”, *International Joint Conference on Artificial Intelligence (IJCAI)*, 2019.
15. Pei Huang, **Minghao Liu**, Cunjing Ge, Feifei Ma, and Jian Zhang. “Investigating the Existence of Orthogonal Golf Designs via Satisfiability Testing”, *International Symposium on Symbolic and Algebraic Computation (ISSAC)*, 2019.
16. **Minghao Liu**, Feifei Ma, and Jun Yan. “A Community-Division Based Algorithm for Finding Relations Among Linear Constraints”, *International Conference on Knowledge Science, Engineering and Management (KSEM)*, 2018.

Journal Papers

17. Rui Han, **Minghao Liu**, Yuhang Dong, Fuqi Jia, Yiyuan Wang, Feifei Ma, Minghao Yin, and Jian Zhang. “AllDiff-LS: Solving Alldifferent Constraints with Efficient Local Search”, *Frontiers of Computer Science (FCS)*, 2026.
18. Tangmeng Guo*, Ping He*, Weilin Lu*, Lili Huang*, Chengyun Liu, Bei Cheng, Yuanyuan Zhang, Qi Zhang, Yanxu Chen, **Minghao Liu**, Peien Zhou, Junxi Liu, Xinchun Gu, Zhengyang Sun, Qiang Zhang, and Sihao Xiao. “Visceral Adiposity Thresholds for Cardiovascular Risk Stratification: A Simplified Biomarker-Driven Model”, *Obesity*, 2025.
19. Jian Gao, Yiqi Lv, **Minghao Liu**, Shaowei Cai, and Feifei Ma. “Improving Simulated Annealing for Clique Partitioning Problems”, *Journal of Artificial Intelligence Research (JAIR)*, 2022.
20. Yupeng Zhou, **Minghao Liu**, Feifei Ma, Na Luo, and Minghao Yin. “Modelling and Solving the Supply Marketing Order Allocation Problem with Time Consistency and Bundle Discounts”, *Journal of the Operational Research Society (JORS)*, 2021.

Preprint

21. **Minghao Liu**, Chia-Hsuan Lu, and Marta Kwiatkowska. “Exact Verification of Graph Neural Networks with Incremental Constraint Solving”, 2025.

PRESENTATIONS

1. “Investigating the Existence of Holey Latin Squares via Satisfiability Testing.” Presentation at *PRICAI 2023*, Online. Nov. 2023.

2. “Can Graph Neural Networks Learn to Solve the MaxSAT Problem?” Presentation at *AAAI 2023*, Online. Feb. 2023.
3. “Automated Reasoning: Principles and Applications.” Invited talk at *ByteDance AI Lab*, Beijing, China. Oct. 2022.
4. “Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks.” Presentation at *CP 2020*, Online. Sep. 2020.
5. “Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks.” Invited talk at *Northeast Normal University*, Changchun, China. July 2020.
6. “A Community-Division Based Algorithm for Finding Relations Among Linear Constraints.” Presentation at *KSEM 2018*, Changchun, China. Aug. 2018.

TEACHING

Foundations of Theoretical Computer Science <i>Teaching Assistant</i> , University of Chinese Academy of Sciences	Spring 2020; Spring 2021
Logic and Proof <i>Class Tutor</i> , University of Oxford	Hilary 2024; Michaelmas 2024
Knowledge Representation and Reasoning <i>Class Tutor</i> , University of Oxford	Hilary 2025
Computer-Aided Formal Verification <i>Class Tutor</i> , University of Oxford	Michaelmas 2025
Design and Analysis of Algorithms <i>Practical Demonstrator</i> , University of Oxford	Hilary 2024; Hilary 2025
Functional Programming <i>Practical Demonstrator</i> , University of Oxford	Michaelmas 2025
Financial Computing with C++ Part I <i>Teaching Assistant</i> , University of Oxford	Michaelmas 2024; Michaelmas 2025
Group Design Practical <i>Project Supervisor</i> , University of Oxford	Hilary 2024; Hilary 2025

PROFESSIONAL SKILLS

Programming Languages: Python, C/C++, Haskell.

Tools & Libraries: PyTorch, PyG, CPLEX, Gurobi, OR-Tools, Z3, CVC5.

SELECTED AWARDS AND SCHOLARSHIPS

SMT Competition, Nonlinear Real Arithmetic (QF_NRA) Track, 2nd Place	Aug. 2022
First Prize Scholarship of UCAS (<i>Top 10%</i>)	Oct. 2021
Alibaba Guangdong Intelligent Manufacturing Innovation Contest, 3rd Place	Dec. 2019
The NENU Medalist (<i>The highest honor for undergraduate students; Top 0.5%</i>)	June 2017
ACM International Collegiate Programming Contest Asia Regional, Gold Medal	Sep. 2016
National Scholarship of China (<i>Top 2%</i>)	Nov. 2014

ACADEMIC SERVICES

PC Member: AAAI 2023, 2024, 2025, 2026; ECAI 2024, 2025; ICTAI 2023; SETTA 2025.

Journal Reviewer: IEEE TNNLS (3); IEEE TKDE (2); Information Fusion (2); CSSE (1).

Last updated: October 19, 2025